Integrated Flood Risk Management and Drainage Masterplan for Ibadan City

Flood Risk Management and

Drainage Masterplan Report

Volume 2/3: Annexes

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Hydrological Analysis

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Terminology

Terminology	Description
ARF	Areal Reduction Factor
ARK	Urban Africa Risk Knowledge
CN	Curve Number
GIS	Geographic Information System
HEC 22	Hydraulic Engineering Circular No. 22
HEC-HMS	Hydrologic Engineering Center - Hydrologic Modelling System
IITA	The International Institute of Tropical Agriculture
IUFMP	Ibadan Urban Flood Management Project
LiDAR	Light Detection and Ranging
LGA	Local Governmental Area
NIHORT	National Horticultural Research Institute
NIMET	Nigerian Metrological Agency
NRCS	Natural Resource Conservation Service
PIU	Project Implementation Unit
SCS	Soil Conservation Service, of United States Department of Agriculture
TEF	Tractebel Engineering France
TRMM	Tropical Rainfall Measuring Mission
USGS	United States Geological Survey
UH	Unit Hydrograph
WB	World Bank

1 Introduction

Hydrologic analysis is the most important step prior to the design of drainage structures and the preparation of a flood risk analysis. This annex presents the collected data from 7 meteorological stations and the proposed regionalization for the estimation of design rainfall depths. The annex details the hydrologic analysis and simulation conducted on Ibadan city to estimate the flow at different points of interest.

The aim of the annex is to clarify the Consultant's methodology in estimating the flow in the watersheds of Ibadan to be further used in the Drainage Master Plan activities and the preparation of the pool of priority investments.

1.1 Background

At the onset of the project, rainfall data were available for only one meteorological station at the New Ibadan Airport obtained from NIMIT. During the progress of the project, large amount of additional rainfall data was acquired by Dar in the Ibadan area and surroundings, with a total of four stations within Ibadan urban study area and three stations outside Ibadan. This annex details the hydrological analysis methodology based on the acquired data and the results of a new regional frequency analysis and additional areal rainfall assessment. The results of various updated analyses in this annex will serve as the basis for further studies in the Ibadan area.

1.2 Annex Contents

This annex is divided into 3 sections as follows:

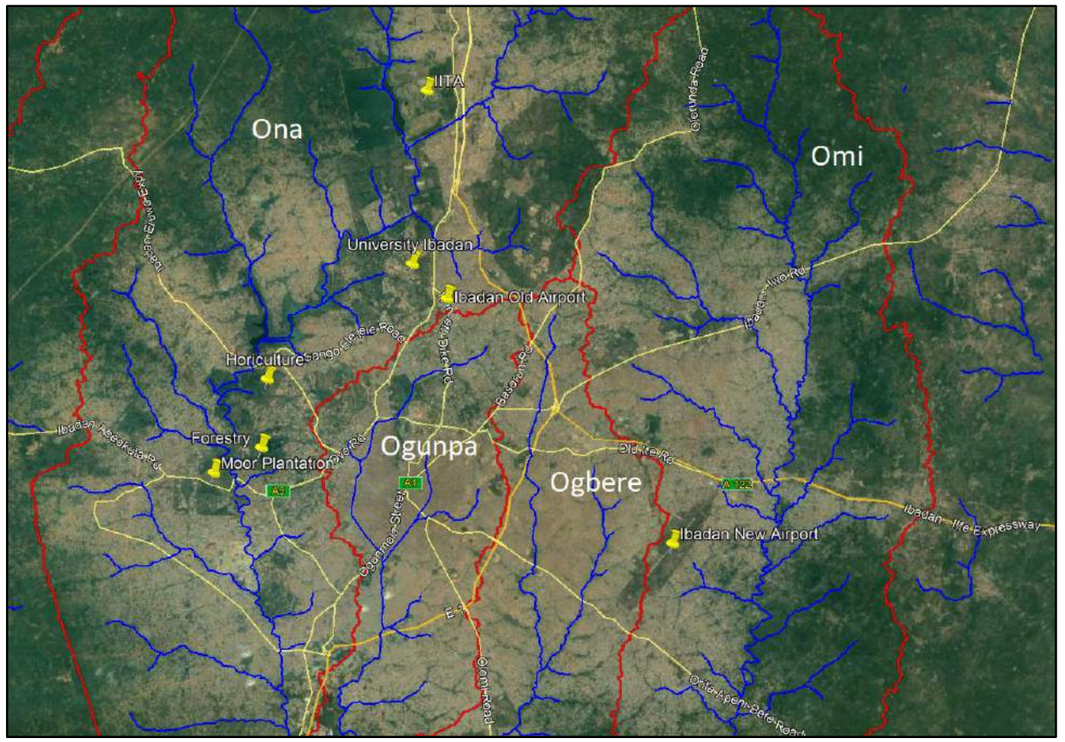
- Section 1 is the present introduction, herein, which states the purpose of this annex and its function in the context of this project.
- Section 2 presents the rainfall frequency analysis including historical and collected and data from different meteorological stations. This section highlights the spatial variability of rainfall in Ibadan and the proposed regionalization for the estimation of design rainfall depths.

Section 3 presents the hydrological analysis and the establishment of a rainfall-runoff model to estimate the discharges at the different points of interest. The inflow at Eleyele reservoir is estimated for a 100-year return period.

2 Rainfall Data and Analysis

Rainfall data is a prime input for hydrological analysis. This section presents the collected rainfall data from 7 meteorological stations in Ibadan along with the historical data collected from available literature.

In addition, this section presents the preliminary analysis of the collected data including a comparison between the historical and collected data, the spatial variability of rainfall, fixed duration correction factor and regionalization. Moreover, this section includes the results of Rainfall Frequency Analysis.


IITA
Ona
Omi
University Ibadan
Ibadan Old Airport
Horticulture
Forestry
Moor Plantation
Ogunpa
Ogbere
Ibadan New Airport
Ibadan - Ife Expressway
Ibadan - Iwo Rd
Old Ife Rd
Oyo Express Rd
Ibadan Abeokuta Rd
Oyo Express Rd
Old Ife Rd
Ibadan - Iwo Rd
Oyo Express Rd
Ibadan Abeokuta Rd
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been collected and analyzed. The following sections give the details of the collected data and their analysis and validation for use in rainfall frequency analysis.

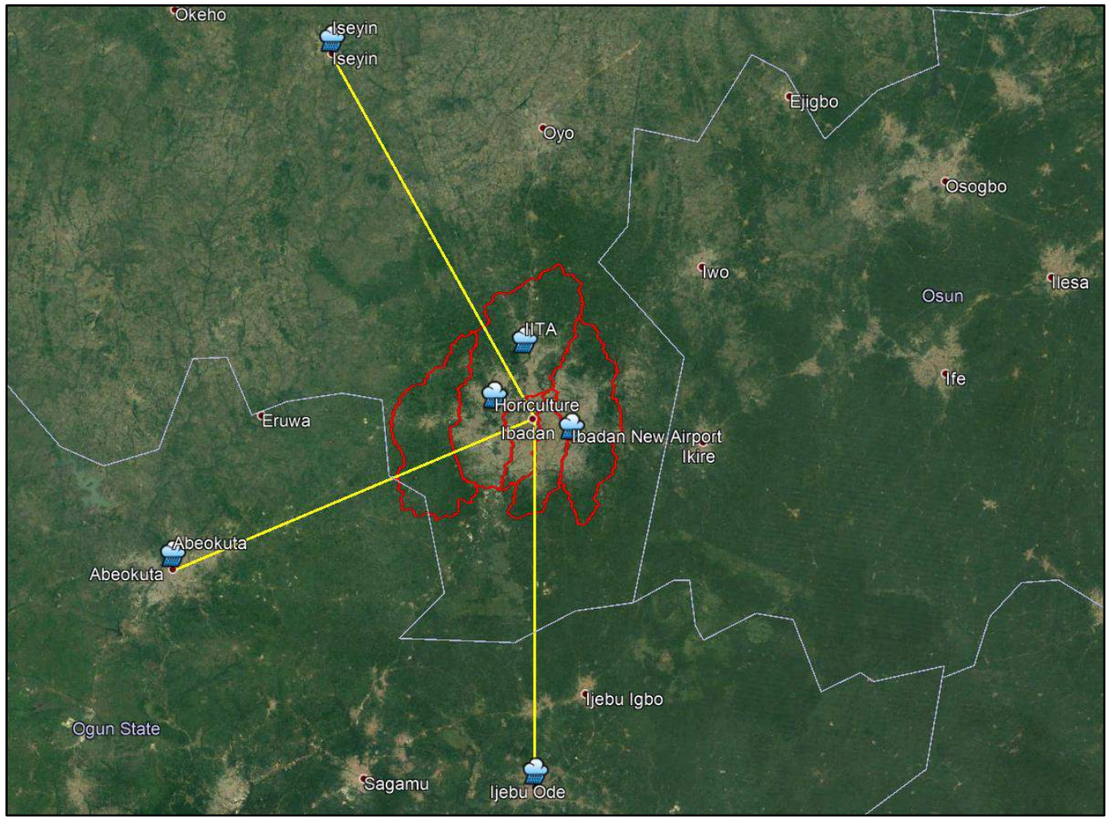

Figure 2.2: Meteorological Stations outside Ibadan

2.1.1 Ibadan New Airport Data (NIMET)

Daily rainfall data were collected from the Nigerian Meteorological Agency (NIMET) station located at the new Ibadan airport in Alakia. The data collected is from 1981 to 2016 (36 years). One of the daily precipitation depths with a value of 233 mm on June 11th, 2009 was noticed for its high value. Communication with NIMET authority revealed that this was a typing error and the correct value of this event was only 23 mm. Accordingly, the maximum daily rainfall for 2009 is corrected to be the next largest value of 87.3 mm instead of 233 mm. Figure 2.3 shows the maximum daily rainfall series for the NIMET station at Ibadan new airport. The maximum recorded daily rainfall depth is 183.4 mm and was recorded on July 3rd, 2001.

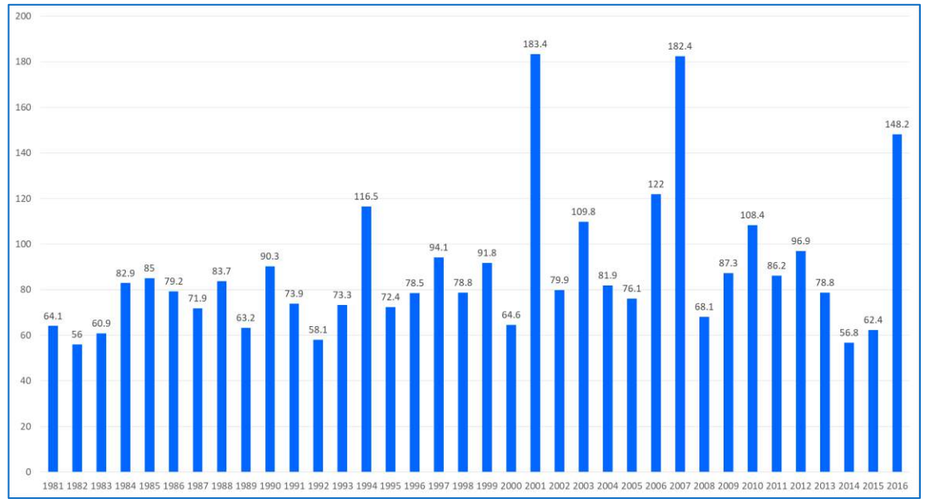

Figure 2.3: Ibadan New Airport Station - Maximum Daily Rainfall in Ibadan 1981 to 2016. [Data Source: NIMET]

2.1.2 IITA Data

Daily rainfall data for the IITA (the International Institute of Tropical Agriculture) station were obtained from TEF for the period from 1963 to 2015 (53 years). Dar collected two other years (2016 to 2017) from the IITA station, but 2017 is incomplete, bringing the total to 54 years. The maximum daily rainfall is presented in Figure 2.4 and Figure 2.5. The maximum daily recorded depth is 178 mm on September 21st, 1987. The IITA was established in 1967 and is headquartered in Ibadan, Nigeria.

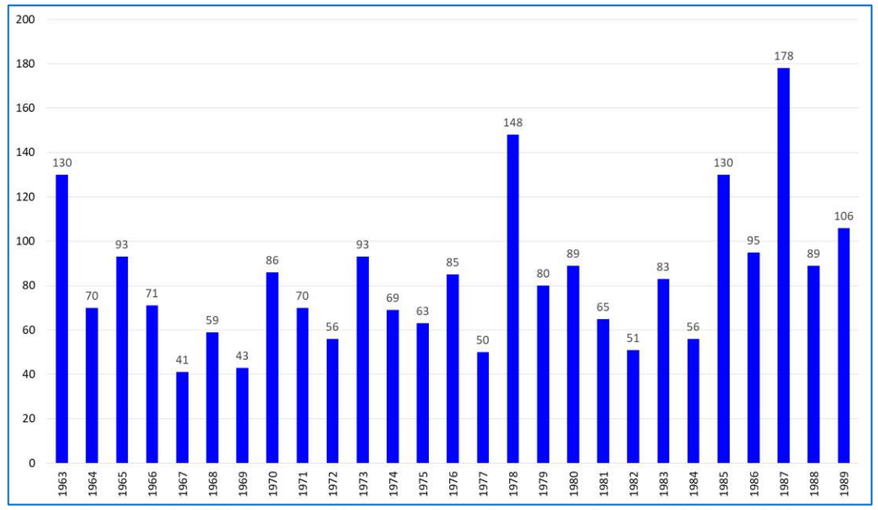

Figure 2.4: IITA Station - Maximum Daily Rainfall in Ibadan 1963 to 1989. [Data Source: TEF]

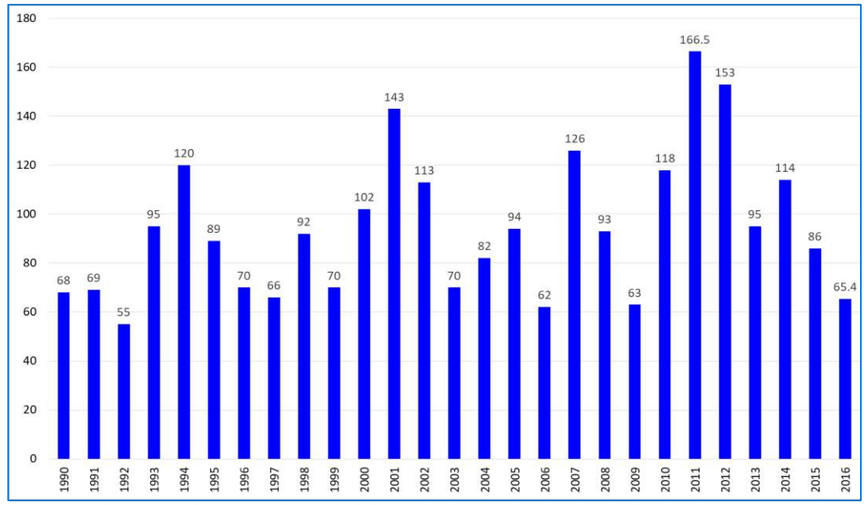

Figure 2.5: IITA Station - Maximum Daily Rainfall in Ibadan 1990 to 2016. [Data Source: TEF (1990 to 2015), IITA (2016)]

2.1.3 Horticulture (NIHORT) Data

Daily rainfall data were collected from the Nigerian National Horticultural Research Institute (NIHORT) located in Ibadan for the period from 1979 to 2017 (39 years). The maximum daily rainfall is presented in Figure 2.6. It is worth noting that NIHORT lies just downstream Eleyele dam and in the middle Ona basin.

NIHORT was established in 1975 with the assistance of United Nations Development Program (UNDP) in conjunction with the Food and Agricultural Organization (FAO) as fruits and vegetables research and demonstration center.

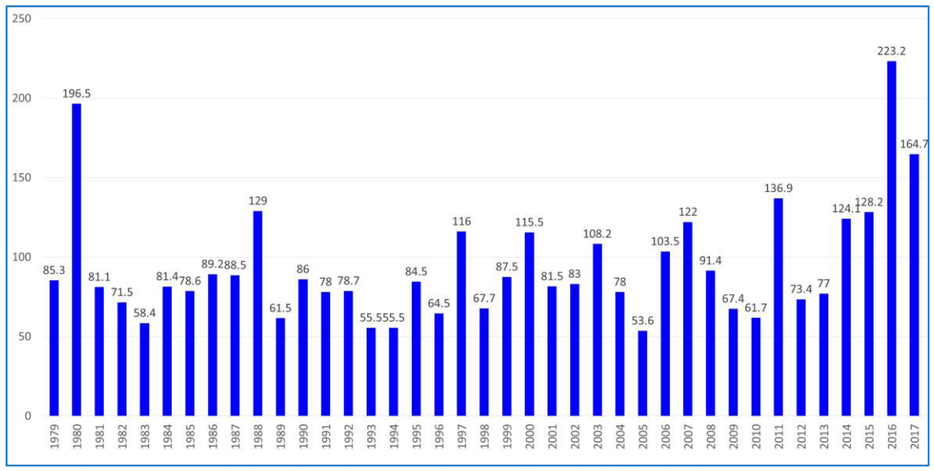

Figure 2.6: Horticultural Station - Maximum Daily Rainfall in Ibadan 1990 to 2017. [Data Source: NIHORT]

One of the daily precipitation depths with a value of 223.3 mm was noticed for its high value on October 18th, 2016. Dar contacted NIHORT for confirmation of this value. NIHORT confirmed this value and a scanned copy of the raw data of the month of October 2016 (as registered by the observer) was copied for references. The maximum daily recorded depth is thus 223.3 mm on October 18th, 2016.

2.1.4 Ibadan Old Airport Data

Daily rainfall data were collected from the Nigerian Meteorological Agency (NIMET) station located in Ibadan Old Airport for the period from 1951 to 1980 (30 years). The maximum daily rainfall is presented in Figure 2.7. The maximum recorded depth is 274.1 mm on August 31st, 1980.

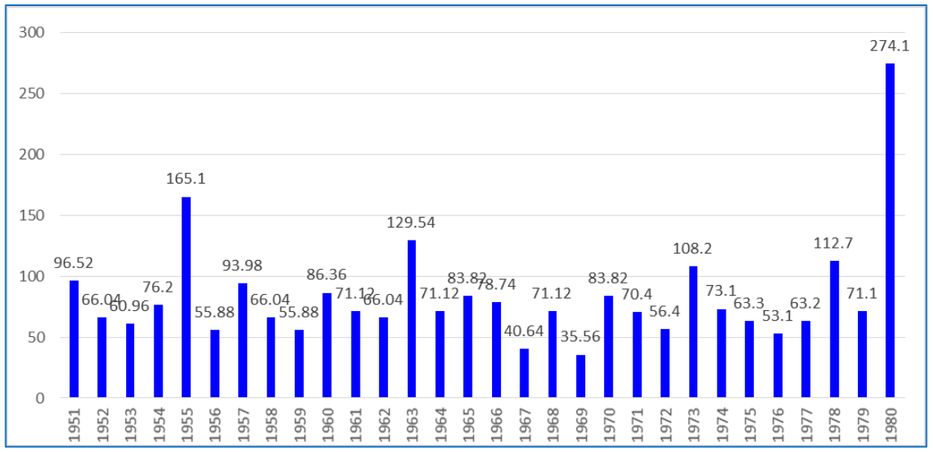

Figure 2.7: Ibadan Old Airport Station - Maximum Daily Rainfall in Ibadan 1951 to 1980. [Data Source: NIMET]

2.1.5 Other Rainfall Stations outside Ibadan

Dar collected daily rainfall from three other stations outside Ibadan, and as follows:

2.1.5.1 Abeokuta Data

Daily rainfall data was collected from NIMET for Abeokuta station in the period from 1981 to 2017 (37 years). The maximum daily rainfall is presented in Figure 2.8. Abeokuta village lies around 68 km southwest of Ibadan city. The maximum daily recorded depth is 134.2 mm on June 27th, 2012.

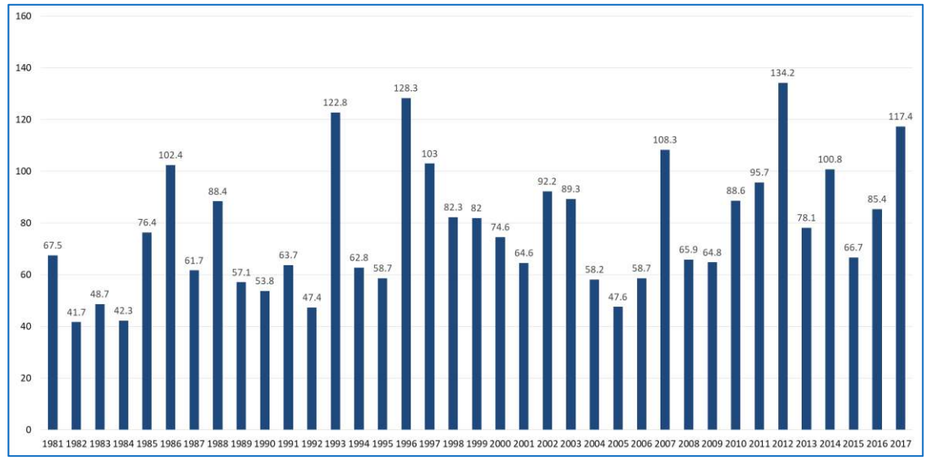

Figure 2.8: Abeokuta Station - Maximum Daily Rainfall in Abeokuta 1981 to 2017. [Data Source: NIMET]

2.1.5.2 *Ijebu Ode Data*

Daily rainfall data were collected from NIMET for Ijebu Ode station in the period from 1981 to 2017 (37 years). The maximum daily rainfall is presented in Figure 2.9. Ijebu Ode village lies around 64 km south of Ibadan city. The maximum daily recorded depth is 174.8 mm on June 28th, 2006.

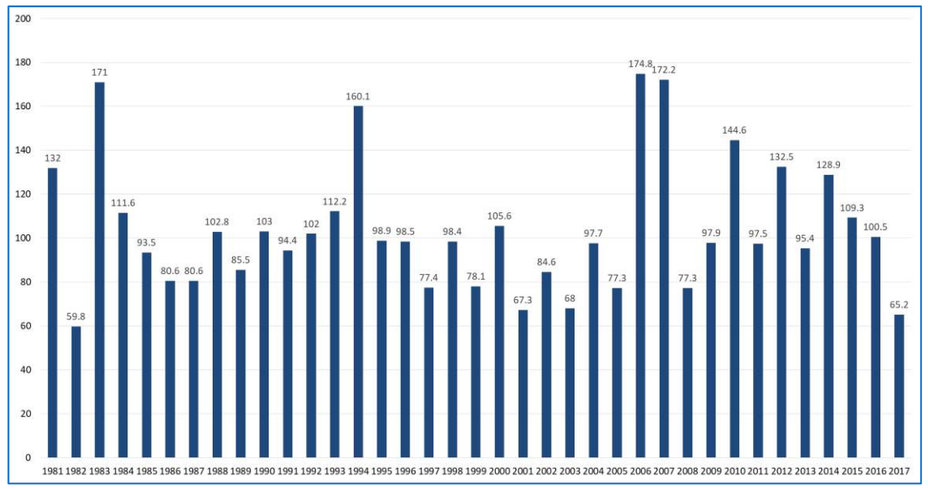

Figure 2.9: Ijebu Ode Station - Maximum Daily Rainfall in Ijebu Ode 1981 to 2017. [Data Source: NIMET]

2.1.5.3 *Iseyin Data*

Daily rainfall data were collected from NIMET for Iseyin station in the period from 1982 to 2017 (36 years). The maximum daily rainfall is presented in Figure 2.10. Iseyin village lies around 72 km north of Ibadan city. The maximum daily recorded depth is 182.4 mm on April 30th, 2008.

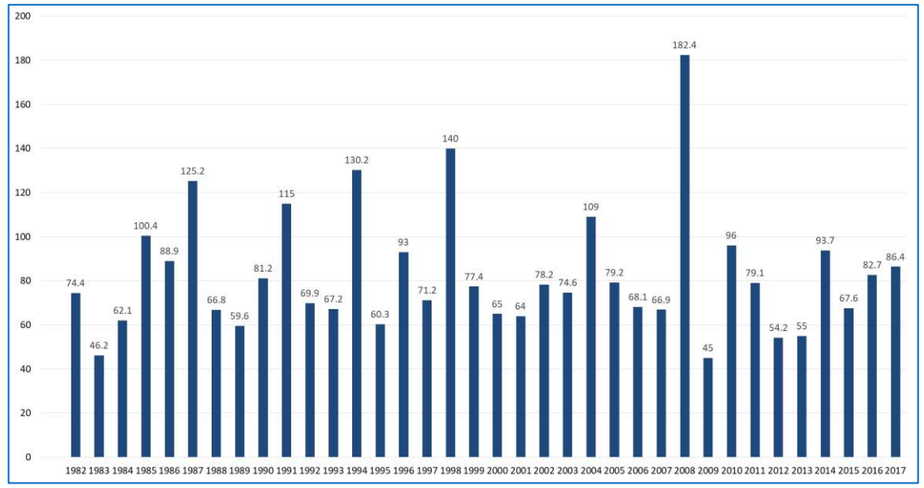

Figure 2.10: Iseyin Station - Maximum Daily Rainfall in Iseyin 1982 to 2017. [Data Source: NIMET]

Table 2.1 presents the collected data for all seven stations discussed above.

Table 2.1: Compiled Maximum Daily Rainfall Data at all Stations.

Year	IITA	NIMET	NIHORT	Old Airport	Abekota	Ijebu Ode	Iseyin
1951	-	-	-	96.52	-	-	-
1952	-	-	-	66.04	-	-	-
1953	-	-	-	60.96	-	-	-
1954	-	-	-	76.2	-	-	-
1955	-	-	-	165.1	-	-	-
1956	-	-	-	55.88	-	-	-
1957	-	-	-	93.98	-	-	-
1958	-	-	-	66.04	-	-	-
1959	-	-	-	55.88	-	-	-
1960	-	-	-	86.36	-	-	-
1961	-	-	-	71.12	-	-	-
1962	-	-	-	66.04	-	-	-
1963	**130**	-	-	**129.54**	-	-	-
1964	69.8	-	-	71.12	-	-	-
1965	92.7	-	-	83.82	-	-	-
1966	71.4	-	-	78.74	-	-	-
1967	41.2	-	-	40.64	-	-	-
1968	58.9	-	-	71.12	-	-	-
1969	43.2	-	-	35.56	-	-	-
1970	86.4	-	-	83.82	-	-	-
1971	70.4	-	-	70.4	-	-	-
1972	56.4	-	-	56.4	-	-	-
1973	93.1	-	-	108.2	-	-	-
1974	68.7	-	-	73.1	-	-	-
1975	63.3	-	-	63.3	-	-	-

Year	IITA	NIMET	NIHORT	Old Airport	Abekota	Ijebu Ode	Iseyin
1976	85	-	-	53.1	-	-	-
1977	50	-	-	63.2	-	-	-
1978	147.5	-	-	112.7	-	-	-
1979	79.5	-	85.3	71.1	-	-	-
1980	**88.5**	-	**196.5**	**274.1**	-	-	-
1981	65.2	64.1	81.1	-	67.5	132	-
1982	50.8	56	71.5	-	41.7	59.8	74.4
1983	83	60.9	58.4	-	48.7	171	46.2
1984	56.1	82.9	81.4	-	42.3	111.6	62.1
1985	130	85	78.6	-	76.4	93.5	100.4
1986	94.8	79.2	89.2	-	102.4	80.6	88.9
1987	178.3	71.9	88.5	-	61.7	80.6	125.2
1988	89.3	83.7	129	-	88.4	102.8	66.8
1989	106	63.2	61.5	-	57.1	85.5	59.6
1990	68	90.3	86	-	53.8	103	81.2
1991	69.2	73.9	78	-	63.7	94.4	115
1992	54.6	58.1	78.7	-	47.4	102	69.9
1993	95.3	73.3	55.5	-	122.8	112.2	67.2
1994	120.2	116.5	55.5	-	62.8	160.1	130.2
1995	88.6	72.4	84.5	-	58.7	98.9	60.3
1996	70	78.5	64.5	-	128.3	98.5	93
1997	65.5	94.1	116	-	103	77.4	71.2
1998	92.2	78.8	67.7	-	82.3	98.4	140
1999	69.5	91.8	87.5	-	82	78.1	77.4
2000	102	64.6	115.5	-	74.6	105.6	65
2001	143.4	183.4	81.5	-	64.6	67.3	64
2002	112.5	79.9	83	-	92.2	84.6	78.2
2003	69.5	109.8	108.2	-	89.3	68	74.6
2004	81.5	81.9	78	-	58.2	97.7	109
2005	94	76.1	53.6	-	47.6	77.3	79.2
2006	62	122	103.5	-	58.7	174.8	68.1
2007	126.2	182.4	122	-	108.3	172.2	66.9
2008	92.8	68.1	91.4	-	65.9	77.3	182.4
2009	62.5	87.3	67.4	-	64.8	97.9	45
2010	118	108.4	61.7	-	88.6	144.6	96
2011	**165.5**	**86.2**	**136.9**	-	95.7	97.5	79.1
2012	152.7	96.9	73.4	-	134.2	132.5	54.2
2013	95	78.8	77	-	78.1	95.4	55
2014	114	56.8	124.1	-	100.8	128.9	93.7
2015	85.5	62.4	128.2	-	66.7	109.3	67.6
2016	65.4	148.2	223.2	-	85.4	100.5	82.7
2017	-	-	164.7	-	117.4	65.2	86.4

2.1.6 Historical Data

The World Bank report on the 26th of August 2011 flood in Ibadan[1] mentioned the maximum daily rainfall depth values for historical floods as shown in Table 2.2. The maximum daily rainfall depth for 2011 is given as 187.5 mm rather than 154 mm, but the World Bank report mentions that the measurement was at IITA. The received IITA data, however, show only 165.5 mm for the same event with practically no rainfall recorded in the previous or the following day. Table 2.3 shows a list of historical floods in Ibadan as given by Urban Africa Risk Knowledge (ARK) Ibadan City Diagnostic report, 20162. Four major flood events occurred in Ibadan in 1963, 1978, 1980 and 2011, with maximum daily rainfall depths of 258 mm, 126mm, 274 mm, and 154 mm, respectively. These flood disasters had significant impacts on the urban city and caused a lot of damages and casualties.

Table 2.2: Precipitation depths for historical floods. [Source: World Bank]

Date	Rainfall intensity (mm)	Details
31 August, 1980	274	500 lives lost, 300 m ₦ damages
28 August, 1963	258	
26 August, 2011	187.5	
17 August, 1960	178	
16-17 June, 1955	173	
9-10 July, 1951	161	
April, 1997	151	
14 May, 1969	137	
20 April, 1978	126	

2.1.6.1 1963 Flood Event

The Urban ARK report mentioned that a flood occurred in Ibadan on 27-28th August 1963 with a rainfall value of 258 mm as recorded at the University of Ibadan. It was reported that the flood caused at least 2 casualties and other damages. The IITA data shows the daily rainfall data for August 1963, refer to Figure 2.11. The figure shows values of around 27 and 28 August respectively.

[1] Report on the 26th of August 2011 flood in Ibadan, World Bank Report no. 70608, 2012

[2] Adelekan, I. O., 2016. Ibadan City Diagnostic Report. Urban Africa Risk Knowledge Working paper No. 4. , Ibadan University, Ibadan.

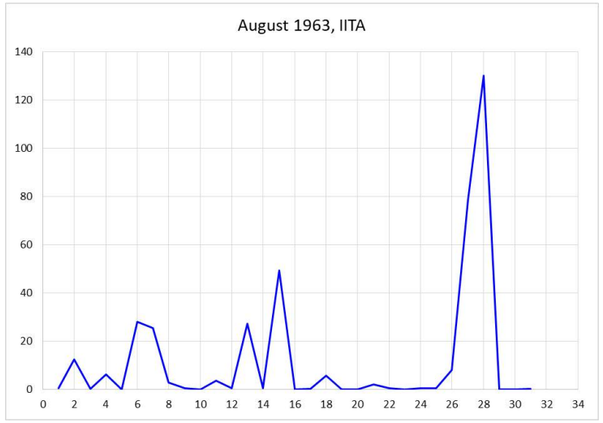

Figure 2.11: Daily Rainfall in IITA, August 1963 [Data Source: TEF]

Table 2.3: Historical flood events in Ibadan City. [Source: Urban ARK Ibadan City Diagnostic Report, 2016].

Date	Rainfall Amount (mm); climate station in Ibadan	Estimated Damages (Naira)	Estimated Loss of Lives and property
9–10 July 1951	161mm; Forestry Headquarter	Unknown	Unknown
16–17 June1955	173mm; Moor Plantation	Unknown	Unknown
16–17 August 1960	178mm; Eleyele Waterworks	Over 100,000	Unknown
27–28 August 1963	258mm; University of Ibadan	Over 200,000	At least 2 person
14 May 1969	137mm; University of Ibadan	Over 100,000	At least 2 persons
1973 (undated)*	Unknown	More than 100,000	3
20 April 1978	126mm; University of Ibadan	Over 2 million	Over 30 deaths, more than 15,000 displaced and 100 houses damaged
31 August 1980	274mm; University of Ibadan	Over 300 million	More than 300 deaths, over 40,000 displaced and over 50 houses destroyed
1982**	N/A	Unknown	Unknown
1984**	N/A	Unknown	Unknown
April 1986**	N/A	Unknown	Unknown
June/July 1987**	N/A	Unknown	Unknown
10 July 2010/2011	45mm; Old Airport Samonda	Unknown	Unknown
26 August 2011	154mm; Old Airport Samonda	Over 30 billion	102 reported deaths
	86.2mm; New Airport Alakia	Unknown	Unknown
9 March 2012+	N/A	Unknown	30 reported deaths, 5000 displaced and 100 persons declared missing
22 September 2013+	N/A	Unknown	7 persons
28 June2014+	N/A	Unknown	15 reported deaths

31 august 1980 seems to be attributed incorrectly to university of Ibadan and it should be the old airport

2.1.6.2 1978 Flood Event

The Urban ARK report mentioned that a flood occurred in Ibadan on April 20th, 1978 with a value of 126 mm as recorded at the University of Ibadan. It was reported that the flood caused over 30 casualties and other damages. The IITA data shows the daily rainfall data for April 1978, refer to Figure 2.12. The figure shows the rainfall depth for IITA is 147.5 mm which resembles the value of the Urban ARK report of 126 mm.

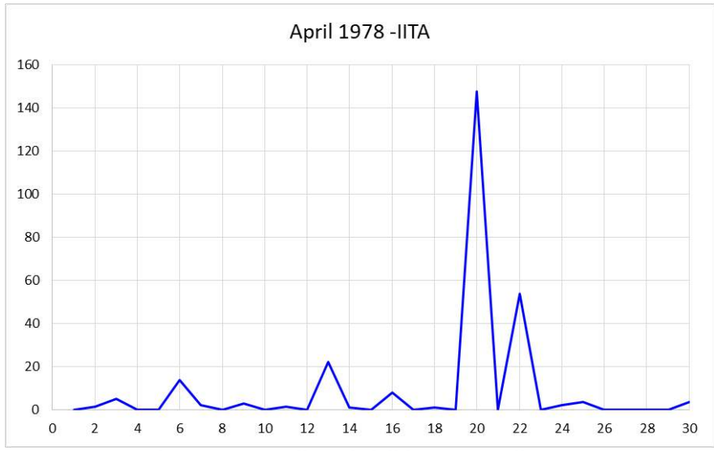

Figure 2.12: Daily Rainfall in IITA April 1978 [Data Source: TEF]

2.1.6.3 1980 Flood Event

The event of August 31st, 1980 is considered as the worst disaster that ever occurred in Ibadan history. Oguntala and Oduntoyinboz 1982[3] and many references (Note-ENV-03 by Dar) mentioned that a flood occurred in Ibadan in 31st August 1963 with a value of 274 mm as recorded at Ibadan Old Airport (middle Ona basin).

Many references in the literature mentioned that 274 mm fell in one day, with one reference mentioning that the rain fell in 6 hours. It was also reported that the flood caused over 500 casualties and other damages. The IITA data presented the daily rainfall data for August 1980, refer to Figure 2.13. The peak rainfall depth for IITA is 88.5.

[3] Oguntala, A. B., & Oguntoyinbo, J. S. (1982). Urban flooding in Ibadan: A diagnosis of the problem. *Urban Ecology*, *7*(1), 39-46.

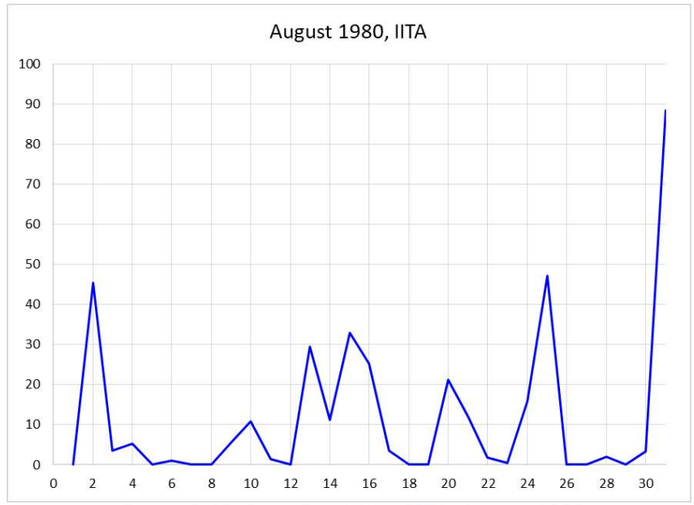

Figure 2.13: Daily Rainfall in IITA, August 1980 [Data Source: TEF]

The report of Konsadem Consultants[4] shows similar values with IITA data for the 1963, 1978, 1980 flood events. Moreover, Konsadem Consultant 1988 also reported that the cumulative monthly rainfall of August 1980 is 605 mm at Ibadan old Airport. Dar calculated the cumulative rainfall of August 1980, the results showed a total monthly precipitation of around 605 mm.

Oguntala, and Oguntoyinbo (1982) give the spatial variation of the Ibadan rainfall during the flood event of 1980 from 7 meteorological stations as shown in Figure 2.14

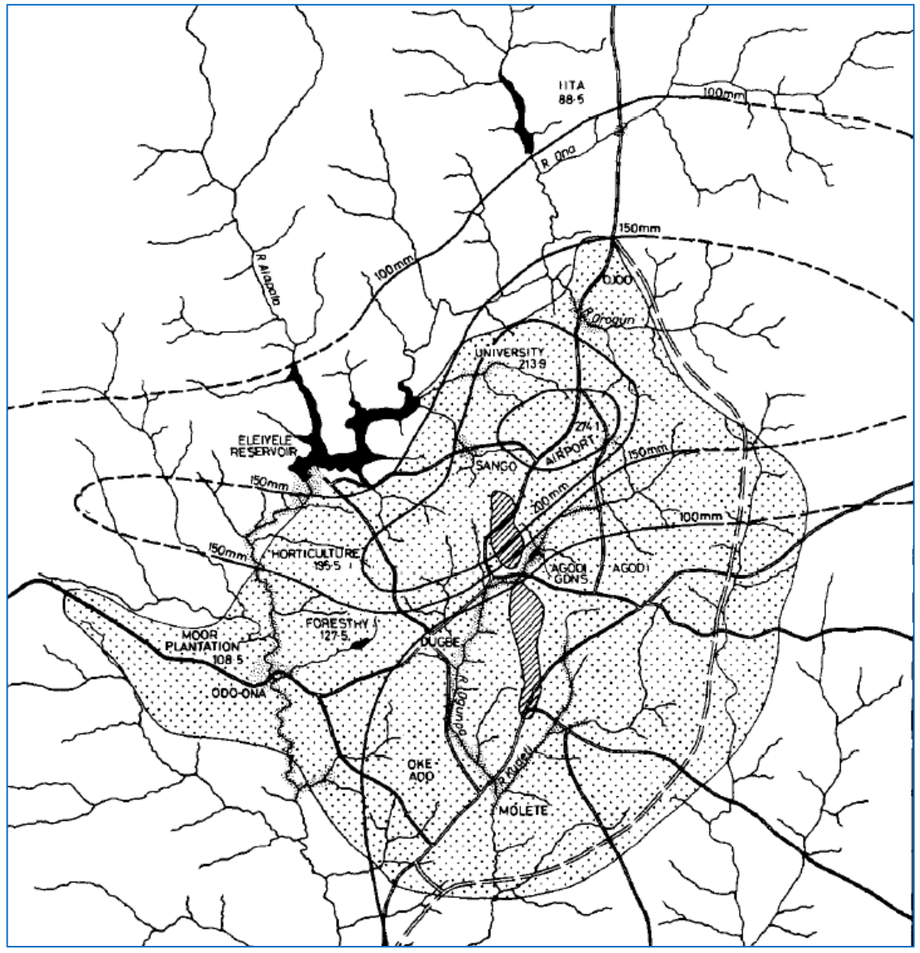

Figure 2.14: Spatial distribution of August 31st, 1980 rainfall depth in Ibadan. [Source: Oguntala, and Oguntoyinbo, 1982]

The values shown in the figure confirm that the rainfall depth at the Ibadan Old Airport was 274 mm (reported in 1963 Flood Event

The Urban ARK report mentioned that a flood occurred in Ibadan on 27-28th August 1963 with a rainfall value of 258 mm as recorded at the University of Ibadan. It was reported that the flood caused at least 2 casualties and other damages. The IITA data shows the daily rainfall data for August 1963, refer to Figure 2.11. The figure shows values of around 27 and 28 August respectively.

[4] Konsadem Associates, "Preliminary Engineering Report for Flood and Erosion Control Works on Kudeti Stream", Ogun Oshun River Basin Development Authority, November 1988.

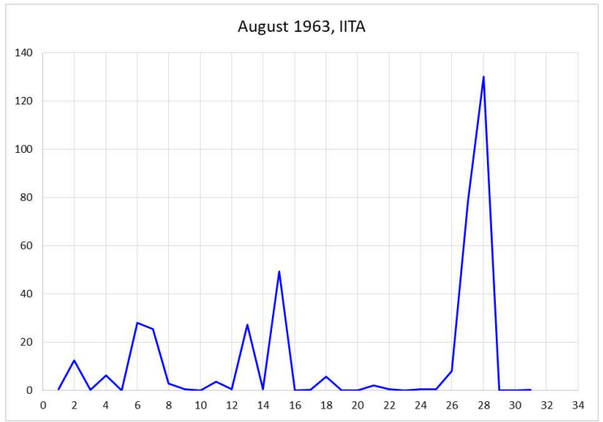

Figure 2.11: Daily Rainfall in IITA, August 1963
[Data Source: TEF]

Table 2.3 as University of Ibadan, probably by mistake) while that at the IITA is only 88.5 mm, with a difference in distance between the two stations of around 8 km only.

2.2 Data Comparison and Preliminary Analysis

2.2.1 Comparison between Historical and Collected Data

The data and discussion in the previous section reveal an important fact. The collected data from the four stations did not always capture the very high values reported for the historical floods of 1963, 1980, which were 258 mm, 274 mm, and respectively. For 1963, IITA reads 130 mm and the Old Ibadan Airport reads 129.54 mm, while the historical data indicate 258 mm at University of Ibadan, for which the record is not available. For 1980, IITA recorded 88.5 mm while NIHORT recorded 196.5 mm, compared to the value of 274.1 mm at the old Airport, which has also been reported historically (Oguntala, and Oguntoyinbo, 1982). On the other hand, for the 2011 flood, IITA recorded 165.5 mm, NIMET recorded 86.2 mm, and NIHORT recorded 136.9 mm, compared to the reported historical value of 154 mm at the Old Airport or 187.5 at IITA according to World Bank report. It is unfortunate that the highest values were recorded, as indicated in references, at either the Old Airport station or the University of Ibadan station since the Ibadan University record is currently not available to Dar, while the Old Airport data stop at 1980. However, it is not justifiable to dismiss high historical values as being erroneous based on the fact that the available data at other stations are relatively lower. Figure 2.14 for the 1980 flood, which had been produced very shortly after the event (paper submitted in 1981), shows a very high spatial variability within the area of Ibadan city. The values ranged from 88.5 at IITA to 274.1 mm at Ibadan Old Airport, with the values for IITA and NIHORT being identical to the obtained records. This means that the 274.1 mm recorded at the Old airport and mentioned in different references is a correct value. High spatial variability can also be confirmed by inspecting for example the recorded data at different stations for the 2011 event.

2.2.2 Spatial Variability of Rainfall Data

In addition to the discussion in the previous section, high spatial variability is further demonstrated by comparing the concurrent daily records at the four collected stations. The correlation coefficients between pairs of stations in Table 2.4 are around 50% only, which indicates a rather low correlation between concurrent daily rainfall. This is also evident from plotting rainfall values for pairs of stations as in Figure 2.15.

Table 2.4: Spatial Correlation of Daily Rainfall Records

	IITA	NIMET	NIHORT	Old airport
IITA	1	0.45	0.51	0.48
NIMET		1	0.46	-
NIHORT			1	-
Old airport				1

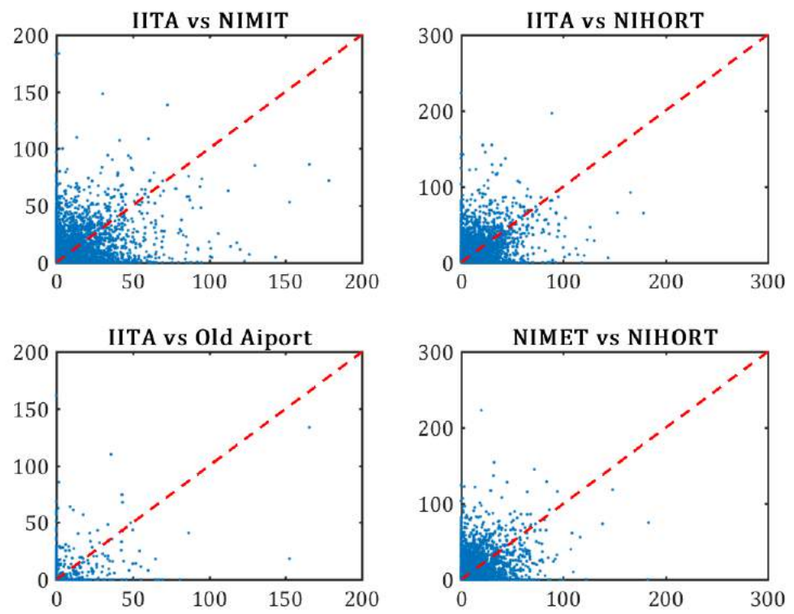

Figure 2.15: Comparison of Daily Rainfall values.

Spatial variability in rainfall is a well-known phesninomenon, which is usually compensated for in hydrologic design by multiplying the maximum recorded point rainfall in a given watershed by an Areal Reduction Factor (ARF) to produce the areal average of rainfall depth over the watershed. The ARF will be further discussed in the hydrological analysis section.

2.2.3 Fixed-Duration Correction

Noting that the maximum point rainfall in the watershed does not seem to be properly captured by the available records as discussed above, care must be taken not to underestimate the design rainfall

depths. One very important aspect to consider in this regard is the correction of frequency analysis results to compensate for the underestimation of maximum daily rainfall due to recording at fixed intervals (calendar days). It has been documented by several studies that the rainfall depths obtained from a frequency analysis that is based on calendar-day records should be multiplied by a correction factor to obtain proper 24-hr storm values to be used in design. The 1-day maxima are generally less than the actual 24-hour maxima because the 1-day maxima are collected on a fixed interval basis (calendar days) whereas the true 24-hour maxima used in design should be determined for any 24 consecutive hours (not necessarily coinciding with a calendar day). Several studies have found that this ratio is in the range of 1.13 (USA, US Weather Bureau, 1961[5]), 1.16 (UK, Shaw et al., 2011[6]), and 1.10 to 1.19 (Australia, Bureau of Meteorology, 2005[7]), see also Papalexiou et al. (2016[8]). This is a statistical correction factor to compensate (by adding 13% to frequency results) for the few possible cases when the total depth value is divided between two calendar days while the duration of the storm is still less than 24-hours. It is thus essential to incorporate such correction in order to reach at a safe design.

2.2.4 Regionalization

As has been seen in above, the number of years with available record data is rather small, ranging from 30 to 54 years. Results from rainfall frequency analysis can be more reliable if based on regional estimation, using all observations in the region rather than using data from single stations. Two commonly used methods are the station-year method and regional averaging of data statistics. In the station-year method, all data in the region are assumed to have the same statistical frequency distribution apart from a site-specific characteristic called the index flood, which is usually taken as the average of observations at that site. In the other method, parameter estimates of the fitted statistical frequency distribution are based on average moments of the data in the region. By using data from all sites in a region, the results will be based on a much larger sample of data than that at the site, resulting in more reliable estimates of design rainfall depths.

2.3 Results of Frequency Analysis

Daily maxima are theoretically distributed as Extreme Value variates. The Generalized Extreme Value (GEV) distribution was found suitable for the data. Regional estimates obtained by the average regional moments method were almost identical to those obtained by the station-year method. Regionalization in Ibadan was conducted on four stations, namely, IITA, NIMET, NIHORT, and Old Airport. Figure 2.16 shows the regional fit of the GEV distribution to the pooled data.

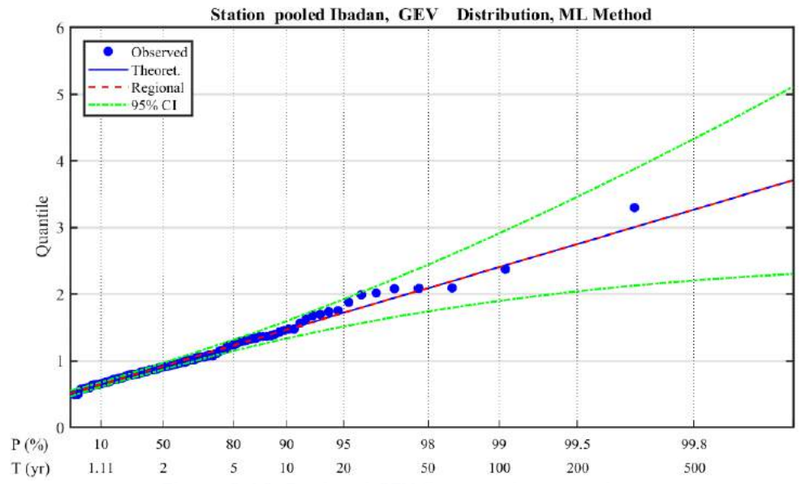

Figure 2.16: Regional GEV fit to station-year data.

Table 2.5 shows the rainfall depths for different return periods resulting from the regional distribution fitted to the data. Results are already multiplied by the fixed-duration correction factor of 1.13 as discussed earlier.

Table 2.5: Rainfall depths for different return periods.

T (yr)	2	5	10	25	50	100
IITA	91	122	146	180	208	240
NIMET	90	121	145	179	207	238
NIHORT	97	130	156	192	222	256
Old Airport	86	115	137	169	196	226

Regionalization on a wider scale using all six stations resulted in a slightly reduced rainfall depths due to the fact that the three new stations, which lie at relatively larger distances from Ibadan all have lower averages. The 100-year regional depth estimates were 228 mm, 226 mm, 243 mm, and 214 mm for IITA, NIMET, NIHORT, and Old Airport stations, respectively. This shows that the regional estimates are consistent. However, since the scale of the project covers only Ibadan area, it is appropriate to consider the values obtained in Table 2.5 above for design purposes.

It can be noted, as can be seen from the observations in Table 2.1 that the maximum point rainfall for a given rain storm over Ibadan could occur at any of the four stations. Since the rainfall depths in Table 2.5 are not very different from each other, it would therefore be reasonable to consider the

[5] US Weather Bureau (1961). Rainfall Frequency Atlas of The United States for Durations from 30 minutes to 24 Hours and Return Periods From 1 To 100 Years. Technical Paper No. 40, Washington, D.C.

[6] Shaw E., Beven, K., Chappell, N., and Lamb, R., (2011). Hydrology in Practice. Spon Press, London.

[7] Bureau of Meteorology (2005). A Pilot Study to Explore Methods for Deriving Design Rainfalls for Australia. Hydrology Report Series, Report No. 10, PART 1, Hydrology Unit, Melbourne, Australia

[8] Papalexiou, S. M., Dialynas, Y. G., & Grimaldi, S. (2016). Hershfield factor revisited: Correcting annual maximum precipitation. Journal of Hydrology, 542, 884-895.

average of the results from the frequency analysis for design purposes in Ibadan area as shown in Table 2.6.

Table 2.6: Design rainfall depths for Ibadan.

T (yr)	2	5	10	25	50	100
Design Depth (mm)	91	122	146	180	208	240

3 Hydrological Analysis

Hydrological analysis is a necessary step prior to the hydraulic analysis of drainage streams. It includes the estimation of the catchment morphological parameters and establishment of a rainfall-runoff model to estimate the discharges at different points of interest.

This section presents the basis of the hydrological analysis including the design storm profile, the areal reduction factor (ARF), the catchment delineation and the hydrologic model development.

Moreover, the results of the hydrologic analysis including the flow estimation are illustrated in the following sub-sections.

3.1 Design Storm Profile

In addition to specifying a design rainfall depth and duration for a given return period, it is necessary to specify a design storm profile, i.e. a description of the variation of intensity with time during the storm. The variation of precipitation intensity over the duration of the storm is an important factor in determining the timing and the magnitude of the peak flow, especially for small watersheds. A realistic estimate of temporal distribution can be obtained only from an analysis of precipitation data from a recording gauge network.

In the absence of short duration records or any similar information, the temporal rainfall distribution could be estimated as a ratio of the daily rainfall depth based on assumed ratios and daily rainfall depth. An example of such ratios was first proposed from durations of 2-hr to 5-min by Bell (1969) based on studies in the USA. Bell ratios have been extended to the 24-hr rainfall depth by the Soil Conservation Service of the USA through their SCS type II dimensionless rainfall curve (SCS, 1986).

In the absence of reliable rainfall-runoff data, the SCS is much less data intensive than other detailed methods, while taking into account several site-specific information such as land use, soil type, watershed characteristics (as reflected by the time of concentration/lag time), etc. The SCS method was developed and is widely used in the USA, where a large part of the country is humid. The curve number (CN) tables cover a large range of climates from arid and semi-arid to forest conditions, from urban to rural, and covering a range of associated soil types. The method also allows adjustment of curve numbers to reflect dry or wet soil runoff conditions (previously antecedent moisture conditions AMC). A number of studies in Nigeria and Africa as well as tropical regions have used the SCS method such as the following examples:

- Dan-Jumbo, N. G. (2018). Assessing the effects of urban development and climate change on flooding in the Greater Port-Harcourt watershed, Niger Delta, Nigeria.
- Salami, A. W., Bilewu, S. O., Ayanshila, A. M., & Oritola, S. F. (2009). Evaluation of synthetic unit hydrograph methods for the development of design storm hydrographs for Rivers in South-West, Nigeria. Journal of American Science, 5(4), 23-32.
- Smithers, J. C. (2012). Methods for design flood estimation in South Africa. Water SA, 38(4), 633-646.
- Sanquah, I. O. (2013). Climate Change and Its Impacts on Flooding In Accra-Greater Accra Metropolitan Assembly (Doctoral dissertation).
- Salami, A. W., Bilewu, S. O., Ibitoye, B. A., & Ayanshola, M. A. (2017). Runoff hydrographs using snyder and scs synthetic unit hydrograph methods: a case study of selected rivers in south west Nigeria. Journal of Ecological Engineering, 18(1).
- Salami, A. W., Amoo, O. T., Adeyemo, J. A., Mohammed, A. A., & Adeogun, A. G. (2016). Morphometrical Analysis and Peak Runoff Estimation for the Sub-Lower Niger River Basin, Nigeria. Slovak Journal of Civil Engineering, 24(1), 6-16.
- Analysing Flood Risk in Lagos Island Local Government Area of Lagos State. (Hudson Irivbogbe, Monsur Adeware, Wasiu Yusuf and Mutiu Akitoye (Nigeria) FIG Congress 2018.
- Faizalhakim, A. S., Nurhidayu, S., & Norizah, K. (2017). SCS-Curve Number in Tropics: A Review. Pertanika Journal of Scholarly Research Reviews, 3(2).

In this study, the max. 24hrs rainfall distribution will follow the SCS assumptions (SCS type-II storm) for design considerations. The ratios of short-duration rainfall to 24-hr rainfall are given in Table 3.1 (USDA, 2015). The cumulative rainfall distribution of the SCS type-II storm is given in and is also shown in Figure 3.1.

Table 3.1: Ratios of short-duration rainfall to 24-hr rainfall for the SCS Type-II storm.

Duration (min)	5	10	15	30	60	120	180	360	720	1440
Ratio to 24-hr	0.114	0.201	0.270	0.380	0.454	0.538	0.595	0.707	0.841	1.000

Table 3.2: Temporal distribution of the SCS Type-II storm.

Time (hrs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Cum. ratio	0.0105	0.0220	0.0345	0.0480	0.0630	0.0800	0.099	0.1200
Time (hrs)	9	10	11	12	13	14	15	16
Cum. ratio	0.1470	0.1810	0.2350	0.6630	0.7720	0.8200	0.8535	0.8800
Time (hrs)	17	18	19	20	21	22	23	24
Cum. ratio	0.9018	0.9210	0.9377	0.9520	0.9647	0.9770	0.9887	1

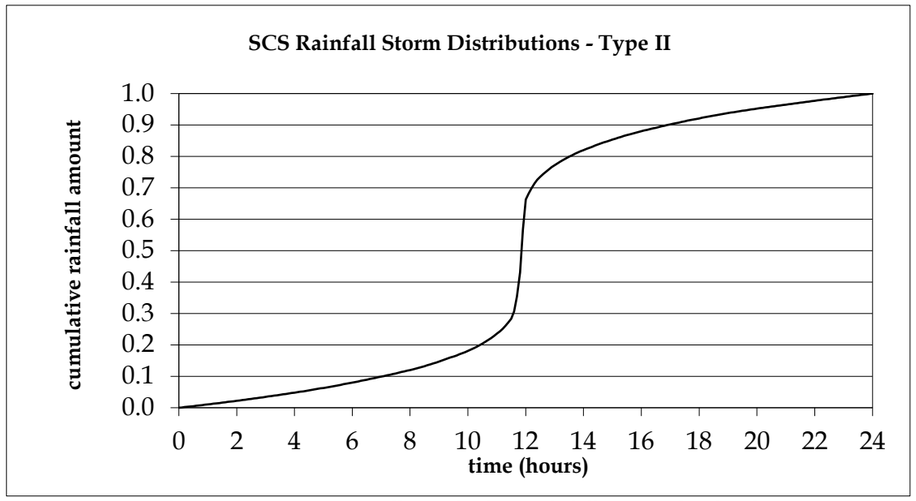

Figure 3.1: SCS type II dimensionless rainfall curves (24 hrs.)

3.2 Areal Reduction Factor

The design of drainage structures requires knowledge of how much rain is likely to fall within a certain amount of time and over a specific area. The rainfall depth of a design storm is estimated from a statistical analysis of a point (station) data. Design point rainfall estimates assume a uniform distribution of rainfall over a catchment, and hence are only representative for a small area.

For larger areas, the areal average rainfall depth is likely to be much smaller than at the point of the maximum observed depth due to the spatial variability of rainfall. The estimation of areal reduction factors (ARFs) is concerned with the relationship between the point and areal rainfall. The Areal Reduction Factor (ARF) is used to convert estimates of extreme point rainfall to estimates of area-averaged rainfall.

The ARF theoretically range from 0 to 1, however, the common practical range is from 0.6 to 1. The ARF varies according to storm characteristics (recurrence interval), and watershed characteristics (watershed size, shape, and geographic location).

The spatial variability of rainfall must be considered, where the observations show differences between the rain gauge records for a concurrent date.

ARF estimates are based on empirical methods. This section presents the Vuillaume equation established for Intertropical Africa (used by TEF). In addition, this section presents an ARF developed for Ibadan based on the collected precipitation depths from 5 meteorological stations. Moreover, the developed ARF is also compared with the Vuillaume equation.

3.2.1 Vuillaume Equation for Intertropical Africa

In order to calculate the proper Areal Reduction factors to use for study catchments, the model established for Inter-tropical Africa has been used. The Vuillaume generalized equation[9] is as follows:

$$ARF = 1 - [(0.95\,s - 10)\,log\,r - 42\times10^{-3}\,P + 152 \pm 10]\times10^{-3}\,log\,S$$

Where

- *ARF* is the Areal Reduction Factor,
- *s* is the scale parameter of the data sample distribution (gradient of the Gumbel fitting),
- *r* is the return period (years),
- *P* is the mean annual rainfall of the catchment (mm), and
- *S* is the surface area of the catchment (km^2).

For example, Table 3.3 illustrates the ARF for Ona watershed at Eleyele dam.

Table 3.3: Areal Reduction Factor at Eleyele dam.

T (years)	Gradex (s)	Annual P (mm)	Area (km2)	ARF
10	24	1300	319	0.72
20	24	1300	319	0.71
30	24	1300	319	0.71
50	24	1300	319	0.70
100	24	1300	319	0.69

3.2.2 Developed ARF for Ibadan

3.2.2.1 Available data

The Consultant studied the spatial rainfall distribution in Ibadan using the collected daily rainfall data from 5 meteorological stations which are: IITA, Old Airport, New Airport, NIHORT and Forestry.

To develop an ARF, it is necessary to select some storm events that can represent the spatial rainfall variation. From the collected rainfall data, 11 significant storm events were selected. Table 3.4 shows the selected events and their corresponding precipitation depth in each station.

Table 3.4: Daily Rainfall Data for some Storm Events in 5 Meteorological Stations.

Date	Forestry	New Airport	IITA	NIHORT	Old Airport
31-Aug-1980	127.5	NA	88.5	196.5	**274.1**
21-Sep-1987	NA	71.9	**178.3**	64.8	NA
5-Jun-2000	NA	4.2	**102**	58.2	NA
1-May-2007	NA	**182.4**	34	70.7	NA
29-May-2011	74.5	31.2	43	**136.9**	NA

[9] Vuillaume, G. (1974). L'abattement des precipitations journalieres en Afrique intertropicale: variabilite et precision de calcul. Cahiers ORSTOM. Série Hydrologie, 11(3), 205-240.

Date	Forestry	New Airport	IITA	NIHORT	Old Airport
26-Aug-2011	133.8	86.2	**165.5**	92	NA
4-Apr-2012	**62.6**	12.8	52	50	NA
27-Jun-2012	**85.5**	71.6	69.6	63.2	NA
14-Jul-2012	**162.1**	52.8	152.7	65.4	NA
22-May-2016	22.7	**148.2**	30.5	118.5	NA
30-Sep-2016	**110**	10.8	35.8	42.3	NA

3.2.2.2 *Analysis*

Based on the available data, the Consultant used the following criteria to develop an ARF for each storm event:

1. The precipitation values of each meteorological station are interpolated on a grid for a specified storm event.
2. The grid is bounded by the meteorological stations. No extrapolation is developed beyond the boundaries of the grid. The total area of the grid is around 204km^2.
3. A raster (Isohyetal map) is developed using a GIS commercial software (ArcMap) for each storm event.
4. The Isohyetal maps are prepared with a precipitation interval of 10 mm.

Figure 3.2 shows a sample of the developed Isohyetal map for the storm event of 30 September 2016. Other Isohyetal maps for the other storm events are presented in the Hydrologic Analysis Report "N17036-0100D-RPT-ENV-18-Rev0".

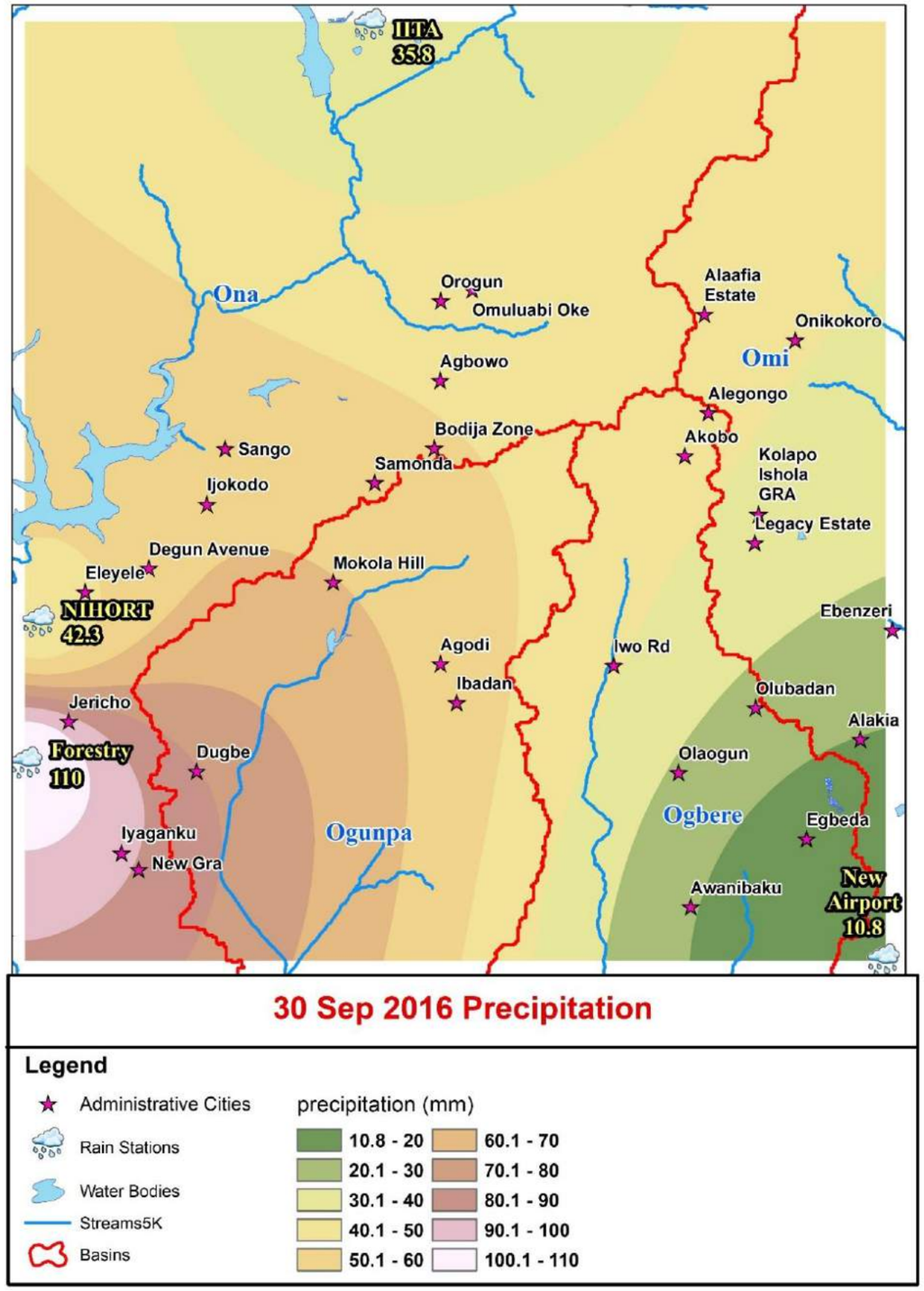

Figure 3.2: Isohyetal Map for the Storm Event of 30 September 2016

3.2.2.3 *Development of Area Reduction Factor*

3.2.2.3.1 ARF for each Storm Event

Based on the developed maps for each storm event, the following data is extracted:

- The precipitation interval, *e.g.* from 100 to 110 mm
- The incremental area of each precipitation interval in km^2

Using the above extracted data, the average precipitation depth is calculated with respect to the accumulated area. Finally, the ARF is calculated.

Table 3.5 shows a sample of the extracted precipitation values from the developed storm map (30th June, 2016) and the estimation of its corresponding Area Reduction Factor. Figure 3.3 shows the developed ARF curve for the storm event of 30th Sep, 2016. Precipitation values and ARF curves for other storms is presented in Annex 3.

Table 3.5: Estimation of the Area Reduction Factor for the Storm Event of 30th Sep, 2016

Precip. Interval (mm)	Precip. Value P (mm)	Area Increment A (km^2)	P * A Increment mm.km^2	P * A Accum. mm.km^2	Area Accum. km^2	Average Precip. mm	ARF
100 to 110	105	1.68	176	176	1.68	105.0	0.95
90 to 100	95	3.79	360	536	5.47	98.1	0.89
80 to 90	85	5.90	502	1038	11.37	91.3	0.83
70 to 80	75	7.69	576	1615	19.06	84.7	0.77
60 to 70	65	14.31	930	2545	33.37	76.3	0.69
50 to 60	55	41.43	2279	4823	74.79	64.5	0.59
40 to 50	45	74.27	3342	8165	149.06	54.8	0.50
30 to 40	35	36.84	1289	9455	185.90	50.9	0.46
20 to 30	25	10.54	264	9718	196.45	49.5	0.45
10 to 20	15	8.37	126	9844	204.82	48.1	0.44

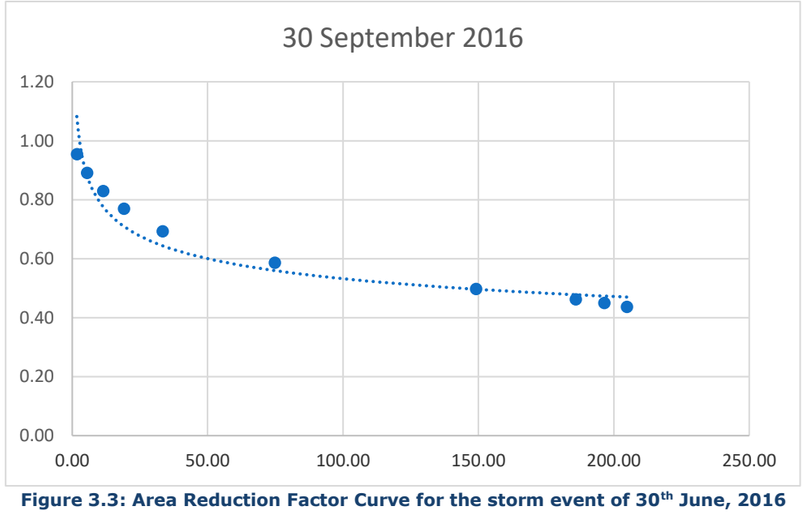

Figure 3.3: Area Reduction Factor Curve for the storm event of 30th June, 2016

3.2.2.3.2 Compiled ARF for Different Storm Events

In a next step, the developed ARF for the 11 storm events are compiled altogether in one table, then a graph is plotted to show the relation of the developed ARF with the accumulated area, refer to Figure 3.4.

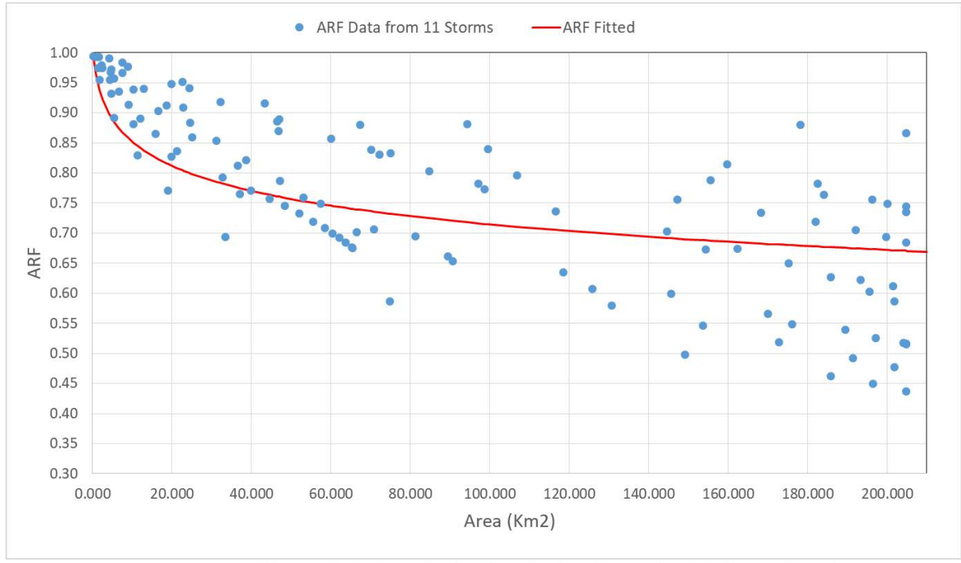

Figure 3.4: Area Reduction Factor Curve for 11 Storm Events

The ARF data of the 11 storm events was used to fit a curve that can present the data. A logarithmic curve similar to the Vuillaume equation was chosen. The equation of the fitted curve is as follows:

$$ARF = 1 - 0.1424 \log(A + 1)$$

Where

- *ARF* is the Area Reduction Factor
- *A* is the surface area of the catchment in km^2

For example, the ARF for Ona watershed at Eleyele Dam (A =319 km^2) is 0.63

3.2.3 Comparison between the Vuillaume Equation and the developed ARF for Ibadan

A comparison between the Vuillaume Equation and the developed ARF for Ibadan is prepared to show the difference between both methods, refer to Figure 3.5.

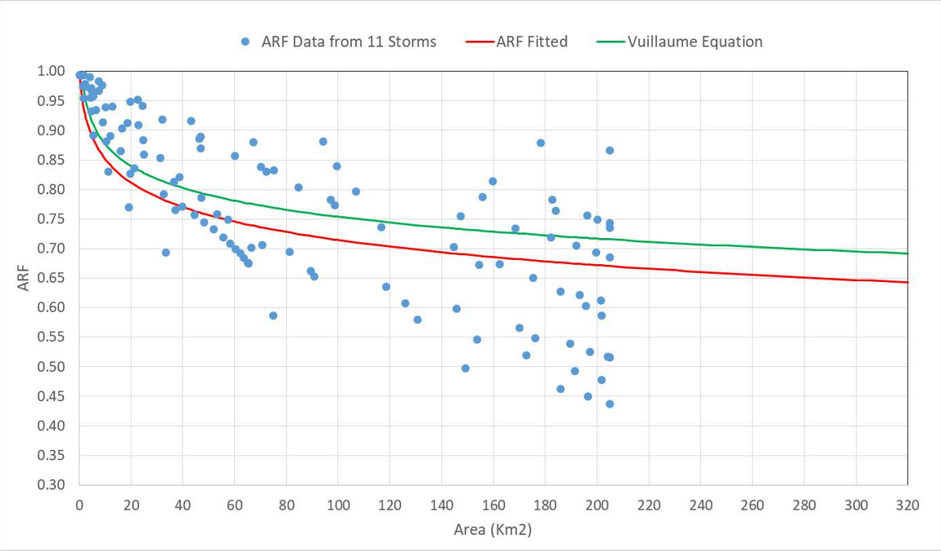

Figure 3.5: ARF relation for Vuillaume Equation and the developed ARF for Ibadan

Based on the above analysis, it is clear that the ARF developed for Ibadan using actual precipitation data is close to the Vuillaume Equation developed for Intertropical Africa, yet the former one is site specific for Ibadan. It is also clear that the ARF developed for Ibadan shows lower values of ARF, this is noticed in the high spatial variability of rainfall data.

The Consultant recommends using the developed ARF for Ibadan as it is site specific, i.e. it simulates the actual characteristics of spatial rainfall variability for the study area in Ibadan. Moreover, it was considered that the catchment area less than 30 km^2 would take ARF equals to 1.

3.3 Catchment Delineation

Delineation is used to define boundaries of the drainage basins, and/or to divide the drainage basins into sub-catchments. Delineation is a part of the process known as watershed segmentation, i.e., dividing the watershed into discrete land and channel segments to analyze watershed behavior. Based on the available LiDAR data, and satellite images the consultant delineated the major catchments under study.

The delineation process was performed using a commercial software GIS package (ArcMap). The results of this procedure determined the morphological characteristics of each catchment such as the watershed area, slope and other morphological parameters of each sub-catchment.

3.3.1 Stream Threshold

The streams network is commonly identified by specifying a threshold area which is the minimum drainage area required to generate a channel flow; such area is identified as the stream threshold.

The procedure followed in this study implemented a methodology that is independent of any of the aforementioned parameters. Instead, it merely requests the area, longest flow path length in addition to its slope as the parameters representing the lumped model of the sub-basin of interest. Nevertheless, the stream threshold defines the minimum delineated area as a sub-basin, i.e. if the stream threshold is defined to be 1% of catchment area or 1% of maximum flow accumulation grid, one cannot have a sub-basin smaller in area than this value. In conclusion, regardless of the geomorphological parameters, the stream threshold should be defined in agreement with the limit of area when applying the unit hydrograph (UH) methodology. The cause of this limit is that UH theory assumes uniform runoff from the entire basin. This assumption is less reliable if the drainage area becomes too large. Based on the above, the threshold is selected based on the definition of the streams. In other words, the threshold should be selected based on the minimum required drainage area to generate a defined stream. After revising the topographic data (LiDAR) and satellite images for Ibadan, The Consultant adopted the 1% of catchment area to be the stream threshold for Ibadan City modelling.

3.3.2 Major Catchments

Ibadan Is divided into four major basins as shown in Figure 3.6. Table 3.6 shows the watershed areas of each major stream along with their average slope and longest flow path length.

Table 3.6: Major Catchments Morphological Parameters

	River Name	Catchment Area (km^2)	Average Slope (%)	Longest Flow Path (km)
1	Ona	451.95	0.35	52.45
2	Ogunpa	72.9	0.57	23.2
3	Ogbere	105.3	0.48	29.2
4	Omi	221	0.35	31.1

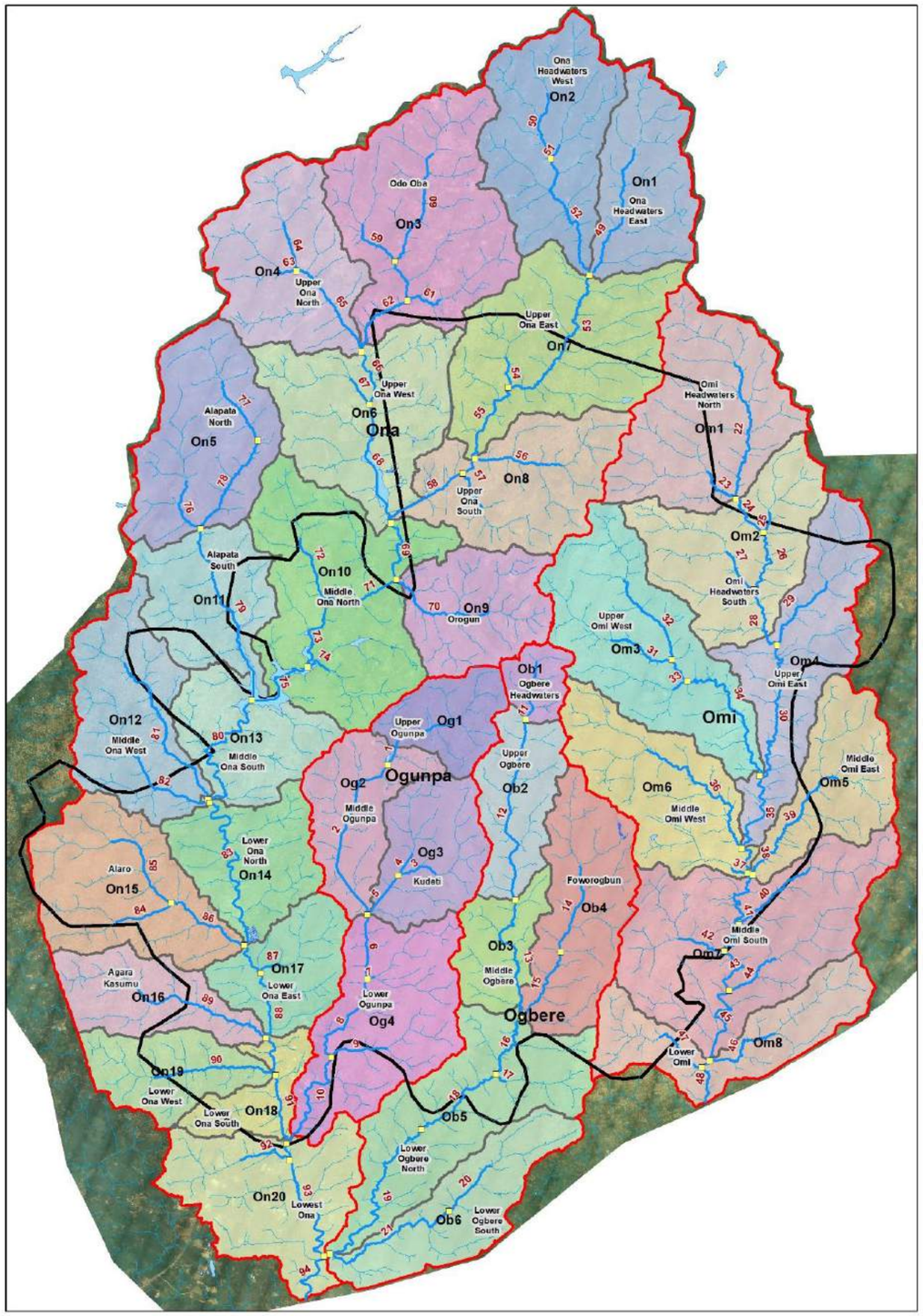

Figure 3.6: Major catchments and the 38 subbasins in Ibadan

3.4 Hydrologic Model Development

3.4.1 Rainfall-Runoff Transform Model

Various methods are available for the determination of flood hydrographs. However, the selection of a specific method depends on the project watershed and the complexity of design or level of accuracy required. The current study used the U.S. Department of Agriculture, National Resources Conservation Service (NRCS), formerly Soil Conservation Service (SCS), runoff method and Unit Hydrograph to estimate peak flood discharges. The SCS method is suited for humid, semi-arid, and arid conditions (SCS, 1985).

The method of the United States Soil Conservation Service (SCS) - (now called the Natural Resource Conservation Service "NRCS") - estimates runoff using catchment characteristics such as antecedent runoff conditions, type of soil, initial abstraction of rainfall, surface treatment as well as land cover. These characteristics are represented by a lumped empirical parameter annotated (CN); the Curve Number, a value used for predicting direct runoff or rainfall excess.

This number typically ranges from 45 (for low runoff depressions) to 98 (for paved impervious areas). An initial abstraction factor (Ia) is specified to reflect the amount of rain depth deducted before effective runoff is generated, such as initial infiltration losses prior to top soil wetness, or rainfall interception by vegetation. The SCS-CN method typically uses an initial abstraction of 0.2S, where *S* is the potential maximum soil storage depth (in mm) and is calculated from the equation below.

$$S = 25.4\left(\frac{1000}{CN} - 10\right)$$

Soil is broadly classified into four different hydrologic groups: A, B, C, and D based on their runoff potential. Soil type A has a low runoff potential, as well as a high infiltration rate and water transmission. This group covers soils such as deep sand, deep loess, and aggregated silt. Soil type B has moderate infiltration and water transmission rates. This group includes shallow loess and sandy loam. Soil type C has slow infiltration and water transmission rates even if thoroughly wetted. This group includes layered soils with high fine textures such as clay loam, shallow sandy loam, soils low in organic contents, and soils of high clay contents. Finally, soil D has a very high runoff potential due to a very low infiltration and water transmission rates. This group includes most of clay soils and soils of high swelling potentials.

Hydrologic soil groups B, C, and D may be chosen to represent the hydrological condition of the soil in general. The Curve Number (CN) associated with normal (average) Antecedent Moisture Conditions (AMC II) for desert soils with vegetation cover ranges from 73 to 85. This value is a very conservative estimate of the curve number and yields a larger value of peak flow. While CN for residential areas may be taken as 91, the CN for mountainous areas may be taken as 85.

The SCS-CN method calculates the volume of runoff given the rainfall depth as an input and the CN value. This relation is given by:

$$Q = \frac{(P - 0.2\,S)^2}{P + 0.8\,S}$$

Where:

- Q is the accumulated depth of runoff (mm);
- P is the accumulated depth of storm rainfall (mm); and
- S is a function of the CN value as given earlier (mm).

Curve Number Estimation

The Consultant reviewed existing land use, land cover and available soil cover and generated a CN map. The Curve Number (CN) Map for Ibadan is presented in Figure 3.7. The Curve Number typically ranges from 73 (for low runoff depressions) to 98 (for paved impervious areas).

The Used CN map has been prepared based on the Digital Soil Map of the World data (http://www.fao.org/geonetwork/srv/en/metadata.show?id=14116), and the Global Land Cover data from (http://due.esrin.esa.int/page_globcover.php).

The study area has a Tropical climate with two well-defined seasons: a wet season and a dry season; Therefore, the Antecedent Moisture Conditions (AMC) should be considered. The estimated CN values in Figure 3.7 represents AMCII conditions (normal moisture conditions); Thus, the values will be adjusted considering the antecedent moisture conditions (AMC).

To weight the found curve numbers to reflect AMCIII conditions (wet conditions), the following equation will be used.

$$CN\ (III) = \frac{23 \times CN(II)}{10 + 0.13 \times CN(II)}$$

Where,
CN(III): the wet condition CN Value
CN(II): the normal conditions CN value

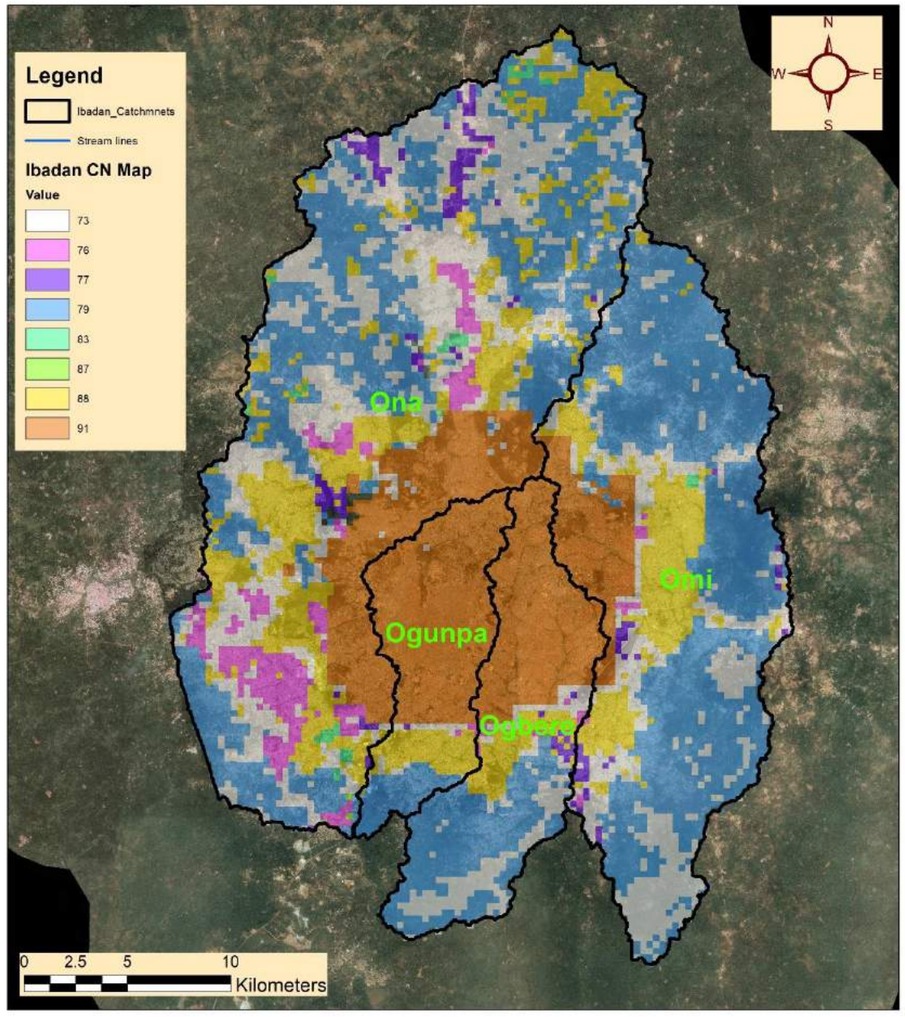

Figure 3.7: CN map of studied sub-catchments

3.4.2 Unit Hydrograph (UH)

A method of converting rainfall to river flow is required. Unit hydrographs, which defines the response of a catchment to an input of unit net rainfall, have gained acceptance by most hydrologists as a useful tool in flood estimation. If possible, catchment unit hydrographs should be derived from flood events recorded on the catchment together with a continuous (autographic) trace of storm rainfall. In the absence of the necessary continuous rainfall and flow data, synthetic unit hydrographs may be constructed using catchment properties such as stream length and channel slope. The hydrograph parameters are related to catchment characteristics from which the parameters are derived. These methods can be applied to ungauged catchments with similar hydrologic conditions. Many synthetic

unit hydrograph methods have been studied. The Clark UH (also called time-area method) has been selected to be used in this study, it has the following characteristics:

- Considering the basin shape, not just the total area
- Consider delays attributed to sub-surface runoff
- Can be applied in non-regular shape basins
- Describe the storage in the sub-basins

The Clark unit hydrograph is adopted in this study because it handles the different catchment parameters and it has been widely used in countries like USA and Australia.

3.4.2.1 Clark Unit Hydrograph

The movement of water through a catchment is subject to the process of translation and attenuation. Translation is a movement of water through the catchment because of gravity force. Attenuation is the result on friction force and channel storage effect. Clark (1945) pointed out that the translation of flow could be described by the time area curve. This time area curve shows the fraction of catchment area contributing runoff to the catchment outlet as a fraction of time since the start of effective rainfall. Effective rainfall is the excess rainfall. i.e. it represents the direct runoff. The time area curve is bounded by the time of concentration, Tc of a catchment, which is a parameter of the Clark's unit hydrograph.

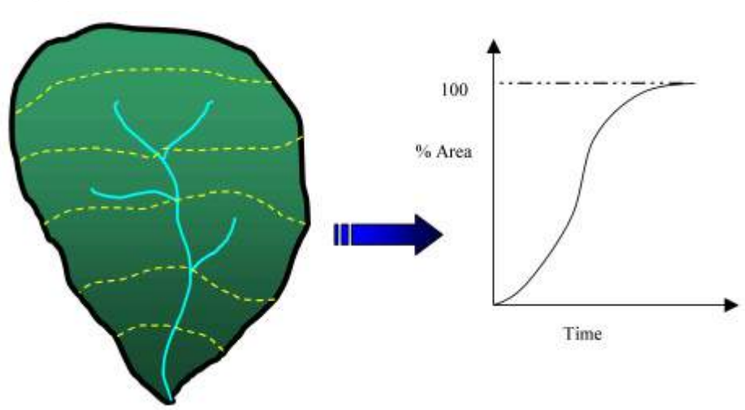

Figure 3.8: Hypothetical watershed divided and Corresponding accumulative time-area curve

Clark used a simple linear reservoir for which storage is related to inflow to describe attenuation as:

$$S = RO$$

Where

- S the catchment storage
- R catchment storage coefficient and
- O outflow from the catchment

Clark stated that a synthetic unit hydrograph could be obtained by routing 1 unit of direct runoff to the channel in proportion to the time area curve and routing the runoff entering the channel through a simple linear reservoir.

Research has found that determining the time area curve for the catchment was not needed to obtain a reasonable unit hydrograph. Experience with the Clark unit hydrograph method at Hydrologic Engineering Centre shows that a detailed time area curve is not necessary for accurate synthetic unit hydrograph estimation. The typical time area relationship which is used in Hydrologic Engineering Centre is:

$$\frac{A_t}{A} = \begin{cases} 1.414\left(\frac{t}{T_c}\right)^{1.5} & for\ t \le \frac{T_c}{2} \\ 1 - 1.414\left(1 - \frac{t}{T_c}\right)^{1.5} & for\ t > \frac{T_c}{2} \end{cases}$$

Where

- A_t cumulative catchment area contributing at time t
- A total catchment area
- T_C time of concentration of catchment

Clark Parameter Determination

The *Tc* and *R* values for the Clark unit hydrograph method were determined by USGS for small watersheds in Illinois report no. 00-4184 (Timothy, et al., 2000), also the department of drainage and irrigation in Government of Malaysia provided the hydrological procedure no. 27 which described the estimating of Clark parameters in rural areas in Malaysia. In the hydrological procedure no. 27, the *Tc* and *R* values for the Clark unit hydrograph method were determined by calibrating HEC-HMS model (2009). The 228 storms used in deriving the rainfall runoff relationships for the 41 catchments were used to estimate the *Tc* and *R*. Due to the similarity between Ibadan and Malaysia (Tropical areas) the provided equations in the procedure no. 27 were used in this study. The equations are as follows:

$$T_c = 2.32\ A^{-0.1188} L^{0.9573} S^{-0.5074}$$

$$R = 2.976\ A^{-0.1943} L^{0.9995} S^{-0.4588}$$

Where

- *A* catchment area in km2
- *L* main stream length in km
- *S* weighted slope of main stream in m/km

3.4.3 Hydrologic Routing Model

In hydrology, routing is the procedure used to predict the changes in a hydrograph shape as water flows through a river channel or a reservoir. In flood protection studies, hydrologists seek an answer as to how to interpret a sudden intense rainfall event to discharge in a watershed upstream of an area of interest.

If water flows past a certain point on a stream where a flow gauge records the flow readings periodically, these records are later used to create a hydrograph. A rainfall event, typically called a flood event, can cause a bulge in the graph, as an increased flow travels down the river, reaches the flow gauge, and passes along it. However, the geometry of the natural river cross section as well as the flow resistance within a river (from the riverbed, for example represented in the roughness coefficient) can affect the shape of the flood wave. Often, the flood wave will be attenuated (have a reduced peak flow).

Routing techniques can be readily classified as Hydraulic or Hydrologic routing. The main difference between both approaches is the way the model handles the conservation of momentum. Usually the hydraulic routing implements the solution of partial differential equations of unsteady open-channel flow. Namely, either the full St. Venant equations or a simplified form, which is the diffusion wave equations. On the other hand, Hydrologic routing solely relies on the conservation of mass (Continuity equation) when performing the routing in rivers or channels.

The hydrologic models (e.g. linear and nonlinear Muskingum models) must estimate certain hydrologic parameters using recorded data at both upstream and downstream sections of rivers and/or by applying robust optimization techniques to solve the one-dimensional conservation of mass and storage-continuity equation.

Another hydrologic routing model is the Muskingum–Cunge model, which is considered an improvement to the nonlinear Muskingum model. The main improvement is it evolves an approach that uses simple physical concepts and common river characteristics such as channel geometry, reach length, roughness coefficient, and slope to estimate the model parameters without complex and expensive numerical solutions.

3.4.3.1 Muskingum-Cunge routing Model

The Muskingum-Cunge flood routing procedure has been successfully incorporated into the Natural Resources Conservation Service (NRCS) Technical Release 20 (TR-20) hydrologic model. It has been used ever since to analyze the impacts of watershed changes (land use, reservoir construction, channel modification, etc.) on the volume of runoff and peak discharge.

Routing tests performed by Younkin and Merkel (1986, 1988) showed increased accuracy, consistency, and range of physical conditions when compared to both the Modified Att-Kin (Attenuation-Kinematic) and convex flood routing methods which had been used previously (USDA, NRCS, 1965 and 1983).

A succinct description of this model is as follows:

- It represents attenuation of flood waves and can be used in reaches with a small slope.
- If the slope varies significantly throughout the stream represented by the reach, it is imperative to use multiple reaches with different slopes.

The theoretical development of the Muskingum-Cunge routing equation is based on the simplification of the convective diffusion equation. The routing equation is the same as the traditional Muskingum routing method (Linsley et al., 1982) wherein the coefficients of the Muskingum-Cunge method are based on data such as cross section and estimated Manning n. The coefficients of the traditional Muskingum method can only be determined from stream-gauged data. This makes the Muskingum-Cunge method more favorably applied to ungaged streams (which vastly outnumber gaged streams). In 1969, Cunge developed equations to estimate the variables (K) and (X) used in the traditional Muskingum equation by using hydraulic properties of the reach. The mathematical derivation is condensed and presented by Ponce (1981). The equations for (K) and (X) are:

$$X = \frac{1}{2}\left(1 - \frac{Q_o}{c\,\Delta x\,B\,S_O}\right)$$

Where (X) is a weighting factor varying between 0.0 and 0.5 (dimensionless). (Q_0) is a reference discharge in (m^3/s), (S_0) is the channel bottom slope in (m/m), (c) is the kinematic wave celerity in (m/s), (Δx) is the routing reach or sub-reach length in meters and (B) is the water surface width in meters.

K is the storage time constant for the river reach in seconds, which has a value close to the wave travel time within the river reach, it is estimated as:

$$K = \Delta x / c$$

$$Q = x\,A^m$$

Where: $x = s^{0.5}/(n\,B^{0.67})$ and m = 5/3

$$c = m\,V$$

Values of (X) and (K) are calculated and updated at each time step to derive the Muskingum-Cunge approach.

HEC-HMS software package offers as one of its capabilities, the Muskingum-Cunge routing model for reaches. The consultant used such feature when building the hydrologic model of Ibadan city. The

manning coefficient of roughness n which is required as an input for the model was assumed based on Hydraulic Engineering Circular No. 22, Third Edition, Urban Drainage Design (HEC 22) (Table 3.7).

Table 3.7 : Typical Range of Manning's Coefficient (n) for channels and pipes (Source: HEC 22)

Conduit Material	Manning's n*
Closed Conduits	
Concrete pipe	0.010 - 0.015
CMP	0.011 - 0.037
Plastic pipe (smooth)	0.009 - 0.015
Plastic pipe (corrugated)	0.018 - 0.025
Pavement/gutter sections	0.012 - 0.016
Small Open Channels	
Concrete	0.011 - 0.015
Rubble or riprap	0.020 - 0.035
Vegetation	0.020 - 0.150
Bare Soil	0.016 - 0.025
Rock Cut	0.025 - 0.045
Natural channels (minor streams, top width at flood stage <30 m (100 ft))	
Fairly regular section	0.025 - 0.050
Irregular section with pools	0.040 - 0.150
*Lower values are usually for well-constructed and maintained (smoother) pipes and channels	

Table 3.8 : Adopted Roughness n value to be used in the hydrological model

Stream Conditions	Roughness n value
Lined channel (like Ogunpa)	0.02
Natural channel with flood plain	0.08
Small vegetated channel	0.15

3.4.4 Software Package Used

The United States Army Corps of Engineers, Hydrologic Engineering Centre - Hydrologic Modelling System (HEC-HMS) version 4.0 has been used for hydrologic modelling of streams that flow into the Ibadan main streams.

HEC-HMS is designed to be applicable in a wide range of geographic areas for solving the widest possible range of flow estimation problems. This includes large river basin water supply and flood hydrology, and small urban or natural watershed runoff. Hydrographs produced by the program are used directly or in conjunction with a full hydrodynamic model for studies of flood wave routing, and sizing of subsequent sections of the main Streams.

The program is a generalized modelling system capable of representing many different watersheds. A model of the watershed is constructed by separating the hydrologic cycle into manageable pieces and constructing boundaries around the watershed of interest. Any mass or energy flux in the cycle can then be represented with a mathematical model. In most cases, several model choices are available for representing each flux. Each mathematical model included in the program is suitable in different environments and under different conditions based on the watershed characteristics and local climate and the goals of the hydrologic study.

3.5 Results of the Hydrology Analysis

The rainfall-runoff model is built based on the previously described methodology using the free software package HEC-HMS (Hydrologic Engineering Centre - Hydrologic Modelling System) developed by the United States Army Corps of Engineers. HEC-HMS software is used to estimate flow for each sub-catchment using the adopted areal reduction factor. For Example, Ona Basin has been modelled based on delineation threshold 1%, adopted Areal Reduction Factor (ARF) 0.63, and rainfall depth for 100 years return period is 240 mm. Figure 3.9 shows the hydrograph at Eleyele dam with peak discharge 981.3 CMS.

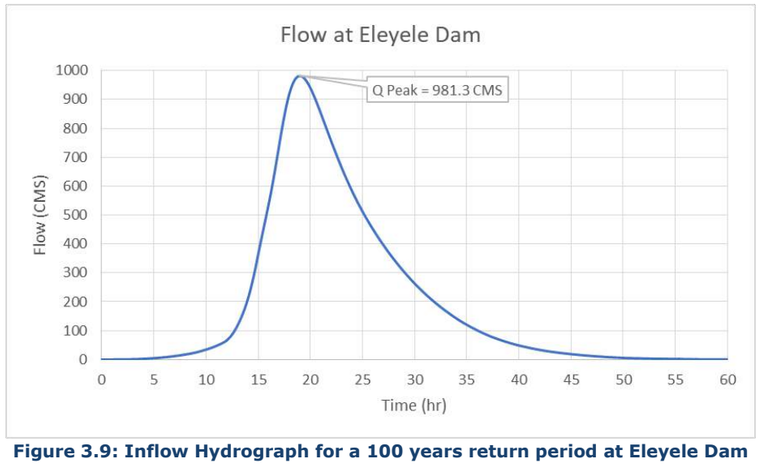

Figure 3.9: Inflow Hydrograph for a 100 years return period at Eleyele Dam

4 Climate Change Projections in Nigeria

Trends in the past climate over Nigeria were investigated by analyzing the historical climate records from 40 stations from the Nigerian Meteorological Agency (NiMet) for the period 1971 to 2000; and future climate change information was generated by downscaling two future climate projections Climate Models. The two future climate projections were based on two scenarios known as A2 and B1, with A2 incorporating higher GHG emissions, and B1 lower GHG emissions (BNRCC, 2011). The results are summarized below.

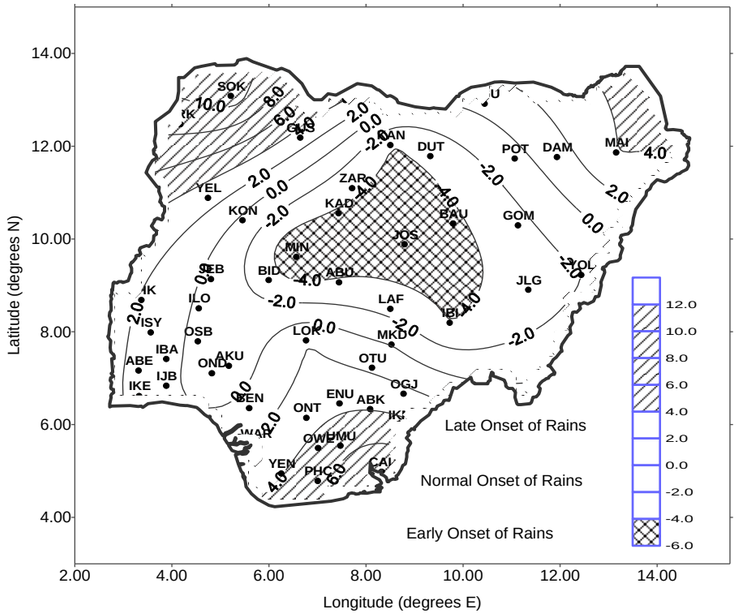

Figure 4-1: Distribution of Anomaly of (1941-1970) Mean Onset Dates of Rainy Season in Nigeria. Source (BNRCC, 2011).

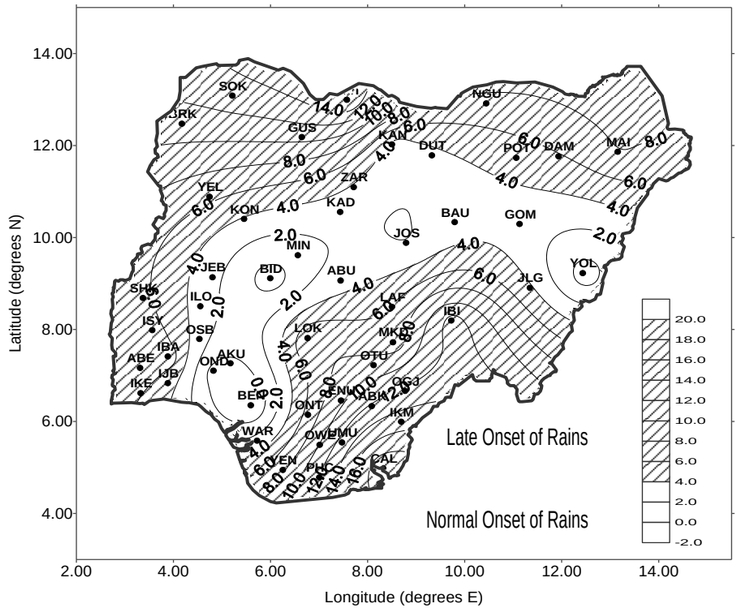

Figure 4-2: Distribution of Anomaly of (1971-2000) Mean Onset Dates of Rainy Season in Nigeria. Source (BNRCC, 2011).

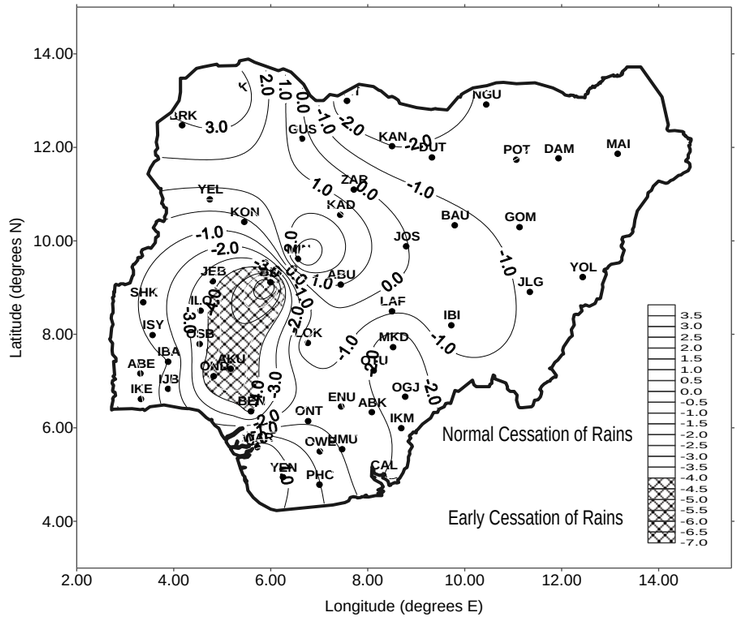

Figure 4-3: Distribution of Anomaly of (1941-1970) Mean Cessation Dates of Rainy Season in Nigeria. Source (BNRCC, 2011).

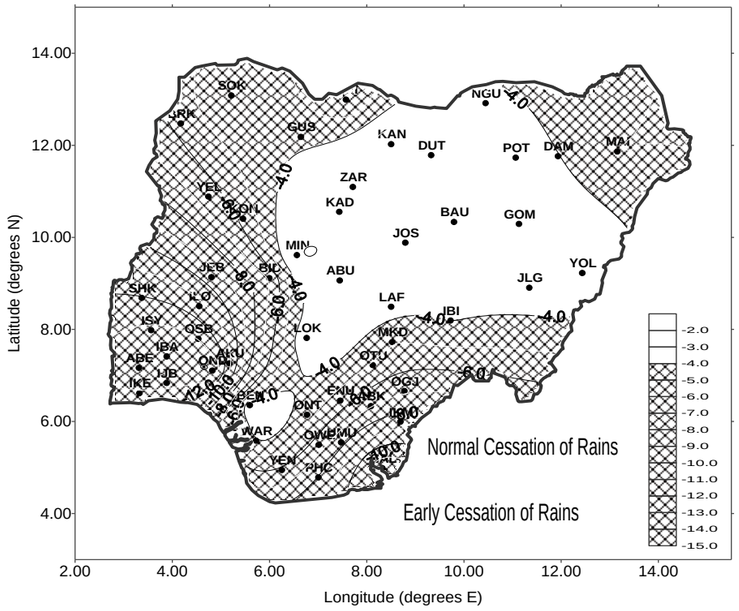

Figure 4-4: Distribution of Anomaly of (1971-2000) Mean Cessation Dates of Rainy Season in Nigeria. Source (BNRCC, 2011).

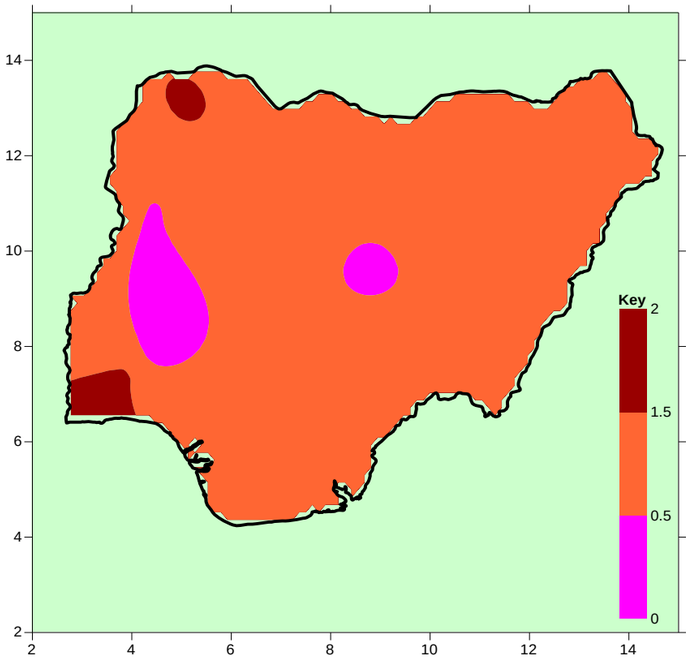

Figure 4-5: Mean Temperature Anomaly: (1942 – 2000). Source (BNRCC, 2011).

4.1.1.1 *Temperature Projections*

Temperatures across the country show an increasing trend from mid-20th century to date. Overall, the scenarios suggest a warmer climate in the future. For instance, the A2 scenario projects a temperature increase of 0.04°C per year from now until the 2046- 2065 period, rising to 0.08°C per year after 2050. However, regional variations are expected.

The coastal regions are projected to warm less than the interior regions because of the cooling effects of the Atlantic Ocean, and the northerly stations are expected to be warmer than the southerly stations. The highest increase (4.5°C by 2081-2100) is projected in the northeast. Figure 4-6 shows the projected increases in maximum daily temperature across Nigeria. This temperature distribution is consistent with the findings of the 2007 Intergovernmental Panel on Climate Change (IPCC)[10] report.

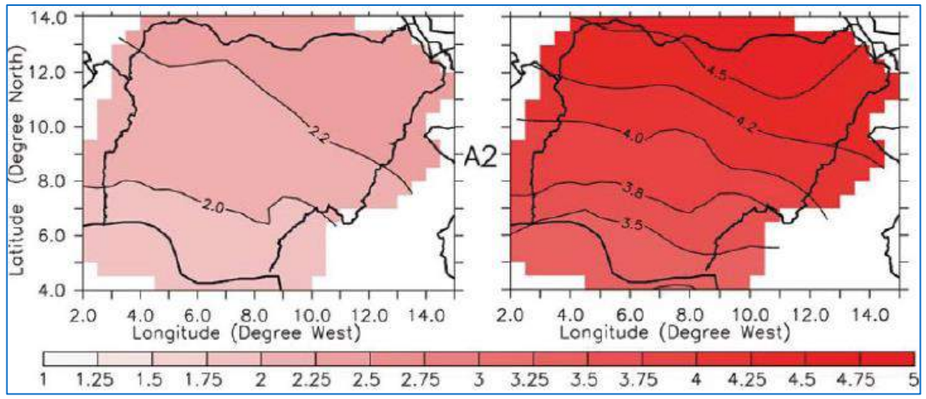

Figure 4-6: Projected Increases in Maximum Daily Temperature over Nigeria (°C relative to the present day climate). The left panel shows the temperature increase in the period 2046-2065 and the right panel for the period 2081-2100. Source (BNRCC, 2011).

Note: Numerical figures on the vertical and horizontal axes are Latitudes and Longitudes, respectively. The maps cover the periods 2046-2065 and 2081-2100).

4.1.1.2 *Rainfall Projections*

The projected changes in rainfall vary across the country, with the A2 scenario suggesting a wetter climate in the south, but a drier climate in the northeast. Figure 4-7 shows these projected changes across the country.

[10] IPCC (2007), Intergovernmental Panel on Climate Change Synthesis Report Summary for Policymakers. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK, accessed at http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-spm.pdf

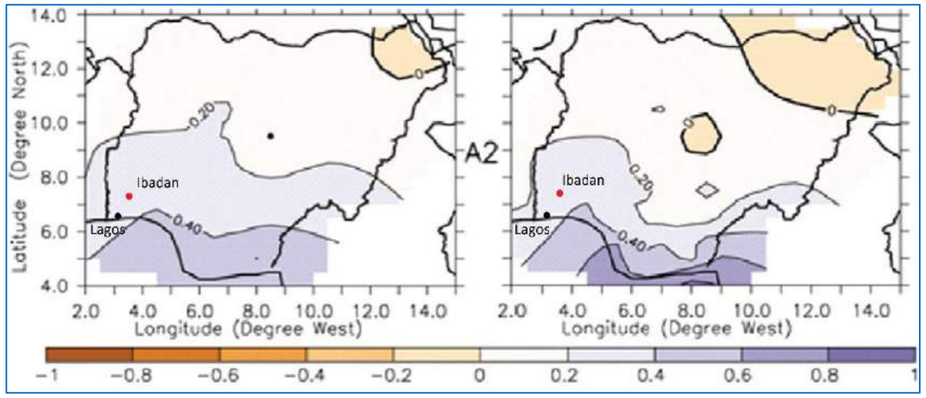

Figure 4-7: Projected Changes in Average Daily Rainfall over Nigeria (mm/day relative to the present day climate). The left panel shows the rainfall changes in the period 2046-2065 and the right panel for the period 2081-2100. Source (BNRCC, 2011).

These changes are consistent with the projected increase in temperature. The higher temperatures along the coast would increase evaporation from the ocean and produce more rainfall over the coastal region, provided there are mechanisms to trigger the precipitation process. On the other hand, a warmer climate in the semi-arid region (i.e. northeast) would decrease the atmospheric humidity (moisture in the air), and thereby reduce the chance of cloud formation and rainfall. Regarding Ibadan, it is essential to recognize the climate change impact and the increase in the projected rainfall amounts, and subsequently the flooding severity across the city.

It is clear from Figure 4-7 that an increase in precipitation values is expected to occur in Ibadan in the following decades. Such an increase may increase the average daily precipitation by an additional value between 0.2 to 0.4 mm/day.

IPCC (2012)[11] indicated that due to the expected climate change, the rainfall of a certain return period would become more frequent. For example, a maximum daily rainfall with current return period of 20 years would have a 10-year or 5-year return period in the future. This indicates an increase in the projected maximum daily rainfall depths in the range of 10% to 20%.

[11] IPCC (2012); "Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation"; Special Report of the Intergovernmental Panel on Climate Change

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Annex

2

Geological Considerations and Geotechnical Investigations

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1 Introduction

This annex intends to make use of the geotechnical investigations that were conducted in the three pools of priority works (Lot1, Lot2, Lot3 and Lot4) in giving sight of the soil conditions in the City of Ibadan.

This annex includes the following:

- An overview for the geological setting at the Project area in terms of stratigraphy and tectonics, and evaluating the potential geological hazards, if any,
- Subsurface investigation results in order to characterize the encountered subsurface formations

The aim of this annex is to give an indication to the geological and geotechnical properties for the soils in Ibadan based on the geotechnical investigations conducted for the priority investments. More details on the results of the geotechnical investigations are indicated in the detailed design reports of Lot1, Lot2, Lot3 and Lot4 and for the surveyed culverts only; refer to the following reports:

- N17036-0100D-RPT-ENV-12-Rev1 (Lot1)
- N17036-0100D-RPT-ENV-13-Rev1 (Lot2)
- N17036-0100D-RPT-ENV-22-lot 3a-Rev2
- N17036-0100D-RPT-ENV-32-Lot 3b-Rev0
- N17036-0100D-RPT-ENV-24-Lot 4a- Rev1
- N17036-0100D-RPT-ENV-33-Lot 4b- Rev0

The locations for Geotechnical Site Investigations include the following Rivers: Orogun, Upper Ogunpa (Agodi), Kudeti, Ogbere and Lower Ona (Ona1), in addition to 7 separate structures located in scattered areas in Ibadan, refer to Figure 1.1.

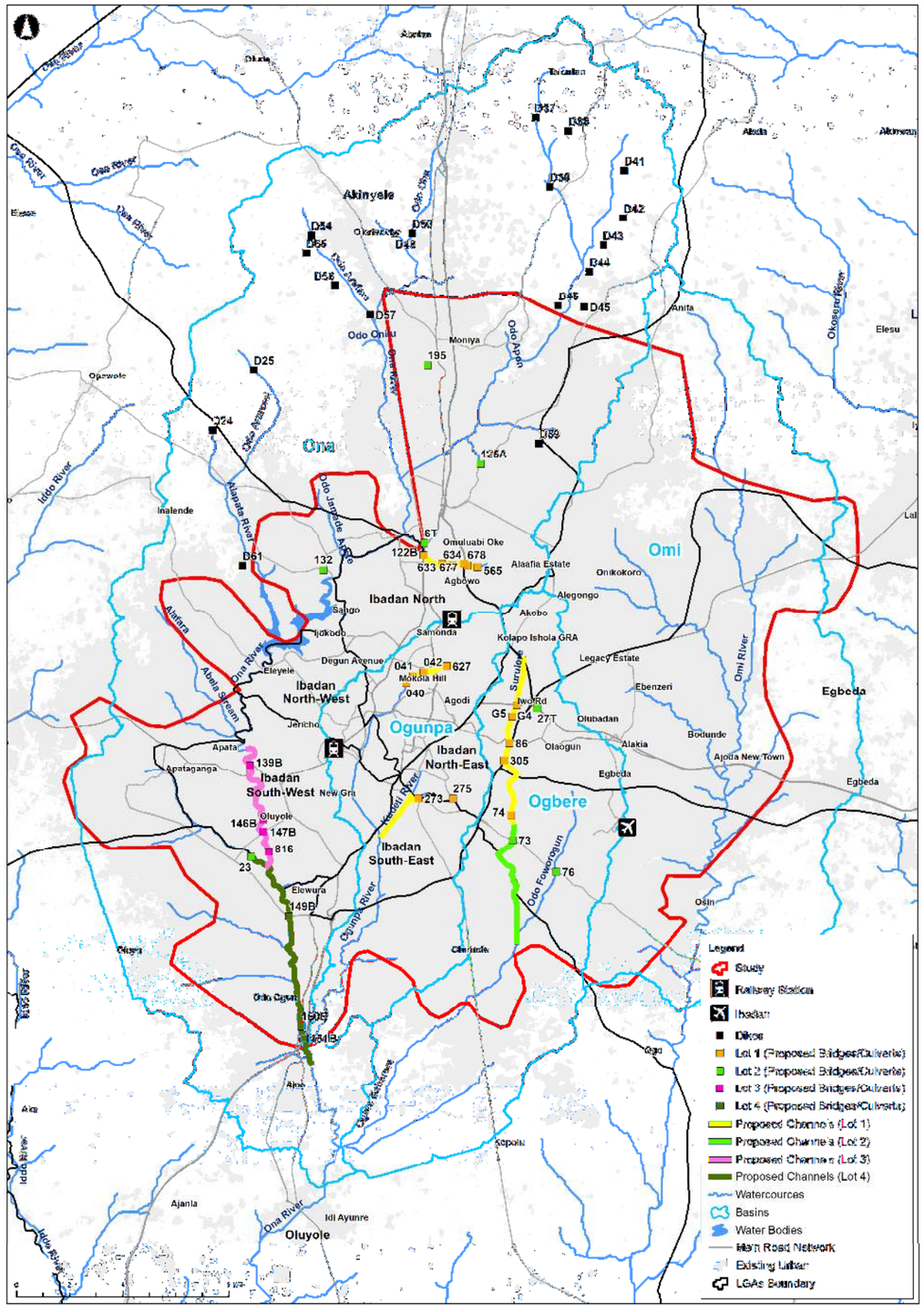

Figure 1.1: General Layout

2 General Geology of the Project Sites

2.1 General Geology

Based on the available geologic maps, reports and literature, the project area is characterized by an undulated topography which is dominated by Precambrian to Upper Cambrian rocks of Basement Complex that are surrounded by major valleys (Figure 2.2).

The Precambrian - Upper Cambrian rocks are dominated by schists - quartzites, gneissic granite, banded gneiss, and migmatites, while the less dominant rocks are represented by pegmatite, aplites, quartz veins and dykes which intruded the main rocks of different composition and orientations.

The outcrops of these rocks show variable degrees of weathering due to the erosion and weathering activities acting near the surface. These rock outcrops are generally, covered with Quaternary alluvial/colluvial soil deposits which have variable thicknesses range between 3m and 10m.

The valley deposits are represented by Quaternary alluvium. The Quaternary deposits are composed of unconsolidated, poorly sorted and moderately to well-sorted sand, silt, clay and gravels that are covered locally with fill materials in some places.

The project area is affected by several Precambrian fractures (faults and joints) of variable extensions and orientations decorating the area. The fractures (faults and joints) have variable extensions and orientations and are oriented mainly in NE-SW and NW-SE directions. The folds are gently-plunging towards north to northwest and south to southeast.

The prevailing geological conditions at the proposed sites are mostly rocky with expected soil cover and highly weathered layers at the upper part resulted from erosion and weathering activities dominated near the surface. The weathered layers may be overlain by lateritic soils derived from different parent rocks based on the locations with respect to the topography.

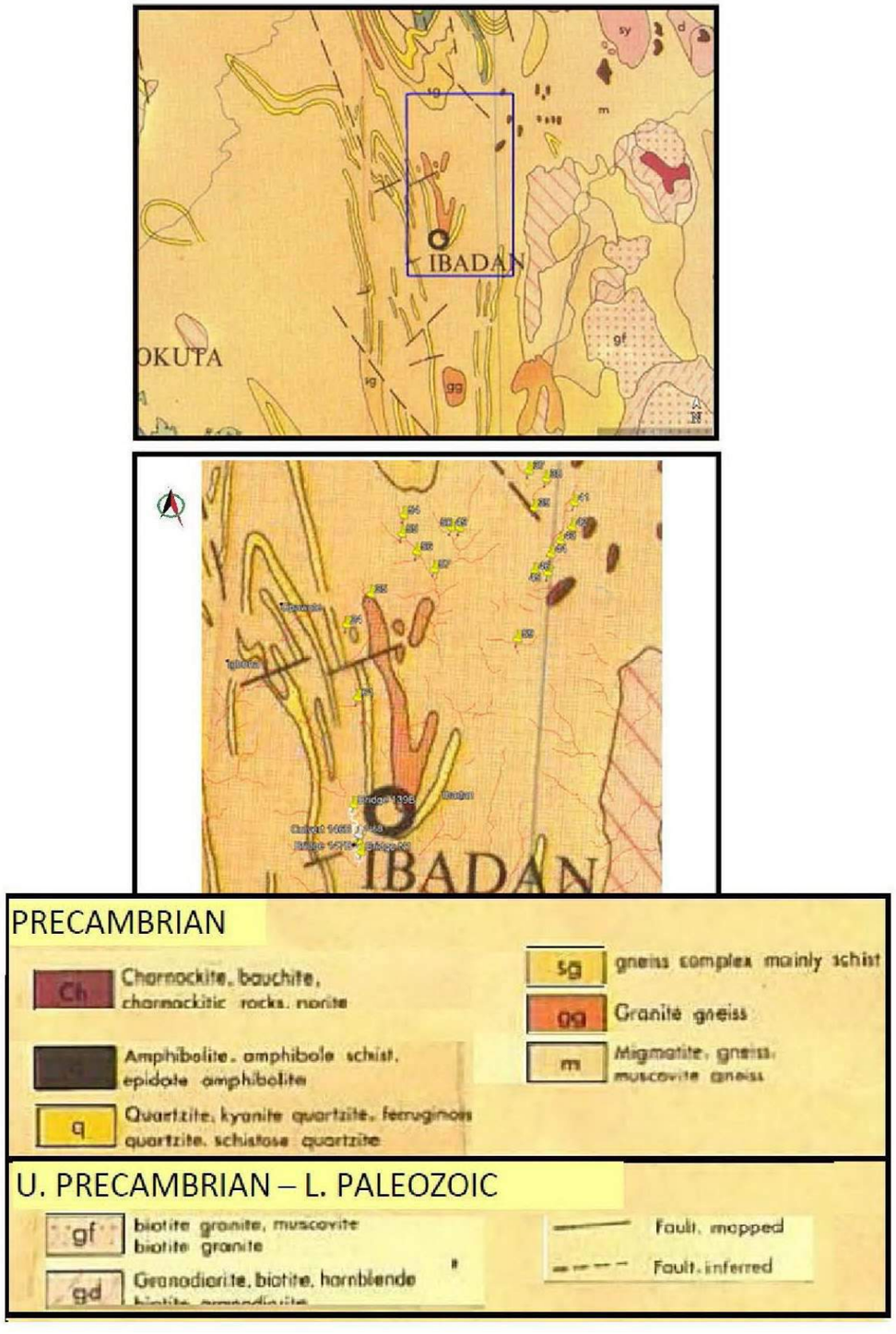

Figure 2.1: General Geologic map of Ibadan

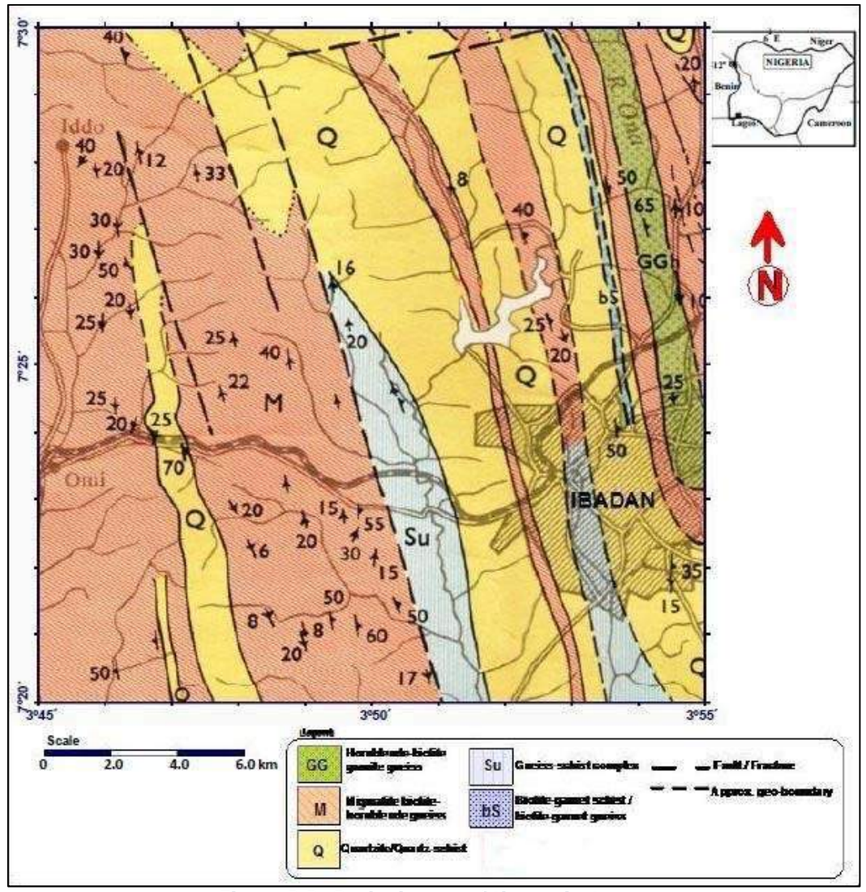

Figure 2.2: Geologic map of the project area

2.2 Geo-Hazards

Based on the desk study, the expected geohazards in the sites of the proposed structures can be highlighted as follow:

2.2.1 Problematic soil

The areas around streams are dominated by considerable thickness of deposits mostly are made of lateritic sand, silt and clay. These deposits, particularly at its upper part, may form permeable overburden and can create, dissolution, leakage and/or swelling problems.

2.2.2 Weathering profile of bedrock

The surface and near surface bedrock is highly to moderately weathered under/near the main stream. The weathered bedrock becomes soft and its strength decrease according to the degree of weathering. When a heavy structure (such as dam and bridges) is founded on such profile, it may create settlement problems. It is necessary to excavate all soil and weathered-altered rock to reach sound fresh rock, based on the geotechnical properties of the rock/soil that will be revised from the data of site investigation, if any.

2.2.3 Potential leakage along fractures and foliations

The presence of fractures and/or foliation crossing / normal to the dam axis or the drainage channel may constitute favorable passages for groundwater movement. Intensive erosion along these fractures may have led to open erosional channels that could facilitate the leakage.

2.2.4 Potential rock failure

The Precambrian rocks at the Project site are affected by variably oriented fractures (joints and faults) and foliation. These major discontinuities may represent potential surfaces of rock failures.

2.2.5 Seismicity of the area

Most of the previous studies revealed that the Nigeria is located in the zone of low seismic hazard activity. However, the country has experienced pockets of tremors of magnitudes ranging from 4.3 to 4.5, between 2000 and 2009, where some were felt in parts of Ibadan and Ogun State. Most of these tremors occurred in south-western Nigeria where a major fault (the Ifewara-Zungeru fault), is believed to exist. Consequently, seismic design is to be carried out considering the prevailing codes and applicable standards.

3 Geotechnical Site Investigation

Around 40 boreholes were implemented on site to understand the specific site conditions at these locations. These boreholes are detailed in the reports mentioned above and the lsit of these boreholes are shown in Table 1.

Table 1 Boreholes locations and depth to groundwater

Boring No.	Easting	Northing	Natural Ground Elevation (m)	Groundwater Depth (m)
Orogun River				
BH 122B- 01	600115	824085	175.113	2.65
BH 633 - 01	600787	823758	176.736	1.68
BH 634 - 01	601176	823709	178.89	1.47
BH 634 - 02	601181	823689	178.374	1.68
BH 677 - 01	601625	823754	188.356	Deep
BH 678 - 01	601749	823709	181.778	1.13
Agodi River				
BH 40-01	599442	819269	184.974	2.85
BH41-01	599689	819552	186.516	1.73
BH 42-01	600086	819689	188.683	1.4
BH4 627-01	600951	819896	193.083	2.59
Kudeti River				
BH 273- 01	599903	814898	181.305	2
BH 275 - 01	601211	814880	193.03	1.95
Ogbere North River				
BH G1- 01	603848	820109	240.991	4.5
BH G2- 01	603853	819652	223.98	2.1
BH G3- 01	603687	818995	228.221	2.25
BH G5- 01	60345	817994	224.48	1.02
BH 86- 01	603332	817017	225.251	6.79
BH 74- 01	603372	814289	206.979	4.7
Ogbere South River				
BH 73 - 01	603432	813339	204.57	Not encountered
BH 73 - 02	603485	813310	203.714	Not encountered
Ona River				
BH–139-01	593605	816155	137.79	3.2
BH–139-02	593491	816123	137.76	3.4
BH–147B-01	594101	813685	136.7	4.3
BH–147B-02	594006	813626	134.709	1.5
BH–149 B-01	595068	810455	125.366	3.4
BH–149 B-02	595028	810453	125.21	3.7
BH–149 B-03	594987	810461	124.999	3.9
BH–149 B-04	594952	810477	124.99	3.4
BH–150 B-01	595502	806311	145.007	3
BH–150 B-02	595496	806292	145.126	5
BH–150 B-03	595475	806253	144.976	5
BH–150 B-04	595458	806213	145.026	5
Separate Structures				
BH 6 T - 01	600130	824520	173.916	1.18
BH 132 - 01	596299	823530	180.036	1.96
BH 195 - 01	600247	831264	215.038	4.25
BH 125 A - 01	602254	827523	233.999	1.36
BH 23 - 01	593584	812679	151.262	1.7
BH 27 T - 01	604386	818329	219.167	1.65
BH 76 - 01	605042	812167	167.995	2

Laboratory tests were carried out in accordance with the relevant ASTM and BS Standards.

The following laboratory tests were performed:

- Determination of physical properties including natural moisture content for soil and rock samples.
- Bulk and dry densities of rock samples.
- Grain size distribution.
- Unconfined compressive strength of rock samples.
- Unconfined compressive strength With Elastic Modulus.
- Point load strength.
- Direct shear strength.
- Specific gravity.
- Atterberg limits.
- Chemical Analysis test on water, soil and rock samples.

4 Soil Stratifications and subsurface conditions

For the boreholes performed, the subsurface conditions and soil stratifications was determined. The following sub-sections present these conditions for each group of investigated boreholes.as also grouped in Table 1.

4.1 Orogun River

The available boreholes drilled for Orogun River represent the following that the soil layers are summarized as follow:

- **Fill Layer:** Debris, appears only at BH 633-01 only with 40 cm thickness from the ground level.
- **Top Soil:** sandy clay to clayey sand, it appears from the ground level up to depth varying between 1.5 m and 5.0 m.
- **Moderately to slightly weathered rock:** it appears at depth varying from 1.5 m to 5.8 and extends to the end of boring.
- **Completely to highly weathered Rock Soil:** it appears in boreholes BH 677-01 from 5 m to the end of boring and in borehole BH 122-01 from 3.60 m to 5.80 m.

4.2 Agodi River

The available boreholes drilled for Agodi River represent the following that the soil layers are summarized as follow:

- **Top Soil:** sandy clay to clayey sand, it appears from the ground level up to depth varying between 4.5 m and5.6 m. This layer is continued to the end of boring in some locations.
- **Completely to highly weathered Rock Soil:** it appears on borehole 677-01 from 5 m to the end of boring. and it appeared from 3.60 m to 5.80m from ground surface in BH 275-01
- **Moderately to slightly weathered rock:** it appears only on BH-275-01 from 7m to the end of boring.

4.3 Kudeti River

The available boreholes drilled for Kudeti River are summarized as follow:

- **Top Soil:** sandy clay to clayey sand, it appears from the ground level up to depth varying between 2.5 m and 4.2 m. This layer is continued to the end of boring in BH-42-01 and BH-627-01.
- **Completely to highly weathered Rock Soil:** it appears only in borehole 40-01 from 4.20 m to 5 m.
- **Moderately to slightly weathered rock:** it appears from 5 m to end of boring at BH-40-1 and 41-01.

4.4 Ogbere North River

The available boreholes drilled for Ogbere North River are summarized as follow:

- **Top Soil:** sandy clay to clayey sand, it appears from the ground level up to depth varying between 2.5m to the end of boring. This layer is continued to the end of boring in some locations.
- **Completely to highly weathered Rock Soil:** it appears on borehole G2-01 at 4.20m to the end of boring. This layer appeared also in BH 74-01 and BH G3-01 from 6.2 m to 9 m from ground surface.
- **Moderately to slightly weathered rock:** it appears on borehole 74-01 from 8 m to the end of boring. This layer appeared twice in BH G3-01 from 2.50 to 6.50 m from ground surface and from depth 9 m to the end of boring.

4.5 Ogbere South River

The available boreholes drilled for the proposed culvert 73 on Ogbere South River are summarized as follows:

- **Natural soil:** The soil layer comprises stiff to very stiff sandy gravelly clay, dark brown to reddish brown and appears from the ground level down to depth varying from 1.5to 3.0 m.
- **Moderately to slightly weathered rock:** This layer is encountered underlying the soil layer and extend to the end of the drilled boreholes. The rock is strong to very strong, white and grey to greyish olive green, with patches of micaceous flakes, fractures to slightly fractured rock.

4.6 Ona1 River

The boreholes drilled for the proposed bridges **139B** and **147B** in Ona1 River are summarized as follows:

- **Top layer:** This layer comprises of a hard-brownish red clay layer and appears from the ground level down to depth 1.0 and 1.2 m at the location of bridges 139B and 147B, respectively.
- **Clay layer:** This soil layer underlies the top layer and extends down to depth 2.8m and 3.5m below the natural ground surface at the location of bridges 139B and 147B, respectively. This layer is described as very stiff to hard Clay.

- **Completely weathered Rock:** This very dense, grey, completely weathered rock underlies the Clay soil with thicknesses of 1.6 and 3.5m at the location of bridges 139B and 147B, respectively.
- **Moderately weathered to un-weathered rock:** This layer is encountered underlying the completely weathered rock and extend to the end of the drilled borehole. The rock is strong to very strong, greyish, porphyritic granite gneiss, moderately to partly fractured, moderately weathered to un-weathered.

Based on the drilled boreholes, the geological conditions at site **149B** are presented below. The drilled boreholes revealed that the encountered lithological units are represented by clay layer, sand layer, weathered rock and sound rock. The description of these units at the investigated sites can be summarized as follow;

- Sandy Clay layer was encountered at the ground surface for all boreholes and continues to a depth from 3.0 m to 6.0 m. It is very stiff to hard lateritic very sandy clay, brown to reddish brown.
- Sand layer is widely distributed across the site underlying the upper layer. It is fine to medium sand, with little silt and gravel. The thickness of this layer ranges between 1.3 m to 4.5 m.
- Weathered rocks these rocks comprise of slightly to moderately weathered, medium to coarse grained granite, dark grey to grey. It appears after the sand layers in all boreholes except borehole 149B 3. The thickness of the weathered rocks is ranges from 3.5 m to 10.6 m.
- The Sound rocks underlie the weathered rocks for all boreholes except borehole 148B 1, with an investigated thickness ranges from 2.0 m to 6.5 m. These rocks are composed of fine to medium grained Diorite rock, grey to dark grey.

As for the boreholes drilled at bridge 150B, it revealed that the encountered lithological units are represented by clay layer, sand layer, weathered rock and sound rock. The description of these units at the investigated sites can be summarized as follow;

- The soil layer was encountered from the ground surface at all boreholes with a thickness ranges from 4.0 m to 9.0 m. This unit comprises of sandy silt to silty clay.
- The weathered rocks were encountered at all boreholes underneath the soil layer, except borehole 150 B -3. These rocks comprise very compact coarse grained highly weathered rock. This layer is extended to the end of boring for boreholes 150B1- 150B2, while it appears with 2.0 m thickness only.
- Moderately weathered to sound rocks it appears at two boreholes only from depth 6.0 to 7.0 m to the end of boring. Fine to medium grained diorite rock.

4.7 Separate Structures

4.7.1 Culvert 6T

The available borehole drilled for the proposed culvert 6T represent that the soil layers are summarized as follow:

- **Top fill material:** This layer comprises asphaltic concrete with lateritic fill and appears from the ground level down to depth 0.4 m.
- **Natural soil:**The soil layer underlies the fill material and extends down to depth 3.5 m below the natural ground surface. This layer is greyish brown to brownish grey, very loose to very dense, silty/gravelly/clayey sand.
- **Completely weathered Rock:** This very dense, brownish grey, completely weathered rock is encountered underlying the natural granular soil with thickness of 0.5 m.
- **Moderately weathered to unweathered rock:** This layer is encountered underlying the completely weathered rock and extend to the end of the drilled borehole. The rock is strong to very strong, greyish, porphyritic granite gneiss, moderately to partly fractured, moderately weathered to unweathered.

4.7.2 Culvert 132

The available borehole drilled for the proposed culvert 132 represent that the soil layers are summarized as follow:

- **Top fill material:** This layer comprises debris, loose, brown, gravelly sand and appears from the ground level down to depth 1.2 m.
- **Natural soil:**The soil layer underlies the fill material and extends down to depth 6.0 m below the natural ground surface. This layer is greyish/brownish gray, very loose to loose, clayey/gravelly clayey sand.
- **Completely weathered Rock:** The completely weathered rock is encountered underlying the natural granular soil down to depth 9.0 m below the natural ground surface. The weathered rock is very dense, brownish grey.
- **Moderately weathered rock:** This rock layer is encountered underlying the completely weathered rock and extend to the end of the drilled borehole. The rock is weak, grey, porphyritic granite gneiss, moderately fractured, moderately weathered.

4.7.3 Culvert 195

The available borehole drilled for the proposed culvert 195 represent that the soil layers are summarized as follow:

- **Natural soil:**The soil layer comprises loose to medium dense, brown to greyish brown, silty/clayey sand and appears from the ground level down to depth 4.2 m.
- **Completely weathered Rock:** This layer is encountered underlying the natural granular soil and extend to the end of the drilled borehole. The rock is medium dense, greyish/brownish, decomposed weathered rock with alluvial silt.

4.7.4 Culvert 125A

The available borehole drilled for the proposed culvert 125A represent that the soil layers are summarized as follow:

- **Top fill material:** This layer comprises firm reddish brown laterite quartz gravels and appears from the ground level down to depth 1.0 m.
- **Natural soil:** The soil layer underlies the fill material and extends down to depth 3.5 m below the natural ground surface. This layer is loose to medium dense, grey, clayey sand.
- **Completely weathered Rock:** It is very dense, grey, completely weathered rock and encountered underlying the natural granular soil with thickness of 0.5 m.
- **Slightly weathered to unweathered rock:** This layer is encountered underlying the completely weathered rock and extend to the end of the drilled borehole. The rock is strong to very strong, grey, porphyritic massive granite gneiss, moderately/mechanical fractured, slightly weathered to unweathered.

4.7.5 Culvert 23

The available borehole drilled for the proposed culvert 23 represent that the soil layers are summarized as follow:

- **Natural soil:** This soil layer comprises loose brownish/greyish, silty/clayey sand and appears from the ground level down to depth 2.5 m.
- **Completely weathered Rock:** It is grey highly weathered decomposed rock and encountered underlying the natural granular soil with thickness of 1.1m.
- **Moderately to partly weathered rock:** This layer is encountered underlying the completely weathered rock and extend to the end of the drilled borehole. The rock is weak to strong, grey, porphyritic massive granite gneiss, moderately to partly fractured, moderately to partly weathered.

4.7.6 Culvert 76

The available borehole drilled for the proposed culvert 76 represent that the soil layers are summarized as follow:

- **Natural soil:** This layer comprises firm brown to white silty clay with rubbles and gravel occurrences and appears from the ground level down to depth 3.0 m.
- **Completely weathered Rock:** This layer encountered underlying the natural soil layer and extends down to depth 7.3 m below the natural ground surface
- **Moderately weathered rock:** This rock layer is encountered underlying the completely weathered rock and extend to the end of the drilled borehole. The rock is weak, grey, foliated, moderately weathered.

4.7.7 Culvert 27T

The available borehole drilled for the proposed culvert 27T represent that the soil layers are summarized as follow:

- **Top fill material:** This layer comprises firm brown, sandy clay with waste materials and appears from the ground level down to depth 1.5 m.
- **Natural soil:** This layer underlies the fill material and extend down to the end of the drilled borehole. The soil is soft to firm, brownish to yellowish grey, sandy/silty clay, clayey sand with gravel and micaceous flakes.

Annex

3

Channel Lining Multi Criteria Analysis

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6. Recommendations: **7**

1. Introduction

This annex covers the possible design options for the drainage channels and/or the required stream training.

The analysis of the natural streams conditions and available ground levels revealed the following observations:

- High longitudinal slopes of the natural streams. The slope values are ranging from 0.2% to 0.7% with a general average slope of 0.5%. These slope values are applicable on most of the streams under study (Ogbere, Agodi, Orogun and Kudeti). The high slopes result in high velocities which range between 2m/sec to 4m/sec with a general average velocity of 2.6m/s.
- The site reconnaissance showed that most of the streams are eroded at the side slopes and downstream of the crossing structures (bridges and culverts) due to the high velocities
- In addition, the soil type of the channel bed are mixture of loose silty sand and clayey sand under laid by rock at different depths. In Kudeti, the rock was encountered about 1.2 m, in average, below the natural channel bed level.

As a result of the above observations, it is worth considering the following concerns when developing the channel designs:

- High slopes and velocities lead to high scour/erosion to the channel section which accordingly results in substantial damages to the channel or natural stream and the areas/ stretches close to the stream.
- Highly erodible soils (e.g. a mixture of fine sand and clay, specifically in the case of Agodi River).
- Significant erosion in natural streams particularly downstream of the crossing structures.

The following sections defines all possible design options that could be practically addressed in order to protect the drainage channels against the substantial damages due to scour.

2. Channel Cross-section Design Options

The major concerns are the high natural slopes resulting in high velocities and erodible bed. In order to overcome these problems, the following measures could be adopted:

- Flatten the channel/natural stream slopes to reduce velocities.
- Propose lining for the channels and/or trained stream sections to minimize soil erosion.
- Combination of both proposals above.

2.1 Change of Natural Slopes

Flattening natural streams slopes could be implemented by introducing a series of drops along the channel as shown in Figure 1. The flattening of the slopes results in the following:

- Reduction in the velocity values along the channel.
- Increase of the channel dimensions in order to accommodate the same flow
- Higher velocities and increased eddies at the location of the drops.

These imply the following considerations while designing the channels:

- Special care while defining the channel alignment to reduce the expropriation requirements.
- Special protection should be implemented at the drop section.
- Protection to the channel side slopes is required
- Special protection at all crossing structures.

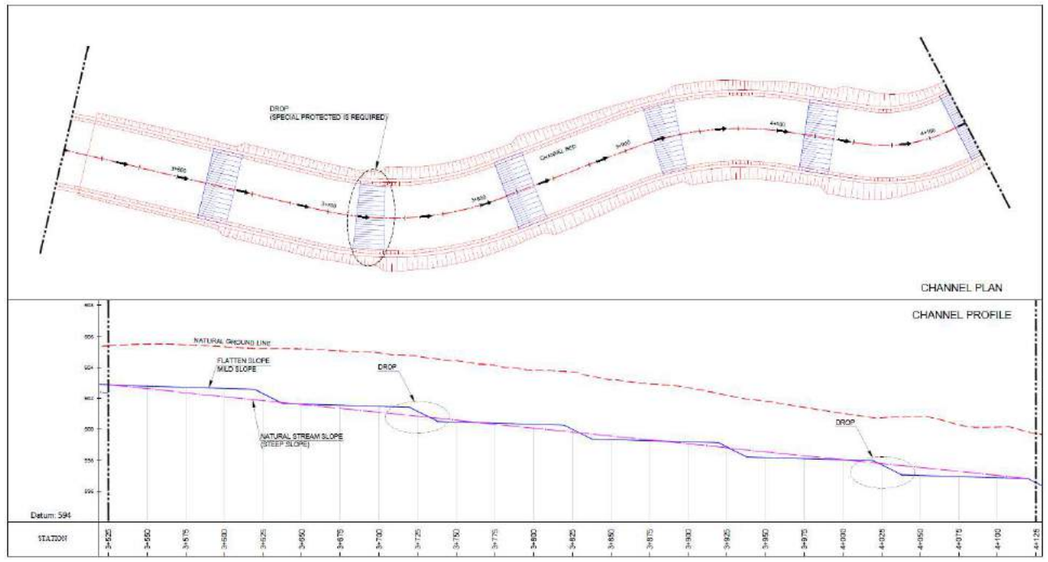

Figure 1: Plan and profile for the drops along the channel

2.2 Lining of channels/trained streams

As a result of the high velocities along the natural streams, higher than the non-erodible velocities, channel sections need to be lined.

As shown in Figure 2, lining could be applied in two configuration options as follows;

a) Full Channel Lining:

The full channel lining will result in the following:

- Eliminates or at least minimizes damages to the channels and the nearby properties.
- Reduction in the roughness and accordingly increase the hydraulic capacity of the channel cross-section.
- Reduction in channel right of way.
- Prevents urbanization encroachment to the streams.
- Reduces maintenance works.

(An example of this type of protection is the channelization of Ogunpa through Ibadan core area/city centre).

The main drawbacks of this type of lining are the following:

- High capital cost
- Decrease in the aesthetics of the area
- High erosion in the bed which should be studied for each specific channel stretch.

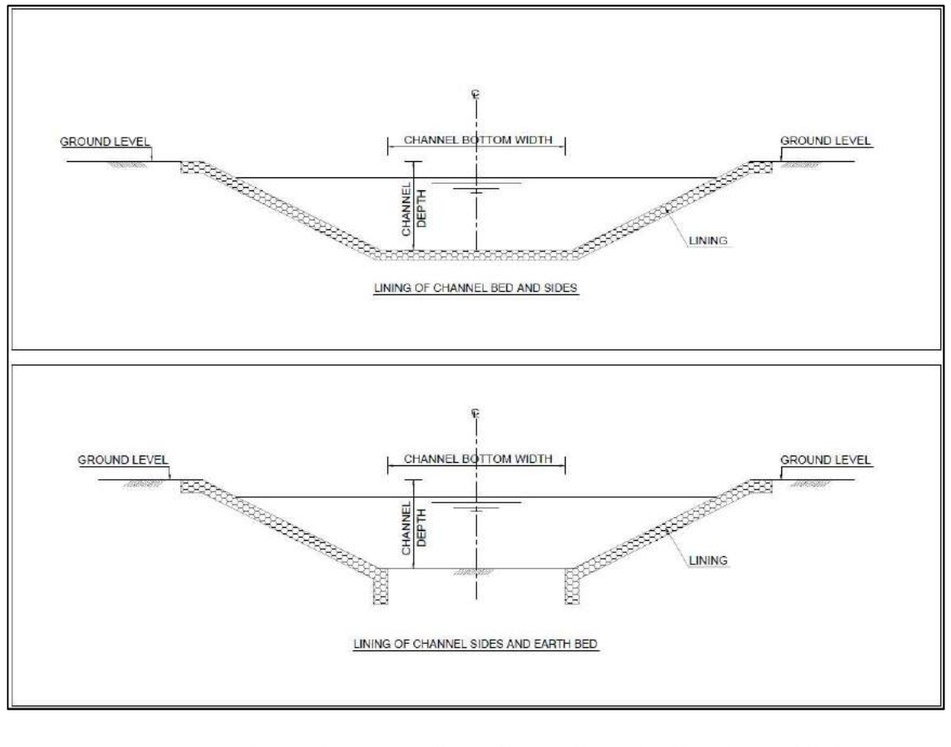

Figure 2. Two configuration options for the channel lining

b) Channel Side Slopes Lining:

In this configuration, the channel side slopes only is protected. Consequently, the bed of the channel is exposed to erosion and as such construction of a special protection at the toe of the side slope embankments is required. This type of protection will result in the following:

- Protection to the channel sides.
- Erosion in the channel bed.
- Relative reduction in the roughness and accordingly moderate increase of the hydraulic capacity of the channel cross-section (less reduction than the full lined cross-section).
- Reduction in channel right of way (wider than full lined cross-section).
- Prevents urbanization encroachment to the streams.
- Medium reduction in maintenance works.
- Protection of the upstream and downstream of the culverts are required.

The main drawbacks of this type of lining are the following:

- Medium capital cost
- Affect the aesthetics of the area

Different types of lining materials could be proposed as follows:

- Reinforced concrete
- Grouted riprap
- Gabion boxes and mattress
- Concrete canvas
- Concrete cable

Figures 3 to 7 present the different types of lining material.

Figure 3. Concrete lining

Figure 4. Grouted Riprap lining

Figure 5. Gabions

Figure 6. Concrete Canvas

Figure 7. Concrete Cables

The following sub-section shall present the different lining alternatives and the selection of the preferred alternative to implement.

3. Proposed Lining Configuration

The Consultant has studied different alternatives for the channel lining as follows:

1- Channel lining with concrete to cover the full section (refer to Figure 8).
2- Channel side slopes to be lined with concrete and use of natural bed (refer to Figure 9).
3- Channel side slopes to be lined with grouted riprap and use of natural bed (refer to Figure 10).
4- Channel side slopes to be lined with grouted riprap and bed is lined with concrete (refer to Figure 11).
5- Channel side slopes to be lined with grouted riprap and concrete shear key and use of natural bed (refer to Figure 12).
6- Channel lined with gabion mattress for the full section (refer to Figure 13).
7- Channel side slope lined with gabion mattress and use of natural bed (refer to Figure 14).
8- Channel is lined with concrete canvas lining (refer to Figure 15).
9- Channel is lined with concrete Cables lining (refer to Figure 16).

The expected cost for each lining alternative has been estimated taking into consideration the excavation and backfilling cost.

Table 1 summarizes the cost estimated for all lining alternatives proposed for Agodi River channelization.

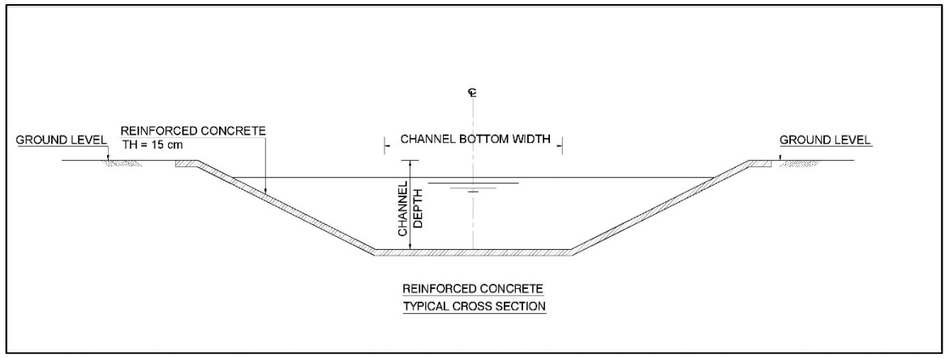

Figure 8: Alternative 1 – Concrete Lining at Channel Sides and Bed

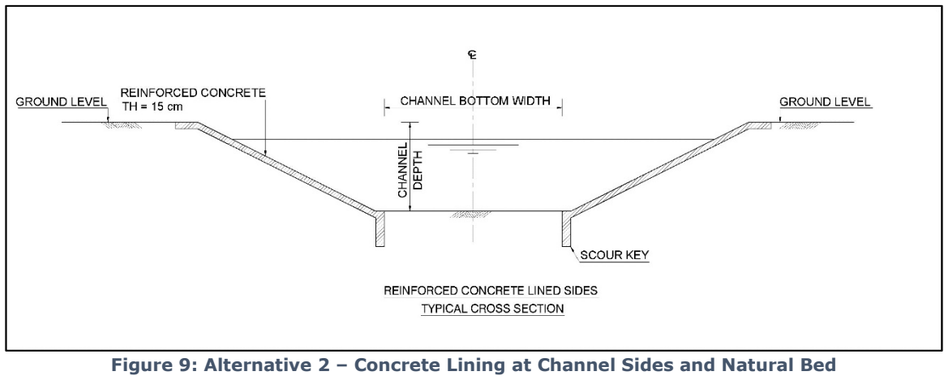

Figure 9: Alternative 2 – Concrete Lining at Channel Sides and Natural Bed

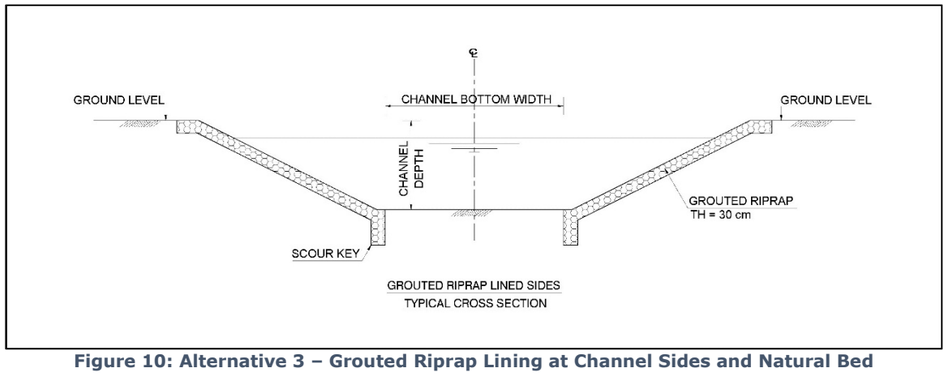

Figure 10: Alternative 3 – Grouted Riprap Lining at Channel Sides and Natural Bed

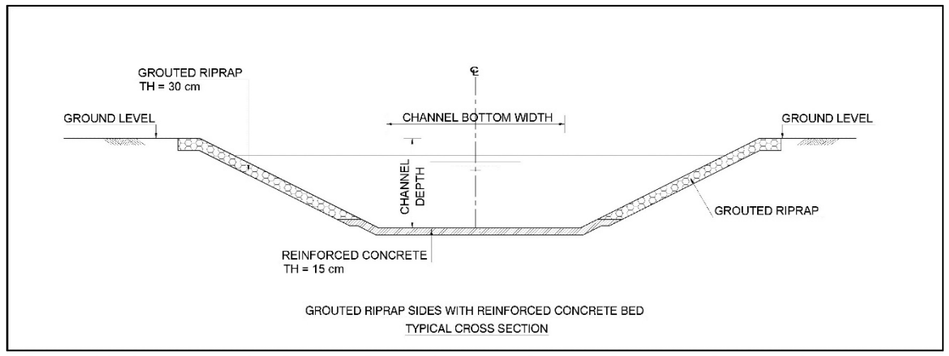

Figure 11: Alternative 4 – Grouted Riprap Lining at Channel Sides and Concrete Lining at Bed

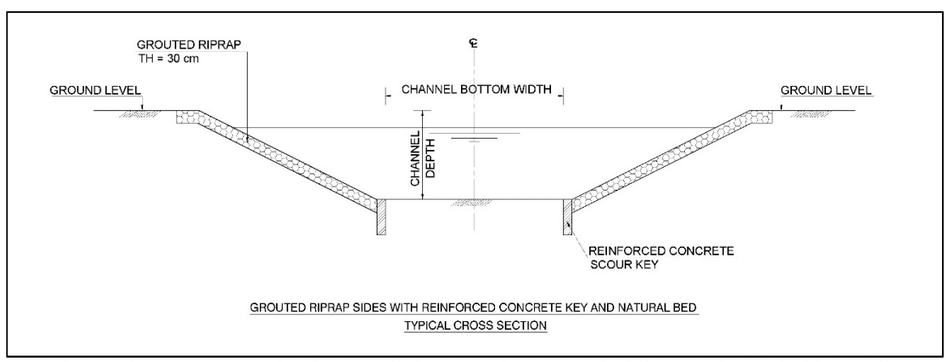

Figure 12: Alternative 5 – Composite (Grouted Riprap and Concrete) Lining at Channel Sides and Natural Bed

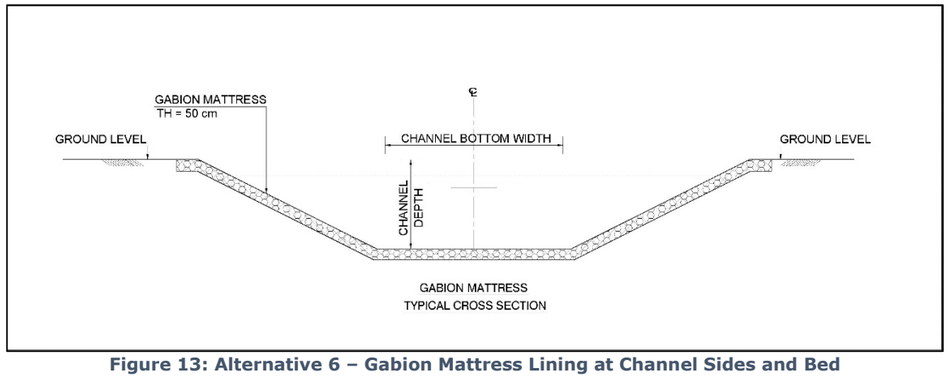

Figure 13: Alternative 6 – Gabion Mattress Lining at Channel Sides and Bed

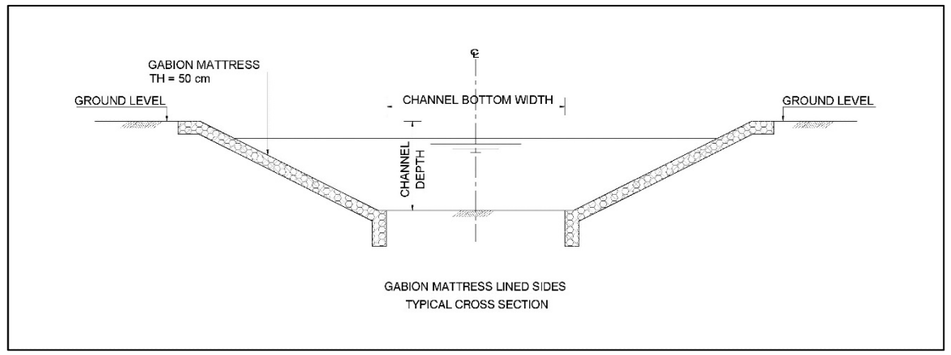

Figure 14: Alternative 7 – Gabion Mattress Lining at Channel Sides and Natural Bed

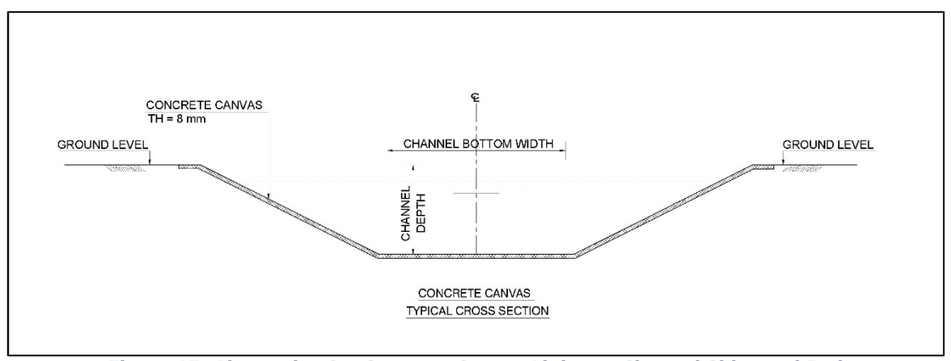

Figure 15: Alternative 8 – Concrete Canvas Lining at Channel Sides and Bed

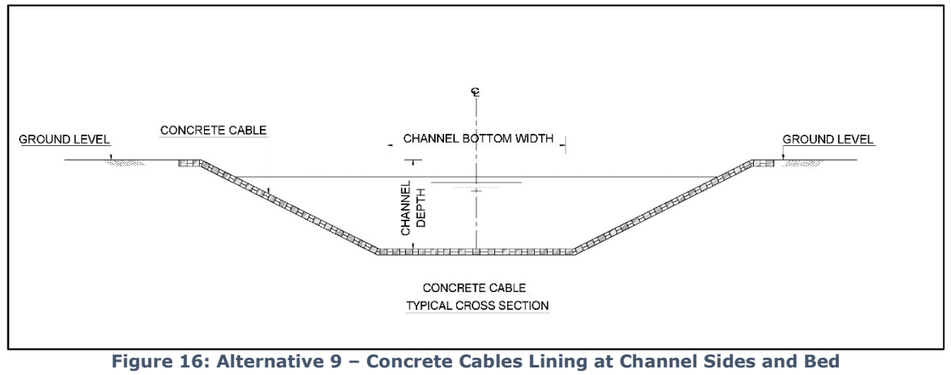

Figure 16: Alternative 9 – Concrete Cables Lining at Channel Sides and Bed

Table 1: Cost estimate for different alternatives for Agodi channel

	Concrete Lining		Grouted Riprap Lining			Gabion Mattress		Concrete Canvas	Concrete Cables
	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9
	Concrete Sides and Bed	Concrete Sides and Natural bed	Grouted Riprap Sides and Natural bed	Grouted Riprap sides with Concrete Bed	Grouted Riprap sides with Concrete Key and Natural bed	Gabion Mattress Bed and Sides	Gabion Mattress Sides and Natural Bed	Concrete Canvas Sides and Bed	Concrete Cable sides and bed
Lining Cost	2,224,100	2,364,400	1,005,100	1,653,700	1,768,700	2,229,850	1,804,350	2,228,700	5,354,400
Excavation Cost	394,278	579,692	841,490	394,278	841,490	841,490	841,490	394,278	841,490
Filling Cost	217,799	166,077	125,399	217,799	125,399	125,399	125,399	217,799	125,399
Total Cost	***2,837,000***	***3,111,000***	***1,972,000***	***2,266,000***	***2,736,000***	***3,197,000***	***2,772,000***	***2,841,000***	***6,322,000***

4. Environmental and Social Considerations

1. Background to Environmental Needs

This sub- section covers the lining impact on environmental and social environment. The key issues are:

a) Ecology and Stream Vegetation
b) Urban Agriculture – utilizing flood corridors
c) Waste management
d) Landscape / Visual perceptions of river corridors

Table 2: presents the impacts of the different lining alternatives on the environmental and social conditions

a) Ecology and Stream Vegetation

The river and stream stretches within Ibadan passes through different environments, some area runs within catchments of high ecological value and some passes through highly urbanized areas. The stretches passing through the high ecological values should be maintained and ecological impact should be rated high. While in the urbanized areas it would be unlikely to rate highly on ecological grounds.

In relation to the channel lining options, the following should be considered:

i. Alternative 1: Concrete sides and bed – no specific benefit to river ecology, concrete sides and bed do not provide suitable habitat for ecology.
ii. Alternative 2: Concrete sides and natural bed – a natural base (bedrock) may provide potential habitats for river ecology.
iii. Alternative 3: Grouted riprap sides and natural bed - a natural base (bedrock) may provide potential habitats for river ecology.
iv. Alternative 4: Grouted riprap sides and concrete bed - no specific benefit to river ecology, rip-rap sides and concrete bed do provide suitable habitat for ecology.
v. Alternative 5: Grouted riprap sides scour key and natural bed - a natural base (bedrock) may provide potential habitats for river ecology.
vi. Alternative 6: Gabion mattress sides and bed – the nature of the gabions will provide a variety of surfaces and voids which will act as a refuge for small fish and macroinvertebrates, this is beneficial in supporting and maintaining ecological diversity. In addition, given the lush tropical vegetation, it is likely that plant root systems will quickly establish in the gaps in the gabions, leading to excessive plant growth which, without ongoing maintenance may impede the flood management function of the channel.
vii. Alternative 7: Gabion mattress sides and natural bed – like Alternative 6
viii. Alternative 8: Concrete canvas at sides and bed – similar to Alternative 1, however Concrete canvas has minimal effects on water quality and therefore a reduced effect on any existing ecology, additionally the fibrous surface of concrete canvas may attract growth of mosses which can be more aesthetically pleasing than traditional concrete sides.
ix. Alternative 9: Concrete cable at sides and bed – similar to Alternative 6, the cables will provide some beneficial habitat variation in addition to spaces for vegetation to take root, potentially leading to problems with future maintenance, if this were required.

b) Urban Agriculture

Due to repeated floods over time, the river corridors contain fluvisols, alluvial soils of reasonable fertility. The river corridors, either side of the channels therefore have the potential to support urban agriculture. In order to maintain the potential for urban agriculture as a future land use it may be beneficial to consider channel linings which do not increase the channel footprint, to the benefit of increasing the agricultural footprint. Adopting urban agriculture in these corridors is an optimal land use, since it does not entail construction of buildings in the set-back, there is existing fertile soil, there is access to river water for irrigation, and small-scale farmers would be likely to manage their smallholding sites well which would also be visually pleasing

There appear to be no differences between the nine alternatives in terms of channel footprint, and so no distinction in the assessment tables has been made.

c) Waste management

Waste is presently dumped into the rivers as conduits to remove the waste and this is likely to continue for some time into the future before controls and waste management systems are established. Certain river linings may potentially trap dumped waste, which will be unsightly.

In relation to the channel lining options, the following should be considered:

i. Alternative 1: Concrete sides and bed – waste unlikely to be trapped due to smooth edges.
ii. Alternative 2: Concrete sides and natural bed – waste unlikely to be trapped along river edges, however during low flow, waste may trap among the natural base (bedrock).
iii. Alternative 3: Grouted riprap sides and natural bed – the rough edges associated with grouted rip rap and natural bed will both likely lead to some entrapment of waste.
iv. Alternative 4: Grouted riprap sides and concrete bed – the rough edges associated with grouted rip rap may trap some waste.
v. Alternative 5: Grouted riprap sides, scour key and natural bed – similar to Alternative 3.
vi. Alternative 6: Gabion mattress sides and bed – gabions will lead to entrapment of waste at sides and in bed.
vii. Alternative 7: Gabion mattress sides and natural bed – similar to Alternative 6
viii. Alternative 8: Concrete canvas at sides and bed – similar to Alternative 1

ix. Alternative 9: Concrete cable at sides and bed – concrete cables may trap some waste.

d) Landscape / Visual Perceptions of Channel Linings

Gabions may trap dumped waste and so be visually unsightly; however, gabions also allow for vegetation growth which will improve visual aesthetics, however this benefit must be considered against any associated maintenance issues. Grouted riprap and cables may trap waste to a lesser degree, but overall will have a more positive visual appeal when compared to a concrete channel. A natural stream bed of bedrock will have a better aesthetic appearance than a concrete channel bed. Concrete channels (sides and bed) are the least visually appealing option, with concrete sides and natural bed being slightly more visually appealing.

In relation to the channel lining options, the following should be considered:

i. Alternative 1: Concrete sides and bed – visually poor.
ii. Alternative 2: Concrete sides and natural bed – visually poor, but better than Alternative 1.
iii. Alternative 3: Grouted riprap sides and natural bed – visually attractive.
iv. Alternative 4: Grouted riprap sides and concrete bed - visually attractive but less so than Alternative 3.
v. Alternative 5: Grouted riprap sides, scour key and natural bed – like Alternative 3.
vi. Alternative 6: Gabion mattress sides and bed – visually unattractive but likely to modify rapidly with growth of vegetation filling the gabion niches.
vii. Alternative 7: Gabion mattress sides and natural bed – similar but slight improvement to Alternative 6.
viii. Alternative 8: Concrete canvas at sides and bed – visually similar, but an improvement on Alternative 1.
ix. Alternative 9: Concrete cable at sides and bed – visually appealing, especially as vegetation fills the gaps between cables, but not easy to maintain over time

Table 2: Matrix for Environmental and Social Evaluation of Channel Lining Materials – Weighting

	Environmental and Social Parameters			
	Ecology / Stream vegetation (50%)	Waste management (20%)	Landscape & Visual Perceptions (30%)	Score (rounded)
Alternative Linings				
1. Concrete sides and bed	1 (0.5)	5 (1.0)	1 (0.3)	1.8 (2)
2. Concrete Sides and Natural Bed	2 (1.0)	4 (0.8)	2 (0.6)	2.4 (2)
3. Grouted Riprap Sides and Natural Bed	3 (1.5)	3 (0.6)	5 (1.5)	3.6 (4)
4. Grouted Riprap Sides and Concrete Bed	2 (1.0)	4 (0.8)	4 (1.2)	3.0 (3)
5. Grouted Riprap Sides, Concrete Scour Key and Natural Bed	3 (1.5)	3 (0.6)	4.5 (1.4)	3.5 (4)
6. Gabion mattress sides and bed	4 (2.0)	1 (0.2)	2 (0.6)	2.8 (3)
7. Gabion mattress sides and natural bed	5 (2.5)	1 (0.2)	2.5 (0.8)	3.5 (4)
8. Concrete Canvas sides and bed	1.5 (0.8)	5 (1.0)	2 (0.6)	2.4 (2)
9. Concrete cable at sides and bed	3.5 (1.8)	4 (0.8)	5 (1.5)	4.1 (4)

5. Scoring Matrix

To select the preferred alternative scoring matrix was developed. The selection criteria are as follows:

a- Cost

It is essential that the costs incurred does not outweigh the benefits derived from the type of lining selected. The cost includes the capital and maintenance cost. The adopted weight for the cost is 30%.

b- Structural Stability

The type of lining adopted should be sufficiently resistant to the damaging forces. Lining should also be flexible to allow moderate settlement of subgrade without cracking. Furthermore, the soil classification shall determine the lining type required (e.g. poor soil conditions require more protection measures against erosion and scour). The adopted weight for the structural stability is 10%.

c- Hydraulic Efficiency

The lining selected should consider the following:

- smooth finish to the channel surface as it increases the channel capacity and as such decrease expropriation.
- Protection of channel to reduce the impact of higher velocities
- Provide means for controlling the channel sediment transport processes.

The adopted weight for the hydraulic efficiency is 20%.

d- Ease of Construction

This criterion is concerned with ease of installation and replacement, construction durations, material availability and labour skills. The adopted weight for the ease of construction is 5%.

e- Ease of Maintenance

It is expected that all major drainage ways and open channels will be maintained regularly. The selection of the lining type should consider life expectancy, needs for repair, reconstruction and regular maintenance, proven performance, accessibility, and regulatory constraints to maintenance. The responsible party must be financially and technically capable of providing long-term maintenance of facilities, including those that utilize concrete, grass, or other bioengineered configurations. The adopted weight for the ease of maintenance is 5%.

f- Durability

The type of lining selected should have a sufficient working or useful life. The lining should be resistant to wearing, weathering and chemical attacks. The adopted weight for the durability is 10%.

g- Environmental and sociological Considerations

Such considerations originate from municipal, provincial or national requirements governing ecological and wildlife hazards and objectives. The adopted weight for the environmental and sociological considerations is 20%. Section 4 presents the details regarding environmental and social consideration.

Each criterion was assigned a weight such that the summation of these weights is 100%. For each alternative, a score rating between 1 and 5, was issued to evaluate the performance with respect to this criterion, where a rating of 1 corresponds to a poor performance and 5 corresponds to an excellent performance. This approach has been represented in the Scoring Matrix shown in

Table 3. This scoring matrix reflects the conditions for streams located in ecological sensitive areas and not urbanized areas.

6. Recommendations:

Based on the analysis presented in section 5, Alternative 1 is preferred alternative, however, it can be seen that different options are available, and combination of options are also available. As such the master plan considers the following:

- Alternative 1 is applied in the minor Rivers and tributaries (ranging from tributaries with a catchment area of 1km^2 to minor Rivers with a catchment area of less than 25km^2).
- For streams with catchment area less than 1km^2, training of the streams is advised, i.e. dredging works with no lining.
- For major rivers of catchment area greater than 25km^2, it is advised that only the side slopes are lined and the bed remains with no protection if the rock is encountered close to surface. In cases with rock far from the surface concrete ribs is to be added every 10 meters between the protected sides slopes. It is worth to note that Rivers with unlined beds provide extra roughness to the bed and contribute in attenuating the peak flow through the channel.

Table 3: Channel Lining Alternatives - Scoring Matrix

		1. Concrete Lining		2. Grouted Riprap Lining			3. Gabion mattress		4. Concrete canvas	5. Concrete Cables
		Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7	Alt. 8	Alt. 9
Channel Lining Selection Considerations	**Weight (%)**	**Concrete Sides & Bed**	**Concrete Sides & Natural Bed**	**Grouted Riprap Sides & Natural Bed**	**Grouted Riprap at Sides & Concrete at Bed**	**Grouted Riprap Sides, Concrete Scour Key & Natural Bed**	**Gabion Mattress at Sides & Bed**	**Gabion Mattress Sides & Natural Bed**	**Concrete Canvas at Sides & Bed**	**Concrete Cable at Sides & Bed**
1. Economics	30	3	3	5	4	4	3	4	3	2
2. Structural Stability	10	5	4	2	4	3	3	3	2	1
3. Hydraulic Efficiency	20	5	3	2	3	2	3	4	5	3
4. Socio-environmental	20	2	2	4	3	4	3	4	2	4
5. Ease of Construction	5	2	3	2	3	3	3	3	5	3
6. Ease of Maintenance	5	4	3	2	3	1	3	2	3	3
7. Durability	10	5	4	2	3	2	3	2	2	4
	100	72	60	66	68	62	60	71	62	56

Rating Score	Category
1	**Poor**
5	**Excellent**

Annex

4

Optimization of Ona1 River Design

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1 Introduction

Based on the meeting conducted in 22nd October 2018 with the World Bank and the PIU, it was agreed that Dar prepares a note to compare between multi-design options for Ona1 River based on different return periods.

In this respect, the aim of this note is to study the impact of multi-design options for Ona1 River on the total cost, and then select the optimum solution. The multi-design options are based on different return periods, while the total cost is considered as the summation of both the capital cost and flood damages in terms of monetary value. The optimum design is considered as the minimum cost of both capital cost and flood damages altogether.

In addition, this note includes the cost estimate for each option along with the Consultant's recommendations for the optimum one.

1.1 Content of the Report

This report is divided into 5 sections as follows:

- Section 1 is the present introduction, herein, which states the purpose of this report and its function in the context of this project.
- Section 2 provides the proposed channelization of Ona River and the conceptual design options for Ona1.
- Section 3 provides the analysis of each option based on the outputs of the 2D hydrodynamic model including flood depth and flood hazard maps.
- Section 4 presents the cost estimate of each option
- Section 5 presents the Consultants recommendations for the proposed option
- Annex 1 presents the minutes for the meeting conducted in 22nd October 2018 with the World Bank and the PIU

2 Ona River Channelization and Design Options

This section investigates the different design options for channelizing the reach of (Ona1) according to different return periods.

2.1 Ona 1 Reach

The reach of (Ona1) passes through high dense urban area in Ibadan South West LGA. This reach was badly damaged during the 2011 flood event. This reach begins from Alalubosa Forest Reserve near the structure no. 139B and ends at the confluence with Alaro tributary near the Private Factories at (Proctor & Gamble, 7-up and Zartech Farms). This reach has a total length of around 6.4km and has a contributing catchment area of 373 Sq.km. The proposed channel crosses 4 main roads. It crosses Abeokuta Road, Alaafin Avenue, Oluyole Estate Road and a private road in the industrial area through 3 Bridges and 1 Culvert. This channel includes structures with the Id numbers: 139B 146B, 147B and 816 *(previously coded as N1)*, refer to Figure 2-1.

2.2 Design Options

To investigate an optimum design for the channelization of Ona River, the Consultant devised different section dimensions for Ona River based on different flows. These flows are summarized in the following options:

- Option 1 considers the design dimensions of Ona 1 channel based on a 100-year storm event.
- Option 2 considers design dimensions of Ona 1 channel based on a 50-year storm event.
- Option 3 considers design dimensions of Ona 1 channel based on a 25-year storm event
- Option 4 considers design dimensions of Ona 1 channel based on a 10-year storm event.

The design approach in option 1 is to convey the total 100-year flow within the channel, while the other options allows the flow to flood out of the channel (within the flood plain for a short period of time) in the significant events.

The three options (2, 3 and 4) are based on a structural section and a non-structural section where part of the flow is conveyed within the structural section and the rest flows through the non-structural part (the flood fringe). The flood fringe is to be demarcated to define the extent of the 100-year flood event.

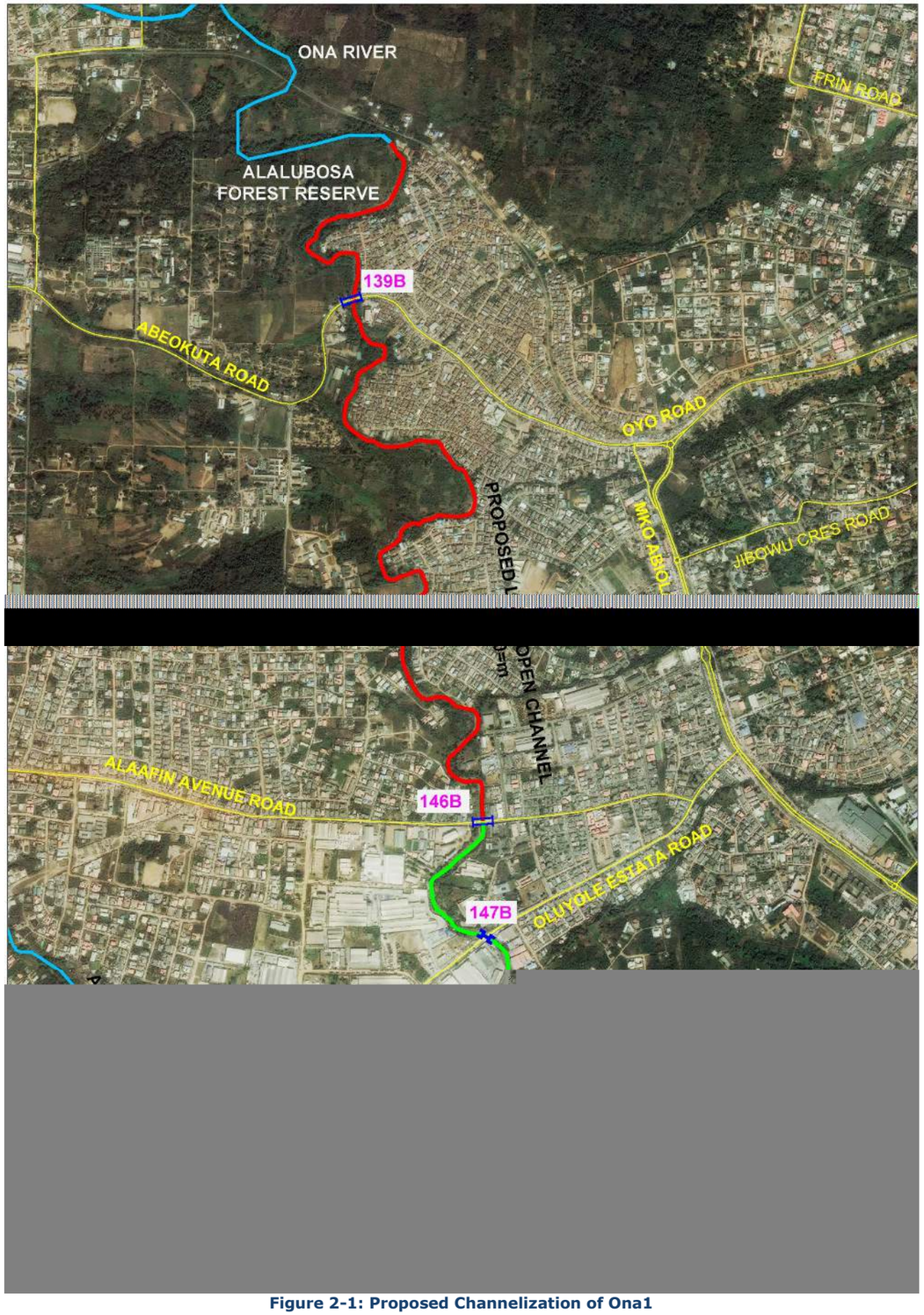


Figure 2-1: Proposed Channelization of Ona1

2.3 Hydrological Analysis

Based on the hydrological model presented in Ona Flood Risk Reduction Report, "**N17036-0100D-RPT-ENV-15-Rev0**", and the updated hydrological report **"N17036-0100D-RPT-ENV-18-Rev0"** the consultant extracted the flow in Ona1 Channel for a 100-, 50, 25- and 10-year storm events. Table 2.1 shows the estimated design flow for Ona1 at Zartech based on attenuation (considering 20 Dikes).

Table 2.1: Ona Estimated Flows at Zartech with 20 Dikes for different return periods

	Return Period	Max Flow at Zartech (St. No. 816) m^3/s
Option 1	100	811.5
Option 2	50	670.0
Option 3	25	548.0
Option 4	10	404.0

2.4 Hydraulic Design

Based on the above proposed options and hydrological analysis, the Consultant prepared the conceptual design of River as follows:

2.4.1 Alignment of Ona River

Based on LiDAR survey and a high-resolution imagery, the centerline of Ona River was aligned to minimize the possible quantities for cut and fill, and the buildings as much as possible. It was noticed that the northern reach of Ona1 passes through an urban area in its eastern side and a green hilly area in its western side. On the contrary, the southern passes through a high dense populated area and industries on the River banks.

2.4.2 Shape

The principal options considered in the shape cross-sections of channels is basically trapezoidal section where this is a sensitivity analysis not a detailed design. However, the shape and the dimensions could be refining in the detailed design. The side slopes of channels depend on the soil conditions and practicality of construction within economical limits. Stabilization of side slopes is required in cases where poor quality soil is encountered.

For Trapezoidal shapes, side slopes of 2 horizontal to 1 vertical are recommended for these channels. The side slopes of these channels are recommended to be lined of suitable material.

2.4.3 Longitudinal Design Slopes

Longitudinal design slopes are proposed to match the natural ground slope as much as possible to minimize the earthwork. The average natural slope of Ona1 is around 0.19% in the northern reach and around 0.28% in the southern reach.

- The northern reach starts from Alalubosa forest reserve and ends at structure no. 146; this is where the longitudinal slope is 0.19%
- The southern reach starts from structure no. 146 and end at the confluence with Alaro; this is where the longitudinal slope is 0.28%

2.4.4 Channel Sizing

The channel sizing of Ona1 channel is performed by applying the commercial hydraulic software program "FlowMaster" by Bentley. For uniform flow conditions, the velocity in the channels and conduits is computed applying the Manning Formula as follows:

$$V = \frac{1}{n} R^{2/3} S^{1/2} \text{ and}$$

$$Q = A * V$$

The manning's roughness coefficient for hydraulic design of channels are selected according to the types of lining materials

- For earth channel with concrete lined side slopes, n value is taken as 0.027
- For full concrete lined section, n value is taken as 0.017

Based on the above criteria, the Consultant designed the channel sections for each option considering different design return periods, flows, reaches, channel shapes, material and type of protection. Table 2.2 summarizes the dimensions of each option.

It is worth to note that the channel dimensions changes from the northern reach to the southern reach due to change in longitudinal slope of channel.

Table 2.2: Ona1 Channel Sizes for Different Options

Option	Return Period	Max Flow at Zartech	Reach		Channel Section				
			From	To	B	Depth	Side Slopes	n	Longitudinal slope (%)
Option1	100	811.5	0+000	4+325	60	3.5	2	0.027	0.195
			4+325	6+420	55	3.5	2	0.027	0.282
Option2	50	670.5	0+000	4+325	50	3.5	2	0.027	0.195
			4+325	6+420	45	3.5	2	0.027	0.282
Option3	25	548	0+000	4+325	40	3.5	2	0.027	0.195
			4+325	6+420	36	3.5	2	0.027	0.282
Option4	10	404	0+000	4+325	29	3.5	2	0.027	0.195
			4+325	6+420	26	3.5	2	0.027	0.282

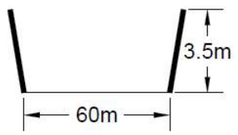
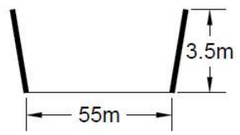
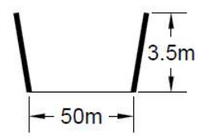
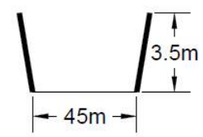
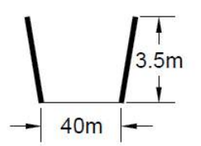
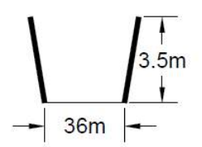
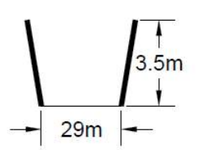
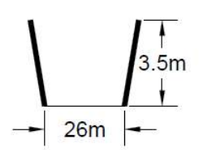
	Ona1 North	Ona1 South
Option 1 (100 yrs)		
Option 2 (50 yrs)		
Option 3 (25 yrs)		
Option 4 (10 yrs)		

Figure 2-2: Ona1 Channel Sizes for Different Options

3 Analysis of Different Design Options

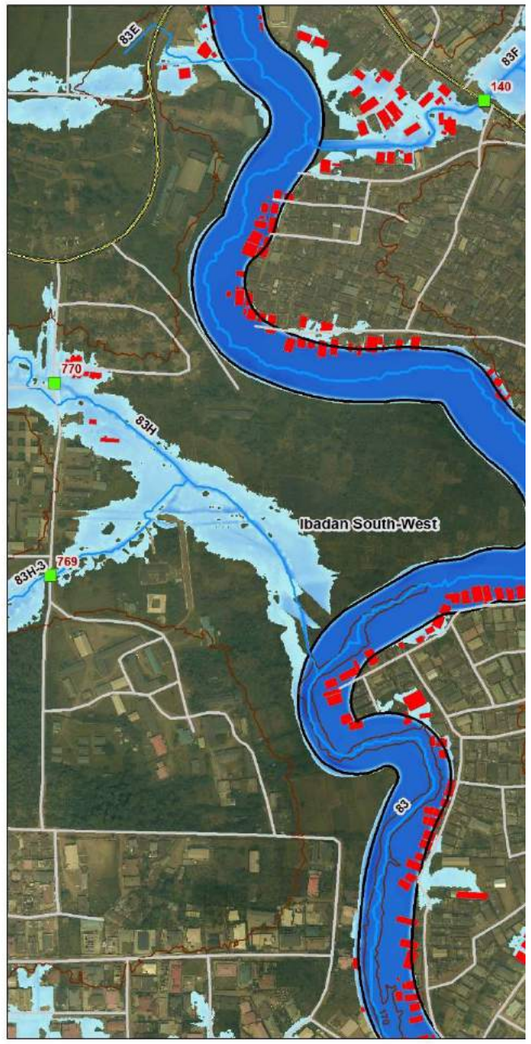
3.1 Flood Depth Maps

The proposed options are modelled to assess the expected flood extents and assess the corresponding Losses in buildings, infrastructures, and people. A 2D Model is prepared for each option using the Digital Terrain Model (DTM), and 100 years event precipitation/flow data. Figure 3-1, Figure 3-2 shows a comparison between the above options.

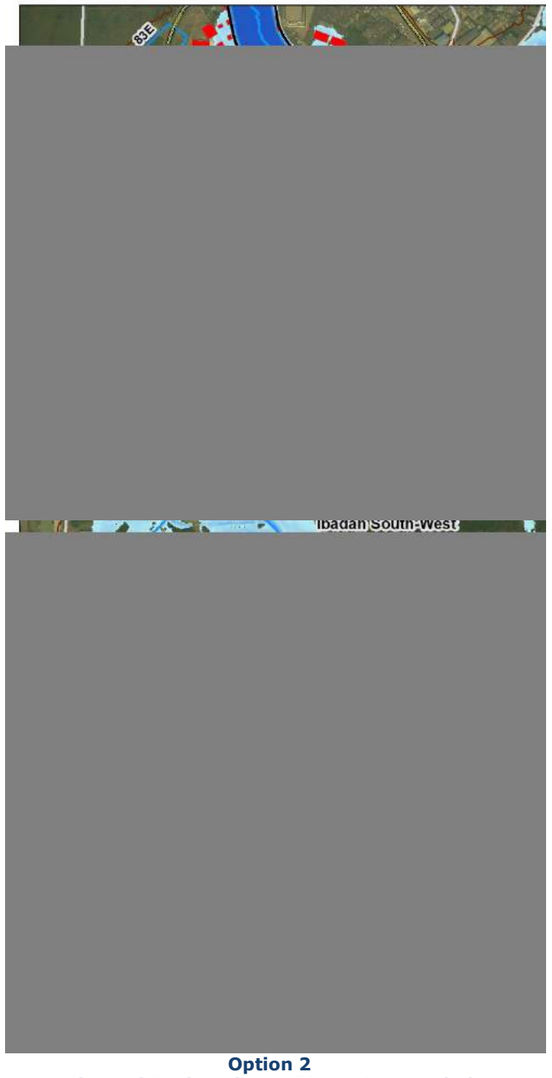
3.1.1 Analysis

It is clear from the different figures, that Option 1 (being designed based on a 100-year event) totally conveys the 100-year flow, with some flooded areas in its tributaries. However, the channel has a big width and its dimensions require expropriation and demolishing too many existing buildings on its banks.

On the contrary, Option 4 (being designed based on a 10-year event) has a smaller width that requires less expropriation and less buildings to be demolished. However, the channel is not capable of conveying the total flow (100-year flow) leading to flooding of the channel banks.

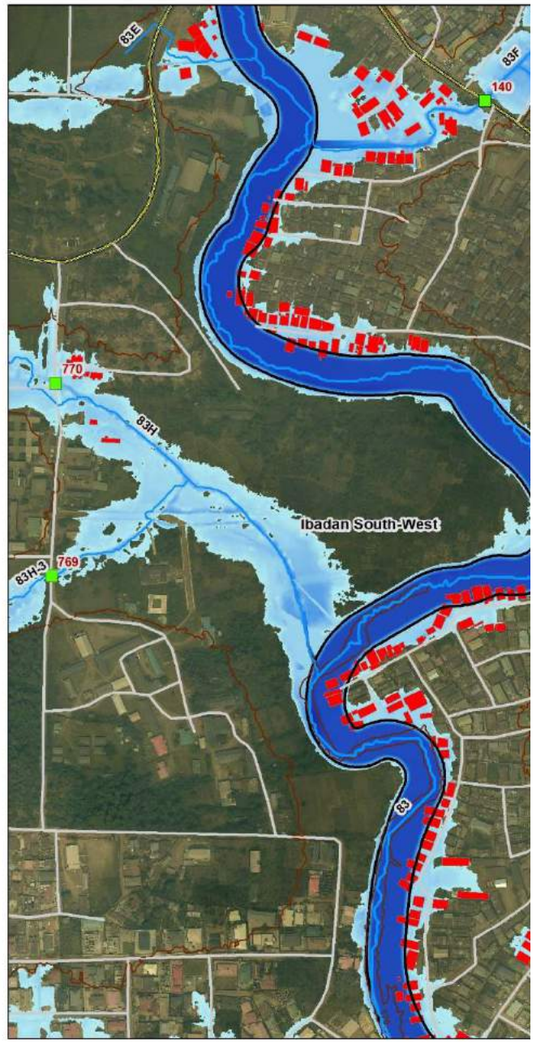


Option 1
Channel Designed on a 100yr return period

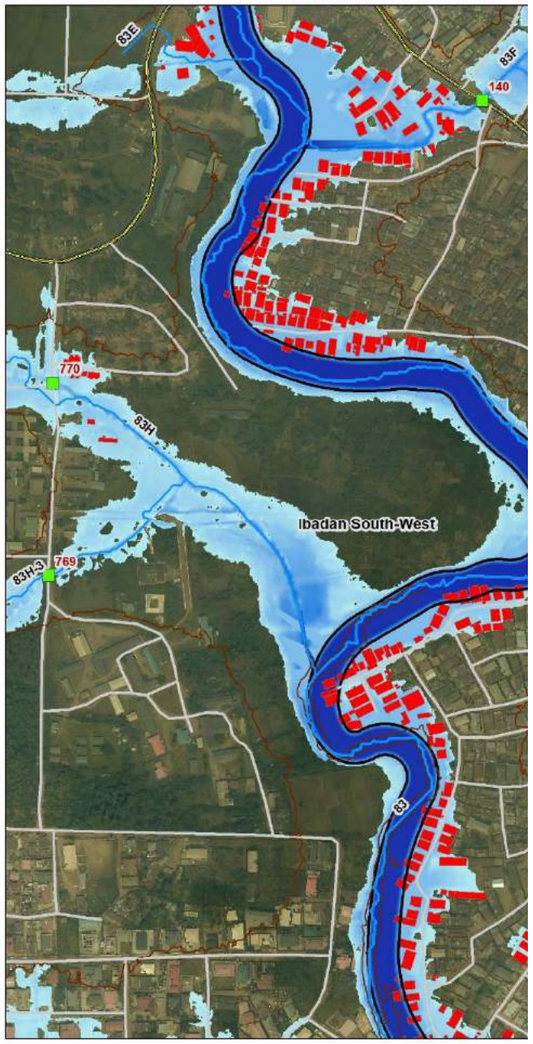


Option 2
Channel Designed on a 50yr return period

Figure 3-1: Floodwater Depth Maps for a 100yr flow in different Options



Option 3
Channel Designed on a 25yr return period



Option 4
Channel Designed on a 10yr return period

Figure 3-2: Floodwater Depth Maps for a 100yr flow in different Options

3.2 Flood Hazard

The goal of flood hazard assessment is to understand the probability that a flood of a particular intensity will occur over an extended period of time. It is a physical event than can have an impact on human beings and their environment. Based on the Flood Hazard Assessment Report "N17036-0100D-RPT-ENV-06-Rev0", the degree of hazard that the floodwaters present to people (and to vehicles and property) is a function of both water velocity and depth.

3.2.1 General

Hazard maps are prepared for each option to give a clear picture about the different levels of dangers and ease the decision of the optimum solution. According to Department for Environment Food & Rural Affairs (DEFRA) guidance, the following formula was used to calculate the flood hazard to people. Table 3.1 shows the classification of the flood hazard.

$$HR = d \times (v + 0.5) + DF$$

Table 3.1: Hazard to people as a function of velocity and depth

d x (v + 0.5)	Degree of flood hazard	Description
<0.75	Low	Caution "Flood zone with shallow flowing water or deep standing water"
0.75 - 1.25	Moderate	Dangerous for some (i.e. children) "Danger: Flood zone with deep or fast flowing water"
1.25 – 2.5	Significant	Dangerous for most people "Danger: flood zone with deep fast flowing water"
>2.5	Extreme	Dangerous for all "Extreme danger: flood zone with deep fast flowing water"

3.2.2 Analysis

The figures from 3.3 to figures 3.4 show a sample of the flood hazard maps for the proposed options near Alalubosa Forest Reserve (Structure no. 139B).

It is clear from the different figures, that Option 1 conveys totally the 100-year flow, showing no hazards along the main river and minor hazards in tributaries. On the contrary, Option 4 - which is a channel coveys 10yrs return period flow - shows large areas exposed to flood hazards along the main river and along tributaries and it has the maximum flood hazard area with respect to other options.

3.3 Risk/Losses Analysis

Flood risk analysis is the determination of qualitative or quantitative estimate of risk related to a well-defined situation and a recognized threat (hazard). Flood risk is defined as the probability of adverse consequences due to inundation. These consequences may be victims and damage to homes, businesses and nature. Flood risk analysis are carried out based upon the hazard, exposure and vulnerability allowing the quantification of potential losses.

Report **"N17036-0100D-RPT-ENV-19-Rev0"** presented a quantitative flood risk analysis to the highly dense built-up areas in Ibadan. The described methodology in the mentioned report has been used to calculate/evaluate the losses on each proposed option.

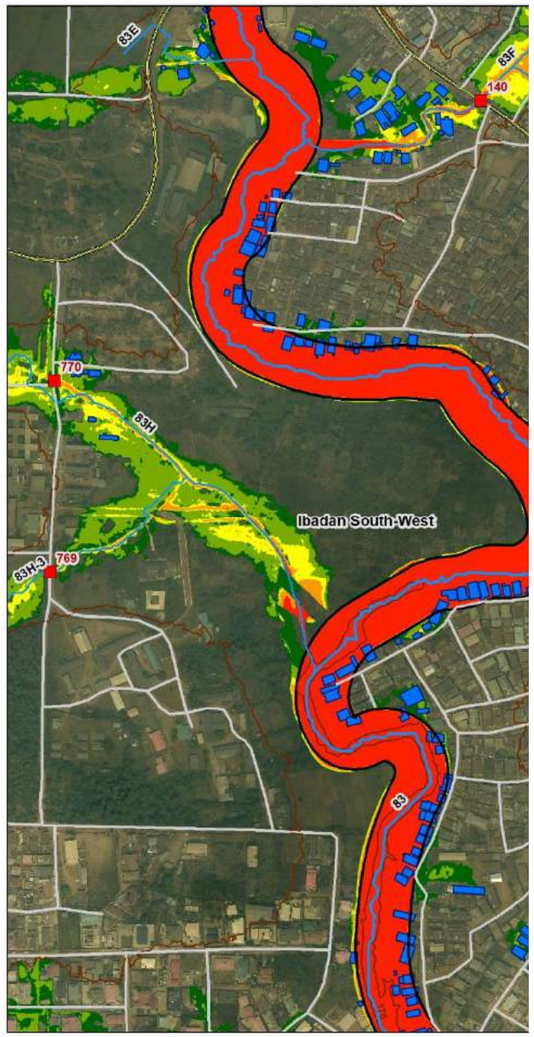
In a further step toward evaluating each option economically, the damages losses for each option has been calculated. The damages losses are classified into 3 types of losses; building losses, infrastructures losses, and people losses. The following sub-section will present the different types of losses for each option and compare the values relative to each other.

3.3.1 Building losses

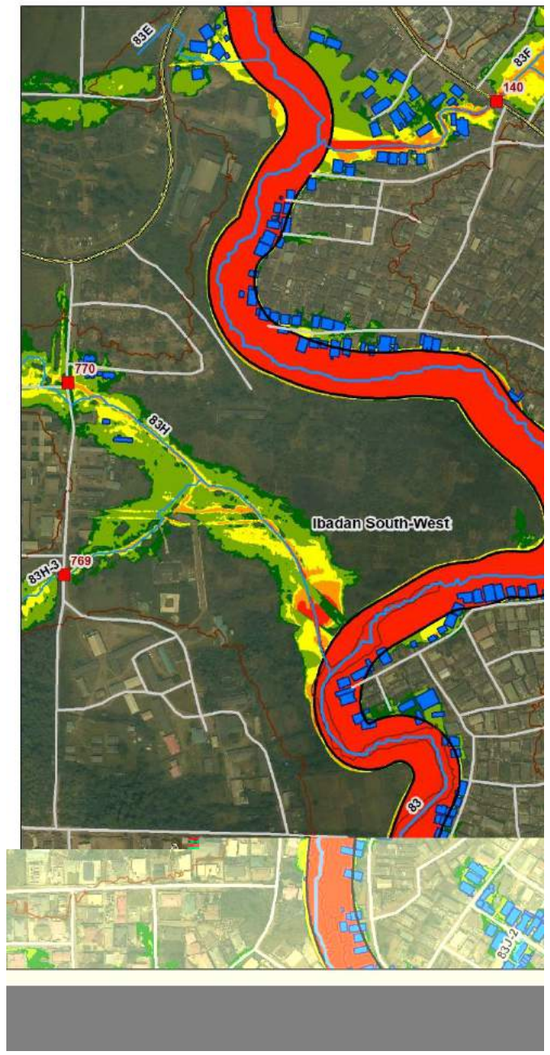
The buildings around and within the stream domain will be affected by floods and proposed interventions in two ways, either the buildings are located inside the proposed channel domain (will be demolished) or located within the flood plain and will be affected by the flooded water. Table 3.2 illustrate the numbers of buildings that will be demolished to construct the proposed channel for each option. Furthermore, the buildings lying within the flood extent have been counted and converted to USD to evaluate the expected damages. The expected building losses are presented for the different options in case of the 100-years storm event. Figure 3-5 shows the losses trend verses the different options.

Table 3.2: Expected Buildings Losses

Return Period	No. of Buildings (within flood extent)	Buildings Losses (within flood Plain)
Option 1 (100yrs channel)	464	$ 2,687,000
Option 2 (50yrs channel)	553	$ 2,860,000
Option 3 (25yrs channel)	666	$ 4,062,000
Option 4 (10yrs channel)	884	$ 4,711,000

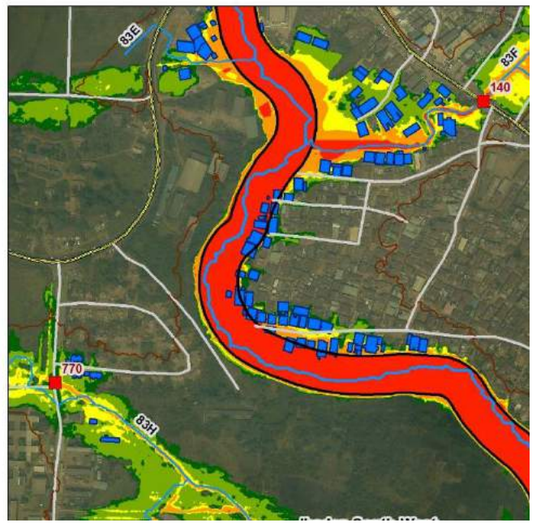


Option 1
Channel Designed on a 100yr return period

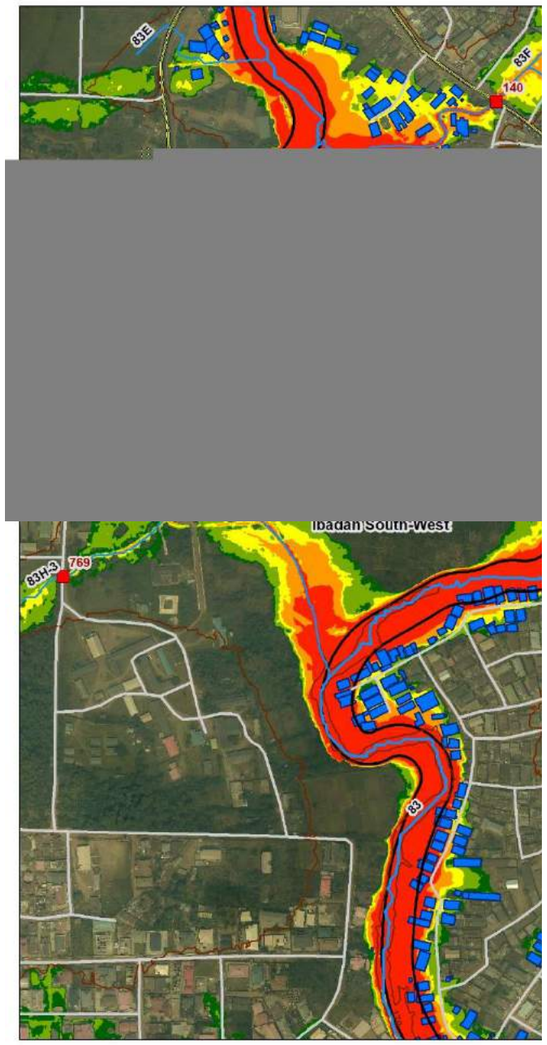


Option 2
Channel Designed on a 50yr return period

Figure 3-4: Flood Hazard Maps for a 100yr flow in different Options



Option 3
Channel Designed on a 25yr return period



Option 4
Channel Designed on a 10yr return period

Figure 3-3: Flood Hazard Maps for a 100yr flow in different Options

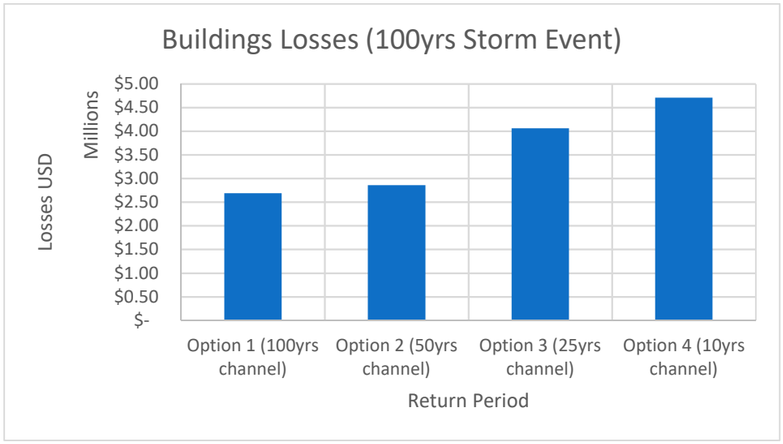


Figure 3-5: Building Losses for a 100yr flow in different Options

3.3.2 Infrastructures Losses

The infrastructures have been affected by the flood in different degrees according to the proposed channel. For instance, Table 3.3 and Figure 3-6 show the expected damages in the infrastructures due to 100-years flood event in case of different proposed channelization options.

Table 3.3: Expected Infrastructures Losses

Return Period	Infrastructures Losses due to 100years Storm
Option 1 (100yrs channel)	$ 93,000
Option 2 (50yrs channel)	$ 94,000
Option 3 (25yrs channel)	$ 107,000
Option 4 (10yrs channel)	$ 130,000

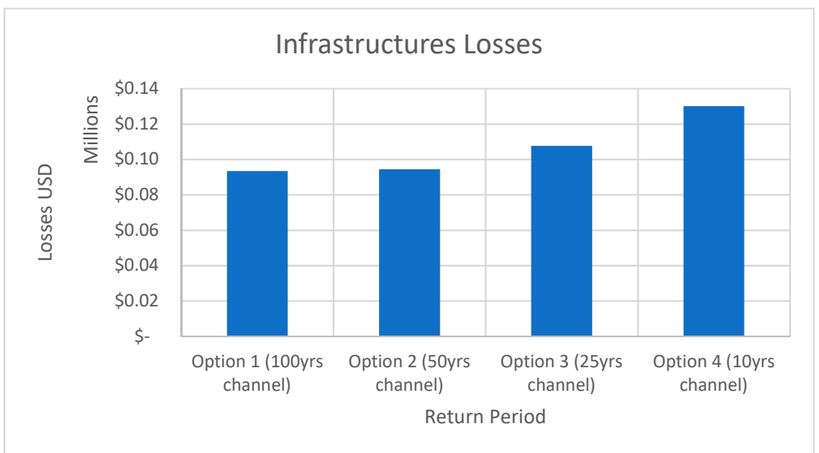


Figure 3-6: Infrastructures Losses for a 100yr flow in different Options

3.3.3 People Losses

Due to flood water depth and velocity, many people are exposed to risk. The expected injuries and deaths in each channelization option are estimated. Table 3.4 present the expected Numbers for both injuries and deaths for each option in case of 100-years storm.

Table 3.4: Expected Numbers of Injuries and Deaths

Proposed Channel	Option 1 (100yrs channel)	Option 2 (50yrs channel)	Option 3 (25yrs channel)	Option 4 (10yrs channel)
No. of Injuries	88	106	174	294
No. of Deaths	6	6	10	20

Based on the methodology adopted in the report **"N17036-0100D-RPT-ENV-19-Rev0"** for evaluating the injuries and deaths, a summary of the monetary rates for death and injuries are presented in Table 3.5

Table 3.5: Monetary Value for Death and Injuries

Category	Monetary Rates (USD/Capita)		
	Lower Value Uneze et al. (2012)	Middle Value Kirigia and Mburugu (2017)	Upper Value Robinson et al. (2018)
Death	40,000	116,572	304,212
Injuries	4,000	11,657	30,421

It is noticed that there is a high contrast between different studies, the lower value for death is $40,000, the middle value is $116,572, while the upper value is $304,212. For the purpose of the current project, the middle value is adopted in the analysis. Table 3.6 shows the expected losses due to people injuring and death.

Table 3.6: Expected People Losses

Proposed Channel	Option 1 (100yrs channel)	Option 2 (50yrs channel)	Option 3 (25yrs channel)	Option 4 (10yrs channel)
No. of Injuries	88	106	174	294
Injuries - USD	$ 1,025,816	$ 1,235,642	$ 2,028,000	$ 3,427,000
No. of Deaths	6	6	10	20
Deaths - USD	$ 699,432	$ 699,432	$ 1,165,000	$ 2,331,000
Total People Losses	$ 1,725,248	$ 1,935,074	$ 3,194,000	$ 5,758,000

4 Cost Estimate

This section presents the preliminary cost estimate of Ona1 channelization for the proposed options. The description of the basic items is first presented, followed by the unit rates. Finally, the cost estimate of proposed channelization options is presented.

4.1 Basic Items

The cost of the proposed option includes the following works:

a. Excavation/Earthworks for channels
b. Channels lining
c. Expected expropriation works

4.2 Unit Rates

The cost estimate unit rates are based on true figures extracted from awarded contracts in similar projects in West Africa and rates received from the PIU. Unit Rates of the main items in USD and Naira are summarized in Table 4.1

Table 4.1: Basic Unit Rates of Drainage Infra-Structure Elements

	General Rates	Unit Rate in USD	Unit	Unit Rate in Naira	Unit
1	**Concrete**				
1.1	High yield steel	1,556	USD/Ton	474,580	Naira/Ton
1.2	In situ concrete class 300/20 for Box culverts, Wing Walls & Apron Slabs	260	USD/m^3	79,300	Naira/m^3
1.3	In situ concrete class 250/20 for Concrete Lining for Channels, Service Ramps and Pavement Screed Layer	240	USD/m^3	73,200	Naira/m^3
2	**Earthworks**				
2.1	Excavation	10	USD/m^3	3,050	Naira/m^3
2.2	Backfilling	11	USD/m^3	3,355	Naira/m^3

*Exchange Rate USD to Naira = 305

Cost calculation of Channels

The capital cost of each option is mainly the cost of the expropriations and the cost of construction. The estimated expropriations cost in this report is estimated for the buildings that will be demolished due to their location within the channel domain. However, the expropriation cost could increase if there are any other additional civil works that needs to be relocated. The construction cost of channels is based on both excavations works and lining.

4.2.1 Excavation/Earthworks for channels

Regarding excavation, the cost estimate was based on the calculated excavation volume along the proposed stream's section. Table 4.3 illustrates the initial calculations of the earth works and its cost.

4.2.2 Lining works for channels

Regarding the lining of the channel, all proposed options have a trapezoidal earth section with lined side slopes till the confluence with Alaro.

For trapezoidal sections, the cost estimate is based on the concrete lining of the side slopes with a thickness of 15cm and providing a key to the lining section with an initial dimension of 30cm x 1m.

Table 4.5 presents the total cost estimate of excavation and lining for the proposed options.

4.2.3 Expropriation cost

The proposed channels have dimensions greater than the natural stream to convey the design flow; thus, the construction of the proposed channel could clash with existing buildings, roads, utilities…etc. Demolishing/ relocated of the civil woks which cause conflicts with proposed channel are considered as a capital cost. Table 4.2 show the numbers of the expected buildings to be demolished in each option and its value.

Table 4.2: Expropriation Cost Estimate of the Proposed Options

Return Period	No. of Buildings (within channel domain)	Buildings Losses (within channel domain)
Option 1 (100yrs channel)	239	$ 6,834,554
Option 2 (50yrs channel)	177	$ 5,240,943
Option 3 (25yrs channel)	121	$ 3,160,633
Option 4 (10yrs channel)	70	$ 1,499,341

Table 4.3: Excavation Cost Estimate of the Proposed Options

Options	Channel Designed based on	Channel Length	Flow	Channel Bed Width	Channel Depth	Side slope Lined	Top Width (m)	Section Area	Excavation Volume	Cost of Excavation
		m	CMS	m	m	(m/m) H:V		(m2)	m3	USD
1	100yrs Flow	6400	811.5	60	3.5	2	74	187.6	1,155,414	11,554,144
2	50yrs Flow	6400	670	50	3.5	2	64	159.6	874,110	8,741,102
3	25yrs Flow	6400	548	40	3.5	2	54	131.6	649,387	6,493,879
4	10yrs Flow	6400	404	29	3.5	2	43	100.8	460,390	4,603,904

Table 4.4: Lining Characteristics for the Proposed Options

Options	Channel Designed based on	Channel Length	Channel Bed Width	Channel Depth	Side slope Lined	Lining of the Side Slopes				Concrete Volume	Steel Weight	Concrete Cost	Steel Cost	Lining Material	Cost of concrete Lining
		m	m	m	(m/m) H:V	Lining Depth (m)	Key Wall Depth (m)	Lined Perimeter (m)	Area of Lining (m2)	m3	ton	USD	USD		USD
1	100yrs	6400	60	3.5	2	3.5	1	20	128000	19200	768	4608000	1195008	Concrete sides only	5803008
2	50yrs	6400	50	3.5	2	3.5	1	20	128000	19200	768	4608000	1195008	Concrete sides only	5803008
3	25yrs	6400	40	3.5	2	3.5	1	20	128000	19200	768	4608000	1195008	Concrete sides only	5803008
4	10yrs	6400	29	3.5	2	3.5	1	20	128000	19200	768	4608000	1195008	Concrete sides only	5803008

Table 4.5: Cost Estimate of Excavation, Concrete Lining, and structures

Options	Channel Designed based on	Cost of Excavation	Cost of concrete Lining	Cost of Structures	Total Cost of Excavation and Concrete lining	Total Cost of Excavation and Concrete lining and structures
		USD	USD	USD	USD	USD
1	100yrs	$ 11,554,144	$ 5,803,008	$ 16,300,000	$ 17,357,000	$ 33,657,000
2	50yrs	$ 8,741,102	$ 5,803,008	$ 13,650,000	$ 14,544,000	$ 28,194,000
3	25yrs	$ 6,493,879	$ 5,803,008	$ 10,850,000	$ 12,297,000	$ 23,147,000
4	10yrs	$ 4,603,904	$ 5,803,008	$ 7,950,000	$ 10,407,000	$ 18,357,000

Table 4.6: Total Capital Cost Estimate

Option	Buildings Losses (within channel domain)	Total Cost of Excavation and Concrete lining and structures (USD)	Total Capital Cost
Option 1 (100yrs channel)	$ 6,834,554	$ 33,657,000	$ 40,491,553.77
Option 2 (50yrs channel)	$ 5,240,943	$ 28,194,000	$ 33,434,943.00
Option 3 (25yrs channel)	$ 3,160,633	$ 23,147,000	$ 26,307,633.00
Option 4 (10yrs channel)	$ 1,499,341	$ 18,357,000	$ 19,856,341.00

5 Risk Metrics and Economic Analysis

Risk Metrics are used to quantify flood risks, such as losses due to damage to buildings, infrastructure, and people. The results can be used to express probable damage using Average Annual Loss (AAL)

5.1 Economic analysis

Economic analysis is important to determine the viability of a project and ensuring the project is economically justifiable. Economic analysis is performed based on project relevant data such as:

1. Capital Cost
2. Average Annual Loss (AAL)
3. Project Useful Life
4. Social Discount Rate

The evaluation of the project is usually based on an overall indicator, such as:

1. Project Present Value (NPV)
2. Project Internal Rate of Return (IRR)

5.1.1 Capital Cost

The Capital Cost is the sum of the fixed one-time expenses incurred as the construction costs of civil works to channelize the streams and construct the associated bridges and culverts. In other words, it is the total cost needed to bring the project to an operable status. Considering the above example, the capital cost of the different options is presented in Table 4.6.

5.1.2 Average Annual Loss (AAL)

Average Annual Loss (AAL, or Expected Loss EL) represents the integration of various loss values with their respective probabilities. In other words, the average annual loss is the expected value of losses based on their probability distribution. Table 5.1, Table 5.2, Table 5.3, and Table 5.4 Show the calculation of average annual losses due to damage losses in different options.

Table 5.1: Average Annual Loss (AAL) for Option 1

Channel based on 100 years Flow				
Increment	Return Period	Annual Exceedance	Damage	Incremental damage
1	1	1		
2	10	0.1	$2,779,075	$ 1,250,584
3	25	0.04	$2,835,136	$ 168,426
4	50	0.02	$3,798,951	$ 66,341
5	100	0.01	$4,412,558	$ 41,058
			Average Annual Losses	$ 1,526,409

Table 5.2: Average Annual Loss (AAL) for Option 2

Channel based on 50 years Flow				
Increment	Return Period	Annual Exceedance	Damage	Incremental damage
1	1	1		
2	10	0.1	$2,884,809	$ 1,298,164
3	25	0.04	$3,067,025	$ 178,555
4	50	0.02	$3,863,985	$ 69,310
5	100	0.01	$4,795,993	$ 43,300
			Average Annual Losses	$ 1,589,329

Table 5.3: Average Annual Loss (AAL) for Option 3

Channel based on 25 years Flow				
Increment	Return Period	Annual Exceedance	Damage	Incremental damage
1	1	1		
2	10	0.1	$3,348,911	$ 1,507,010
3	25	0.04	$3,921,626	$ 218,116
4	50	0.02	$5,264,632	$ 91,863
5	100	0.01	$7,256,483	$ 62,606
			Average Annual Losses	$ 1,879,594

Table 5.4: Average Annual Loss (AAL) for Option 4

Channel based on 10 years Flow				
Increment	Return Period	Annual Exceedance	Damage	Incremental damage
1	1	1		
2	10	0.1	$4,200,209	$ 1,890,094
3	25	0.04	$4,742,957	$ 268,295
4	50	0.02	$7,420,694	$ 121,637
5	100	0.01	$10,470,044	$ 89,454
			Average Annual Losses	$ 2,369,479

5.1.3 Project Useful Life

The Project Useful Life is the estimated amount of time (in years) that the mitigation action will be effective. The Standard Project Useful Life of Infrastructure works considering Concrete infrastructure, flood walls, roads, bridges, major drainage system is 50 years.

5.1.4 Social Discount Rate

The discount rate is the interest rate used to determine the present value of future cash flows in standard discounted cash flow analysis. For public projects, the social discount rate is usually used, which measures the rate at which a society would be willing to trade present for future consumption. As such, it is one of the most critical inputs needed for cost-benefit analysis of projects. This discount rate is usually lower than private investment rates, in the range of 3% to 7% (Blank and Tarquin, 2018). For example, the World Bank (Lopez, 2008) estimated the social discount rate for nine Latin

American countries to be in the 3-4 percent range, if the recent track record in terms of growth in the region is indicative of future performance. However, if the region improves on its past performance, the social discount rate would increase to the 5-7 percent range. The paper also argues that the discount rate should be dependent on the horizon of the project, declining from 4.4 percent for a 25-year horizon to less than 4 percent for a 100-year horizon. For the purpose of this project, and due to lack of specific information, a social discount rate of 6% is considered as average rate against which projects will be evaluated.

5.1.5 Present Value

Present Value (PV) is the current value of a future sum of money or stream of cash flows given a specified rate of return. Future cash flows are discounted at the prescribed discount rate. The higher the discount rate, the lower the present value of the future cash flows.

The present value is always less than or equal to the future value because money has interest-earning potential, a characteristic referred to as the time value of money. A dollar today is worth more than a dollar tomorrow because the dollar can be invested and earn a day's worth of interest, making the total accumulate to a value more than a dollar by tomorrow. The PV can be calculated as

$$PV = \sum_{i=1}^{n} \frac{C_i}{(1+r)^i}$$

C_i = Cash Flow at period 1

r = rate of return

n = number of periods; this is considered as the useful lifetime of the project

Table 5.5: Annual Present Losses

Options	Channel designed on (Return Period)	Average Annual Losses	Present Value
Option 1	100	$ 1,526,409	$ 24,059,040
Option 2	50	$ 1,589,329	$ 25,050,783
Option 3	25	$ 1,879,594	$ 29,625,904
Option 4	10	$ 2,369,479	$ 37,347,398

5.1.6 Internal Rate of Return (IRR)

The Internal Rate of Return (IRR) is considered as the break-even point (BEP) in economics and business. It is the point at which total cost and total revenue become equal, i.e. "even". There is no net loss or gain, and one has "broken even", though opportunity costs have been paid and capital has received the risk-adjusted and expected return.

5.2 Selection of the Optimum Design Level

A hydrologic design level on the design scale is the magnitude of the hydrologic event to be considered for the design of a structure or project. There are many approaches to select the design level (design return period). One of the most commonly used methods to is to determine a hydrologic design value is hydro-economic analysis.

5.2.1 Hydro-Economic Analysis

The optimum design return period can be determined by hydro-economic analysis if the probabilistic nature of a hydrologic event and the damage that will result if it occurs are both known over the feasible range of hydrologic events.

As the design return period increases, the capital cost of a structure increases, but the expected damages decrease because of the better protection afforded. By summing the capital cost and the expected damage cost on an annual basis, a design return period having minimum total cost can be found. Figure 5-1, and Table 5.6 illustrate the results of the hydro-economic analysis.

Based on Figure 5-1, it is clear that option 3 has the minimum total cost for both the capital cost and the expected damage cost.

Table 5.6: Hydro-Economic Analysis

Option	Channel design flow	Capital Cost	Average Annual Losses (PV)	Total Cost
1	100	$40,491,000	$24,059,000	**$64,550,000**
2	50	$33,434,000	$25,050,000	**$58,485,000**
3	25	$26,307,000	$29,625,000	**$55,933,000**
4	10	$19,856,000	$37,347,000	**$57,203,000**

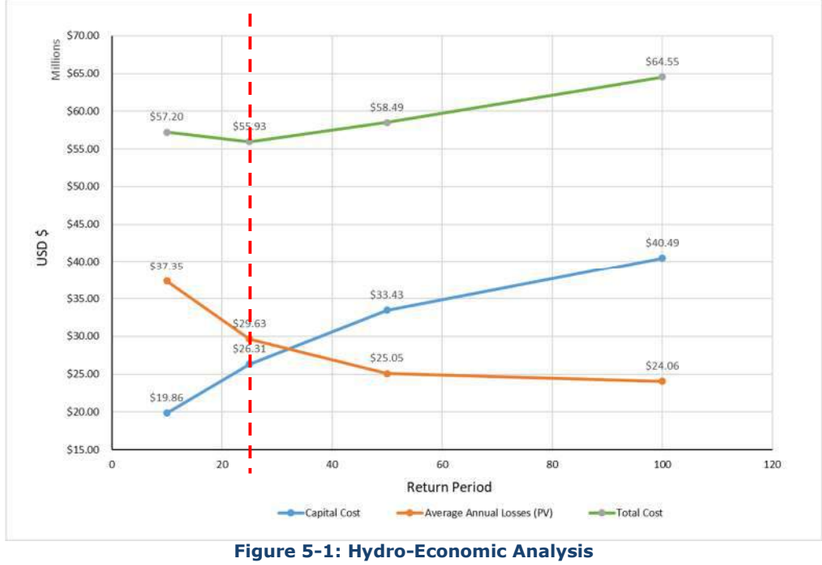


Figure 5-1: Hydro-Economic Analysis

6 Summary and Recommendations

6.1 Summary

The report illustrates two different design approaches through the proposed options.

- The first approach is to convey the total flow in a proposed channel without flooding, although this will require huge channel dimensions (Option1).
- The second approach to is to design a channel with smaller dimensions to convey the flow of small return periods (10yrs, 25yrs, or 50yrs), and allow flooding in the higher return periods storms.

Four proposed options have been studied to obtain the optimum return period that shall be used in channel sizing. The options are;

- Option 1: Proposed channel to conveying 100-yrs return period flow
- Option 2: Proposed channel to conveying 50-yrs return period flow
- Option 3: Proposed channel to conveying 25-yrs return period flow
- Option 4: Proposed channel to conveying 10-yrs return period flow

Comparison between available options are based on clear criteria; for example, the expected hazard and losses, channel construction cost, and expropriation cost. The analysis reveals that option 3 (a channel designed based on a 25-year flood event) has the minimum total cost for both the capital cost and the expected damage cost.

6.2 Recommendations

Based on the previous analysis, the Consultant recommends option 3 (a channel designed based on a 25-year flood event) for the following reasons:

- The channel size of option 3 is much less than that of Option 1 and thus less amounts of excavation.
- Less number of demolished houses and expropriation requirements in option 3 when compared to option 1, and option 2. Thus option 3 preserves the environment better than other options.
- The flow of the 2011 flood event is totally conveyed within the channel size of option 3.
- The number of buildings exposed to flood hazards are minimum.
- Option 3 is the cheapest option based on the hydro-economic analysis.
- Option 3 does not currently force the government or the WB to compensate for the buildings lying in the flood extent. The people currently living in these houses can continue living in their settlements. However, the following should be taken into consideration:
  - People living in the moderate hazard zone needs to be notified that they are located in a hazardous area and that they should follow the warning system.
  - Guidelines should be prepared to warn people from flooding and should guide them to leave their houses during a flood event.

Annex

5

GIS Database

ACRONYMS

Acronym	Description
DEM	Digital Elevation Model
DTM	Digital Terrain Model
GIS	Geographic Information System
GPS	Global Positioning System
GSD	Ground Sample Distance
IMU	Inertial Measurement Unit
IUFMP	Ibadan Urban Flood Management Project
LGA	Local Governmental Area
PIU	Project Implementation Unit
PPP	Precise Point Positioning
RS	Remote Sensing
SRTM	Shuttle Radar Topography Mission
UTM	Universal Transverse Mercator
WB	World Bank
WGS	World Geodetic System
WKID	Well-Known ID

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APPENDICES 1

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1 Introduction

Data collection and inventorization is a major step in preparing the necessary information for Flood Risk Analysis. Flood risk analysis is more complex in urban areas than that in rural areas because of their closely packed buildings, different kinds of land uses, and large number of drainage systems. In general, assessing the risk for any study area due to floods requires preparing a hydrodynamic model to study the effect of flood on people, structures and objects. To develop the hydrodynamic model, it is important to collect information on drainage systems, drainage structures, topography and meteorological information.

In addition, it is necessary to develop a GIS database to collect all gathered baseline data, satellite imageries in a geodatabase format that acts a storage pool for digital spatial data and as an analytical planning tool.

This report presents an inventory of data collected and the development of the GIS database.

1.1 Project Context

The incidence of flooding has been a recurring event in Ibadan, the third largest metropolitan area in Nigeria. The most recent flooding event took place on August 26, 2011, induced by the overflow from Eleyele reservoir on River Ona, resulted in a death toll of more than 120 people and serious damages to goods, properties and infrastructure, making many homeless and destitute.

The Ibadan Urban Flood Management Project (IUFMP) was thus set up by the Oyo State Government to oversee implementation of the various flood management projects being executed with the World Bank assistance through the Project Implementation Unit (PIU).

The Project Implementation Unit (PIU), acting as the Client, commissioned Dar (the Consultant) to prepare an Integrated Flood Risk Management and Drainage Masterplan for Ibadan City (the Project), covering the 11 local government areas which includes the Ibadan Metropolis and the surrounding outlying areas.

1.2 Current Status

This report complements the Flood Risk Analysis Report which are both considered as the sixth milestone submission. The report is also complemented by the prepared geodatabase handed to the PIU as a softcopy with this report.

This report presents an inventory of data collected, the development of the GIS database, in addition to the methodology used for the development of asset valuation and classification.

1.3 Objectives

The main objective of this report is to describe the methodology used in

- Creation of a GIS database;
- Gathering baseline data;
- Acquisition of satellite imageries;
- Data development and processing;
- Additional mapping;
- Data modelling and analysis;
- Site surveys;
- Map production and data presentation.

1.4 Report Structure

This report comprises five (5) Sections:

- **Section 1** is the present introduction.
- **Section 2** describes the general methodology and technology used in the database development.
- **Section 3** describes the approach and procedures for data acquisition and data development including collection and gathering baseline data; acquisition of both high and medium satellite imageries, LiDAR survey, as well as, data development and modelling. The section is complemented by a detailed inventory of the collected data presented in Appendix A.
- **Section 4** describes the conducted survey including the preparation for the field surveys, onsite data collection, and integration of results and data validation. The section is complemented by two Appendices (B, C) showing a sample of the landuse survey and its corresponding database.
- **Section 5** describes the preparation of layout frames and presentation of data in topical maps.

2 Methodology and Implementation

2.1 GIS Technology

The developed database is based on Esri ArcGIS technology latest version (10.5).

ArcGIS Desktop is the main software used to create the project spatial database, to perform the required analysis and to prepare the required maps. Spatial Analyst and 3D extensions were used to perform specific spatial analysis and 3D modelling, such as generation of Digital Elevation Models from topographic contours and delineation of drainage network.

The final data repository is a File Geodatabase which is an Esri database format optimized to store and query data that represents objects defined in a geometric space.

2.2 GIS Database Development

2.2.1 Development of Database Model

The preliminary preparation of the database model was done at the early stage of the project. The preparation leaned on identifying the required layers and tables in the GIS database and defining the relationships between the different data elements.

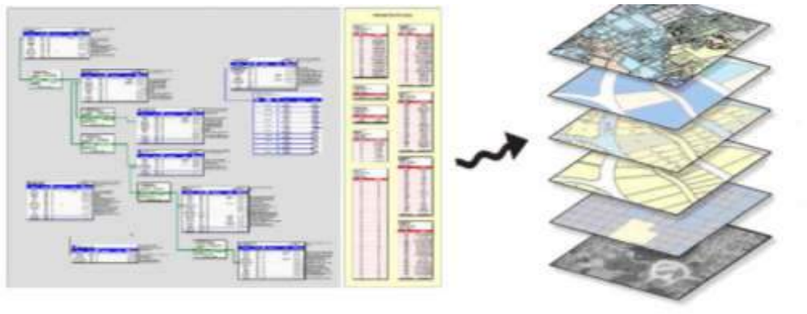

Figure 2-1: Preliminary Database Modelling

Once the preparation was done, a detailed database model was developed for organizing and storing the data. The model organizes the data, both spatial and tabular, in a Geodatabase, which allows primarily storing, querying, and manipulating spatial data in an efficient way. It is mainly organized into feature datasets (Administrative, Building Survey, Hydrology, Infrastructure, Landuse, Study Area, Terrestrial, Topography and Transportation) in addition to the raster layers which are standalone. Each feature dataset is made of a set of thematic layers. A preview of the preliminary database structure is shown in Figure 2-2. It will be amended and additional layers will be added to the Geodatabase as needed during the progress of the project.

Figure 2-2: Detailed Database Modelling

2.2.2 Spatial Reference

One important aspect of the data is the spatial reference or projection system. The spatial reference adopted for the GIS database is the UTM (Universal Transverse Mercator) Zone 31 North.

The "WGS_1984_UTM_Zone_31N" system uses as a geodetic datum the WGS 1984. It is based on 6° belts with a Central Meridian of 3.0° and a Scale Factor at Origin (mo) = 0.9996. It is published in Esri products with a Well-Known ID (WKID) 32631.

2.2.3 Metadata

In the data preparation stage all layers are populated with their metadata, "data about data". This describes the content, quality, condition, and other characteristics of the data and allows any potential future user to understand among other things, the origins of the data and thus any risks that may be attached to its use.

The most important aspects of the project data described by metadata are identified as follows:

- Identification;
- Data quality;
- Spatial data organization;
- Spatial reference;
- Entity and attribute information;
- Distribution; and
- Metadata reference.

Figure 2-3: Sample Metadata Report

2.3 Data Preparation

The Consultant identified the information of interest with reference to the scope of work. The information and data whether collected or surveyed were collated, processed and transformed into Esri GIS format. The conversion methodology and techniques varied from a layer to another based on the different native format, quality and accuracy as follows:

- Data in Raster (image) format were converted into digital GIS format by applying several conversion procedures that consist of rectification, projection into the appropriate coordinates system, digitization, building the topology of the spatial features and assigning attributes to features.
- Data in hard copy format were scanned then followed the procedures described above for Raster data.
- Data in AutoCAD format were converted to GIS and projected into the appropriate coordinates system.
- Data in tabular format were mapped based on the provided coordinates and then converted to GIS format.

All converted data were validated, consolidated in a centralized database repository and organized under proper datasets.

Some data were not found available and were developed from satellite imagery, some other were modelled and derived from customized hydrodynamic models. The infrastructure data were preliminary mapped from the high resolution satellite imagery and then validated in the field where detailed information were collected for each identified structure.

The process of development and checking is detailed below in Section 3, specifically for the feature layers mapped from the imageries or derived from hydrodynamic models, as well as, data resulting from site survey.

Several analyses were produced, models were built to automate processes and various thematic maps were produced presenting the acquired data and the outcomes resulted from the complex analyses applied on the acquired layers.

2.4 Satellite Imagery

imagery was mainly used as a reference base for the creation of new spatial data, as well as, for viewing, validating and updating any existing data. In the project, imagery was used in the preparation of land uses maps, identification of buildings footprints, tracing of road network and mapping of agricultural lands and water bodies.

It was also used as a visual reference base for the Project Maps: images are used in the background of digital vector maps to provide a visual reference base i.e., agriculture areas, main landmarks, urban areas, and physical infrastructures (roads) can be easily identified as the imageries provide valuable information on inaccessible or distant locations.

The used imagery and process of development of satellite imagery datasets are described in Section 3.2.

3 Data Acquisition and Development

The GIS objective under that project is to collate and develop data for the extent of Ibadan City, for inclusion in a GIS database. Therefore, meetings, site visits, field surveys were consecutively conducted and data were collated accordingly.

The high resolution satellite imagery and selected topical layers were extracted from the Ibadan City Master Plan GIS database and used in the development of the "Integrated Flood Risk Management and Drainage Masterplan for Ibadan City" project.

Additional layers were specifically developed for this project and include the following:

- Crossing structures;
- Building surveys.

3.1 Data Collection

3.1.1 Meetings

The Data Collection task was initiated where appointments for meetings were scheduled and meetings were consecutively conducted with the representatives of the ministries, governmental and public authorities to obtain data from their records.

3.1.2 Site Visits

Site visits were scheduled and undertaken by qualified engineers. The aim of the site visits was to explore and make reconnaissance of the sites, meet the operations and representatives of the site works, collate specific information that help in the planning and development of works. The outcomes of the site visits were incorporated in the project database and made use in the development of both projects.

Photo1: Restoration Bridge Id No. 44, Secretariat Road, 600556E, 819787N

Photo2: Culvert Id No. 6 Oladele New Town, Gbekuba, 591397E, 817719N

Photo3: High Value Buildings (Modern Style)

Photo4: Ogunpa Channel

Plate 3-1: Site Visit to Drainage Structures and Buildings

3.1.3 Field Surveys

Field surveys were planned and carried out by qualified surveyors. The aim of the surveys was to make reconnaissance of the sites, validate onsite the available data and collect further information that assist in the planning and development of works for the Integrated Flood Risk Management and Drainage Masterplan for Ibadan" project.

The field surveys specific to the present project and their relevant details are described in Section 0.

3.1.4 Correspondences

The communication and follow-up with the visited authorities were made through official correspondences stating in written the purpose of the meetings, summarizing the minutes of meetings and enumerating in details the required data and relevant extent.

3.2 Satellite Imagery Acquisition

Satellite imagery was mainly used as a reference base for the creation of new spatial data, as well as, for viewing, validating and updating any existing data. In the project, imagery were used in the preparation of land uses maps, identification of buildings footprints, tracing of road network and mapping of agricultural lands and water bodies.

It is also used as a visual reference base for the Project Maps: images are used in the background of digital vector maps to provide a visual reference base i.e., agriculture areas, main landmarks, urban areas, and physical infrastructures (roads) can be easily identified and provide valuable information on inaccessible or distant locations.

Two types of imagery were targeted for the project. They differ in spatial resolution (pixel size), higher resolution offer higher level of details and accuracy:

- High resolution satellite imagery (0.5m resolution); and
- Medium resolution satellite imagery (15m)

The used imagery and process of development of satellite imagery datasets are described in following sections.

3.2.1 High Resolution Satellite Imagery

At the early stage of the "Ibadan City Master Plan" project, the Consultants have acquired a set of high resolution archival satellite imagery (0.5m resolution) for the study area. The images were captured by Pléaides satellite (Airbus) in November and December 2015.

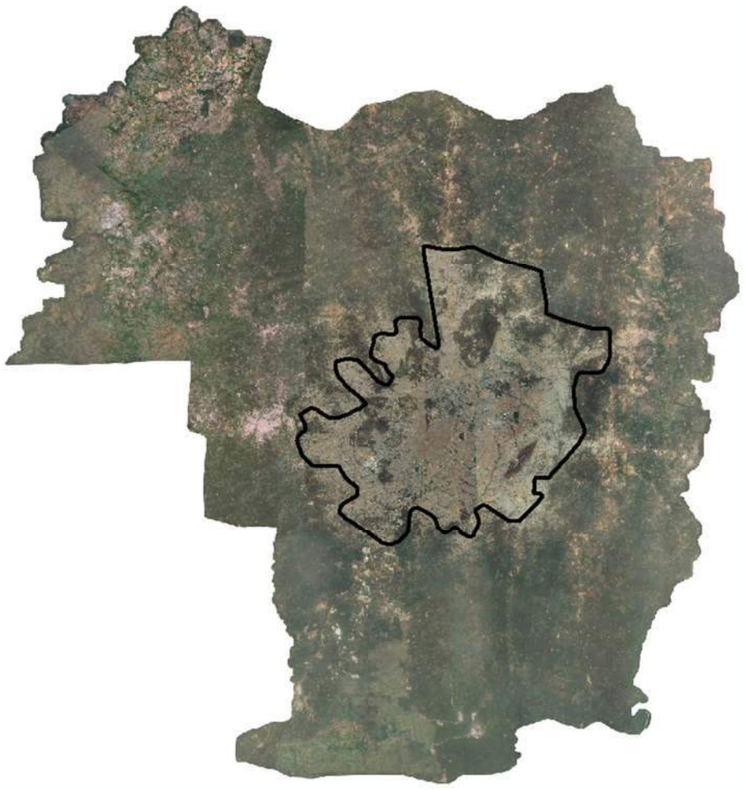

Figure 3-1: Ibadan High Resolution Satellite Imagery

The images were orthorectified using available base maps, SRTM (Shuttle Radar Topography Mission) Digital Elevation Model and online databases (Streets, landmarks) as well as a set of ground control points acquired during a field survey. The imagery tiles were color-balanced and mosaicked in one seamless imagery as shown in Figure 3-1.

3.2.2 Medium Resolution Satellite Imagery

Land imaging from medium-resolution Earth-observing satellites, such as Landsat and Sentinel, offers the capability to observe land use and land use changes across time. The use of Landsat and Sentinel images was essential because it provides accurate, timely and repetitive information for wide geographical extents where changes and forecast patterns of change in future urban landscapes can be identified.

This type of imagery is suitable for thematic mapping. Considering the changes in the land surface, vegetation, water cycle, population growth and other aspects of the landscape, the nature of this milestone has important implications on the project study. Therefore, datasets of archived Landsat-8 and Sentinel-2 imageries from 2015-2016 have been acquired.

The selection of the requested block of tiles was made based on the index published by USGS that shows the Path/Row scene boundaries and geographic coordinates for the available Landsat and Sentinel acquisitions. The selection that covers the required extent consisted of two (2) Landsat-8 tiles and one (1) Sentinel-2 tile as shown in Figure 3-2 and Figure 3-3.

The medium resolution imageries were used in the interpretation of land cover classes, as well as, in identifying the urban areas and major roads outside Ibadan City.

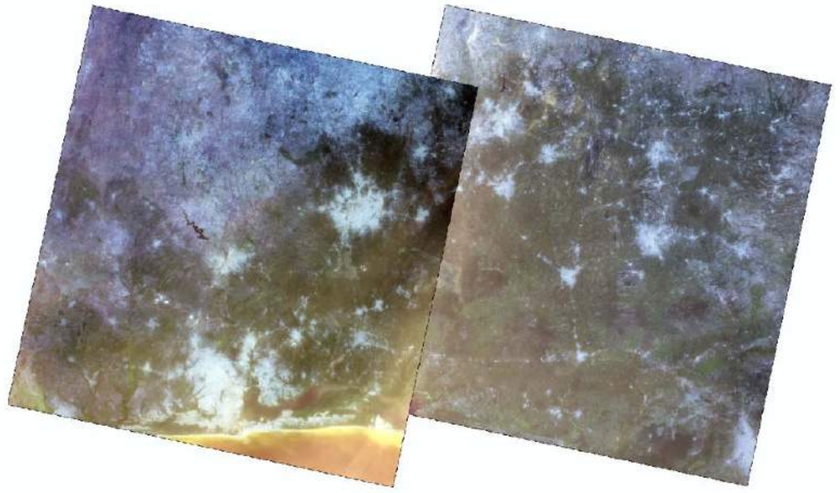

Figure 3-2: Medium Resolution Landsat-8 imagery

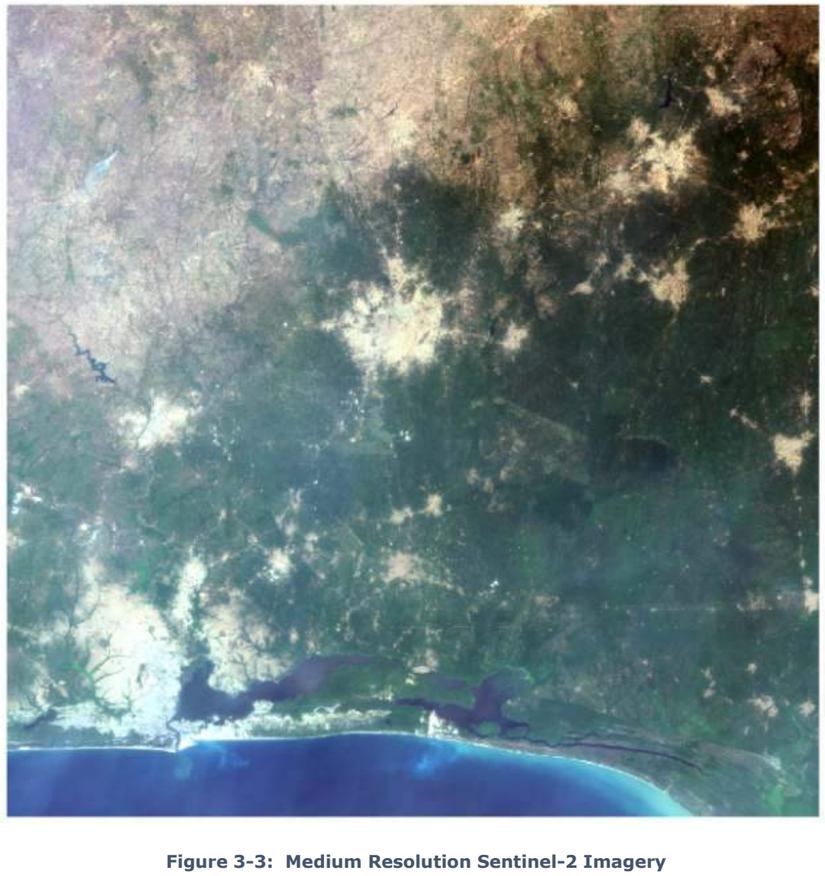

Figure 3-3: Medium Resolution Sentinel-2 Imagery

3.3 LiDAR Survey

A detailed aerial survey was conducted in January 2018 covering the core area of Ibadan with a total surface area of approximately 1,030 sq km. The survey was performed using a fixed-wing aircraft platform consisting of three-dimensional laser scanning (LiDAR) and high-resolution aerial photography.

3.3.1 Airborne LiDAR Collection

A Leica ALS80 dual-channel LiDAR system was used for acquisition of the LiDAR data. This system was installed in a Diamond DA42MPP aircraft. In total, 17 flight lines were required to cover the area of interest with a flying height ranging between 1,000m and 1,450m above ground level and with a flight speed of approximately 100 knots.

The trajectories of the aircraft during survey sorties were determined by means of precise point positioning (PPP). The flight orientation angles were determined at every point along the trajectory through the use of an inertial measurement unit (IMU). Using the orientations and GPS-based positions of the aircraft, accurate point clouds were generated from the continuous laser scanning.

The time-of-flight for each transmitted and reflected laser pulse was combined with the flight trajectory and orientations to produce a point clouds with the Leica CloudPro software.

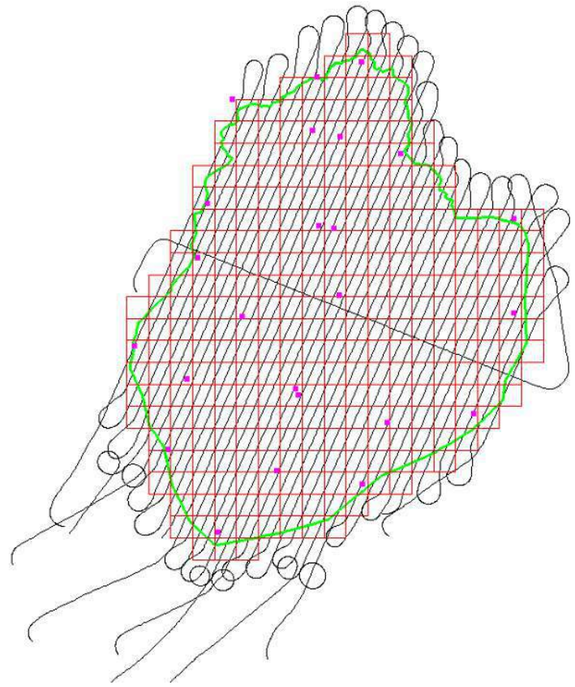

Figure 3-4: Flight trajectory

3.3.2 Point Cloud Survey

LiDAR data was collected with an average density of around 2 points / sq. meter for all returns. The industry-standard workflow was used for the post-processing of data using the Terrasolid suite of software.

Around 3,582,311,966 point clouds were collected and subdivided into 303 tiles of 2km x 2km. The points were generally classified as ground, non-ground, overlap and error point classes. The non-ground data was consequently classified by height above ground to low, medium and high vegetation classes. The high points were further classified by an automated macro process to extract building roofs. The classification is generally found to be good for high points (exceeding 2.5 m above ground), for buildings larger than 40m² and with roof structures with general smoothness below 0.2m variations. The water bodies were classified manually by comparing the point clouds to the orthophotos.

Digital Elevation Model (DEM) and Digital Terrain Model (DTM) data were respectively generated in both ASCII XYZ grid format and GeoTIFF format (1m and 5m intervals respectively).

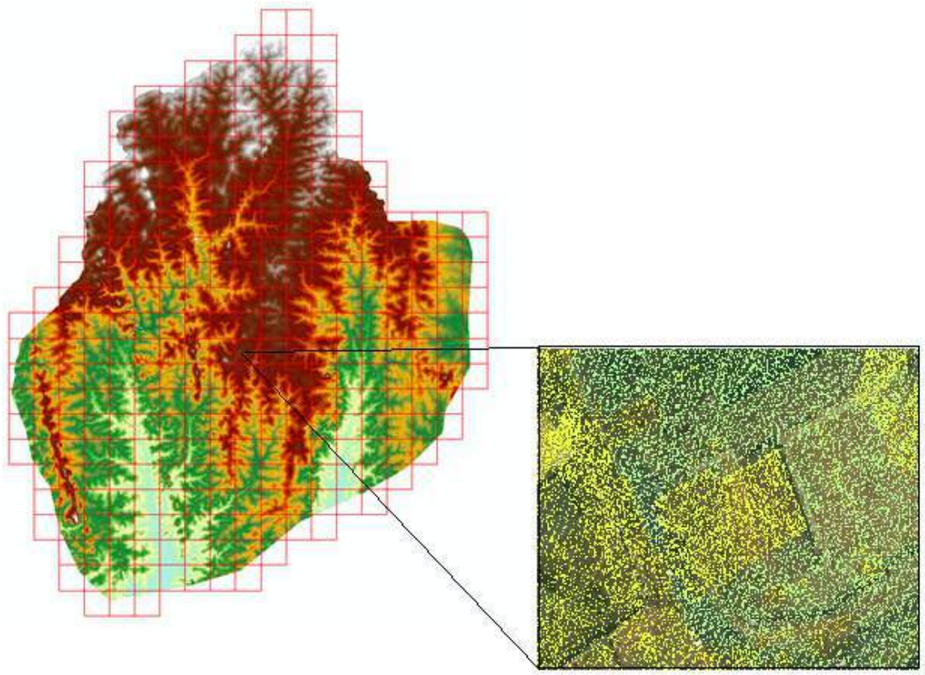

Figure 3-5: LAS Point Elevation

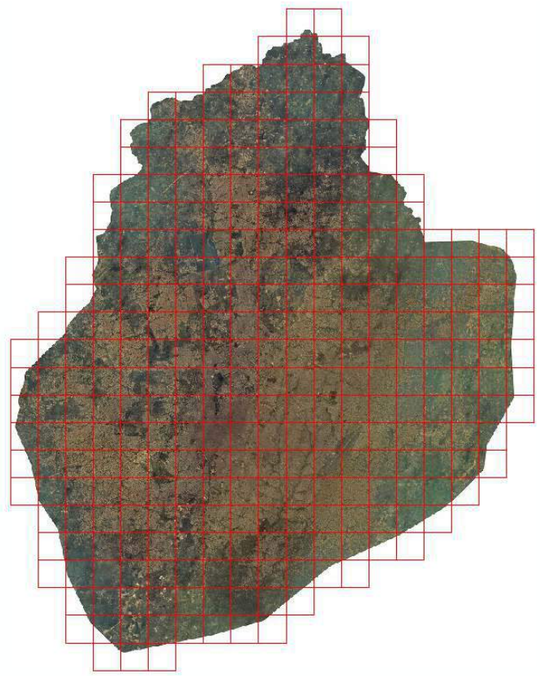

Figure 3-6: Mosaic high-resolution Orthophotos

3.3.3 Aerial Photos

A 100-megapixel camera Phase One iXU-R1000 was used for capturing the high-resolution aerial photos simultaneously with the LiDAR scanning. The photos were collected in 3 bands (red, green and blue) at a resolution of less than 20 cm GSD and were subdivided into 303 tiles of 2km x 2km.

Photogrammetric standards of 30% side overlap and 60% forward overlap were maintained throughout the survey. Image frames were developed from the captured proprietary IIQ format to TIFF format with Capture One, for use in photogrammetric software.

3.4 Data Development and Processing

The main purpose of the data development and processing is to:

- Highlight the available baseline information collected from previous various projects;
- Identify the gaps in the available baseline data;
- Identify the available information that may no longer be accurate and need to be re-acquired;
- Identify the list of primary information required for the project;
- Identify the coverage for each required information;
- Identify the level of accuracy of each required information;
- Identify the source of information and define accordingly the list of potential ministries and authorities to be addressed for data collection.

The collated data were mainly acquired either in a digital vector format or raster formats and others as hardcopies. The hardcopies were converted to softcopy raster format (scan) or entered (in case of tables). Several systematic procedures were applied to convert the softcopy raster format into digital vector format. The vector format can be data points, lines or, polygons where typically each feature is tied to a set of attributes stored in the database.

Due to the different types of the data which vary from a dataset to another and from a data source to another, detailed procedures were set for validating the attributes and the creditability of the

information such as the time accuracy (up-to-date), the resolution (position of the features versus scale of the map) and the geographic location (checked versus the satellite imagery). Other procedures were applied for processing the data prior organizing and storing the related layers in the main project database.

The contents of the datasets of the GIS database are given below. The main data preparation and processing techniques applied on specific layers are also described.

3.4.1 Administrative

The study of geography mainly leans on the distribution of the administrative divisions and related geographic features. The gathered information includes but is not limited to:

- Nigeria boundary;
- Ibadan District boundary;
- Local Government Areas (Ibadan District);
- Localities.

3.4.1.1 Local Government Areas Processing

The local governmental areas known as "LGAs" layer was initially acquired from the "Surveyor General Office of Ibadan". Another version of the layer was also acquired from the "Polytechnic University of Ibadan" where in both sources of data, the geographic boundaries were not found following properly the natural physical features in the landscape such as the rivers, mountains ridge, valleys, and roads.

In some places, the boundaries were found schematically drawn in straight lines running all over the alignment of the rivers. In other places, the boundaries were found cutting through the existing urban areas or running parallel to the existing roads or mountain ridges without respecting their natural shapes. In those cases, the geographic boundaries were subjected to slight adjustments to follow properly the alignment of the physical features observed on the high resolution satellite imagery and on the available topographic maps.

The below Figure 3-7 and Figure 3-8 illustrate the above described cases and show the applied adjustments.

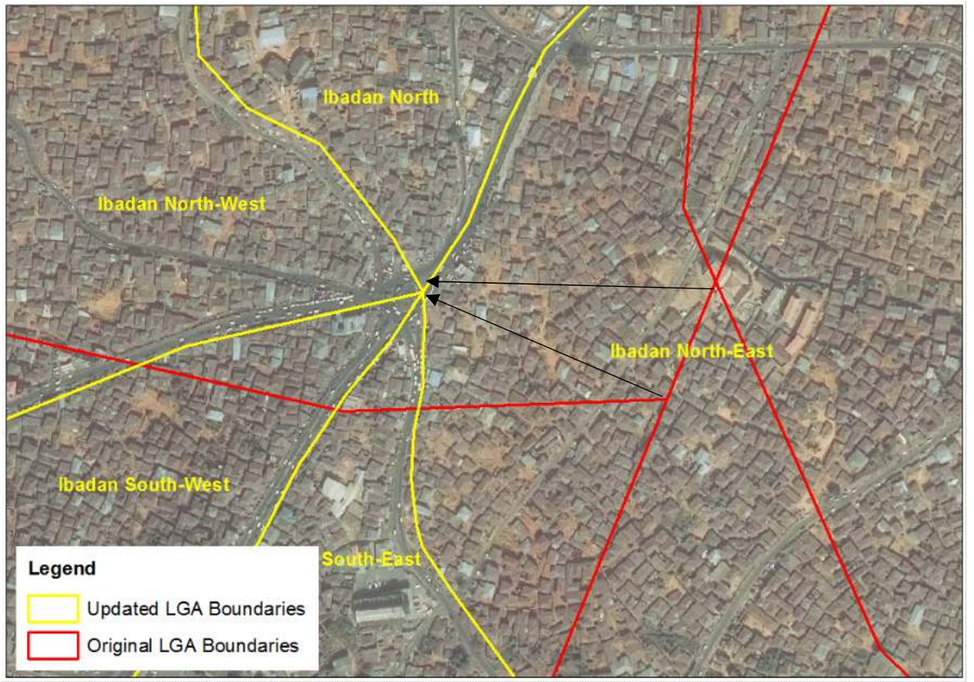

Figure 3-7: Modifications Applied on the LGAs to Follow the Roads

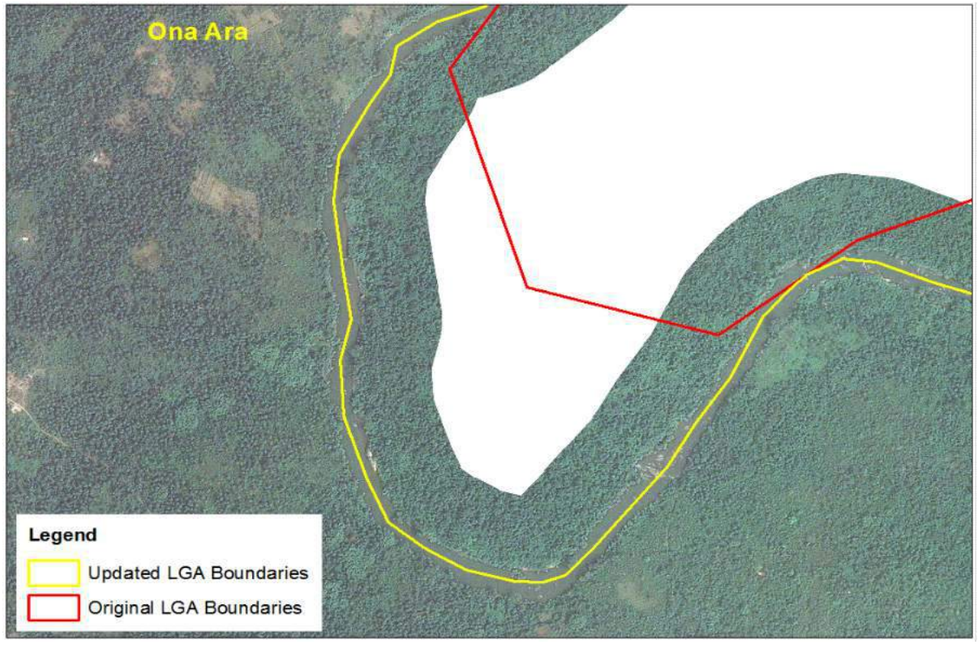

Figure 3-8: Modifications applied on the LGAs to Follow the River

3.4.1.2 *District Boundary Processing*

The district boundary of Ibadan has been amended to follow the outer boundary of the relevant eleven (11) LGAs of Ibadan City.

3.4.2 Topography

The topographical information provides an overview of the shape of the terrain and indicates the different elevations along surface. This information is useful when it comes to study the terrain and surrounding regions. It assists in the hydrological modelling and the infrastructure design.

Ibadan city setting is characterized by rugged terrain with steep slopes creating a very dense network of streams with wide valley plains. Three major landforms which are hills, plains and river valleys dominate the whole landscape of Ibadan region. The general elevation within the built up area is between 100m and 350m above sea level.

The gathered information includes but is not limited to:

- Contour Lines;
- Digital Elevation Model (DEM);
- Digital Terrain Model (DTM).

3.4.2.1 *Contour Lines Processing*

At an early stage of the project, the Consultants obtained a copy of an aerial survey conducted in 1991. The survey covers the urban area of Ibadan. The survey files received are in the form of CAD files with a Scale of 1:1,000 including spot elevations and 0.5 to 1m contour intervals covering the centre Ibadan City. Although this survey covers a large portion of the current urbanized area, yet there are many urban areas outside this boundary. The extent of the survey and the index of survey sheets are shown in below Figure 3-9. A sample of the converted data is also shown in below Figure 3-10.

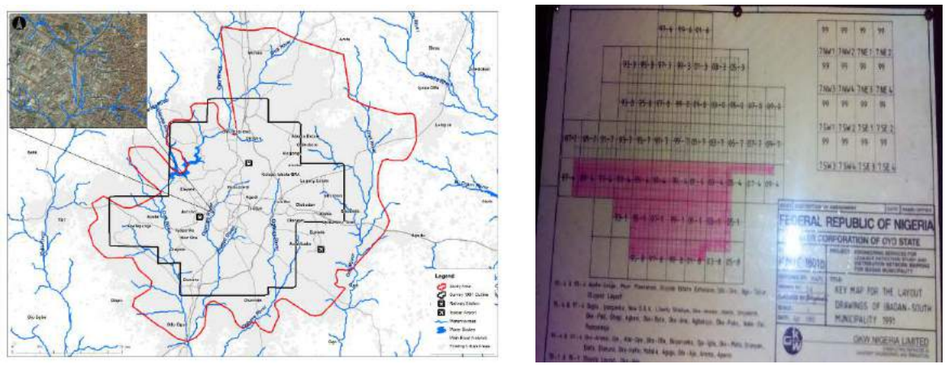

Figure 3-9: Survey Boundary (1991) and Index of Survey Sheets

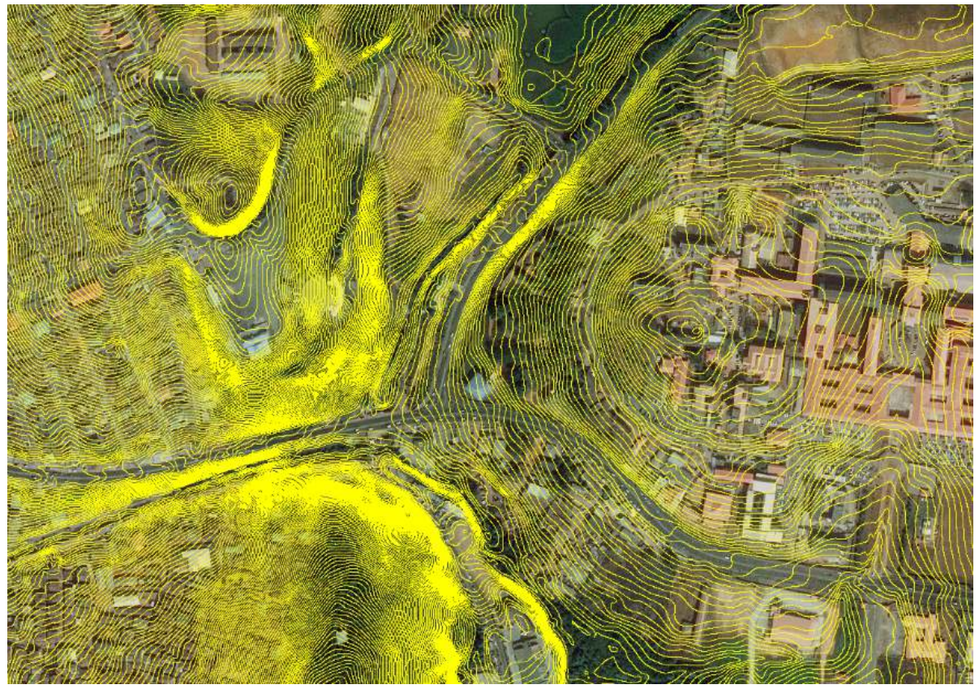

Figure 3-10: Sample Contour Lines

The content of the survey sheets were converted sheet by sheet from CAD to GIS. The elevations were assigned as attributes to the features and were subjected to validation to ensure the consistency of the elevation value along the same contour line and its continuity from a sheet to another.

After the completion of the LiDAR survey and generation of the DTM tiles, contour lines of 1m interval were respectively generated covering the surveyed area.

3.4.2.2 *Digital Elevation Model Processing*

At an early stage of the project, the Consultants made use of the available survey 1991 and generated a Digital Elevation Model (DEM) of 1m resolution using ArcGIS software, 3D Analyst extension.

The generated DEM shown in below Figure 3-11 is used as input data for many purposes such the development of the 1D/2D hydrodynamic model, identification of the flood prone areas and the preparation of watershed delineation.

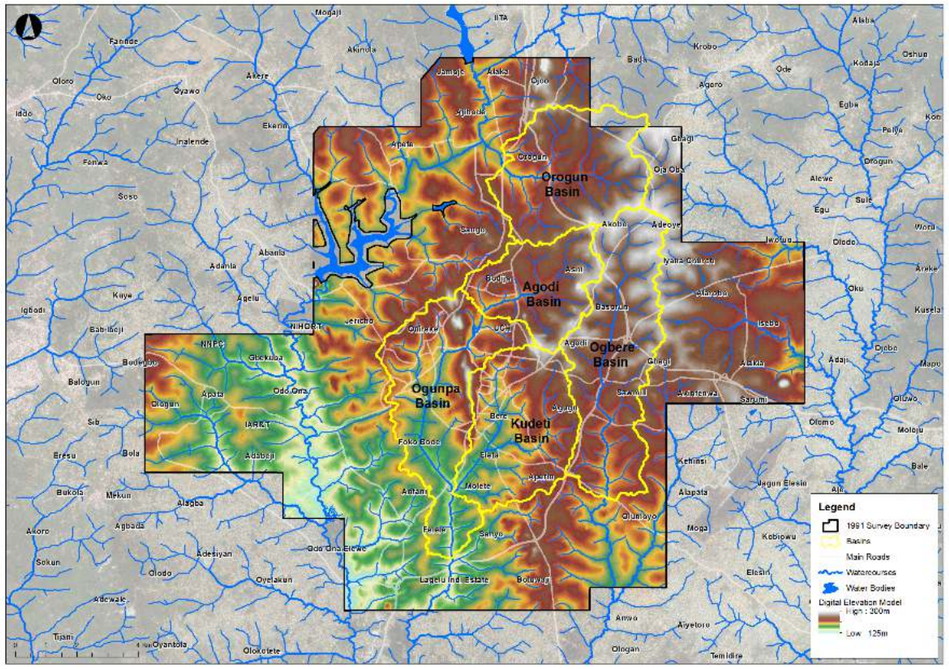

Figure 3-11: Digital Elevation Model Generated from 1991 Aerial Survey for the Centre of Ibadan City

A 30m resolution Shuttle Radar Topography Mission (SRTM) was also acquired from NASA, USGS EROS Data Centre and made available for use. These layers were found suitable for the delineation of the watershed network, catchment areas, and flood mapping.

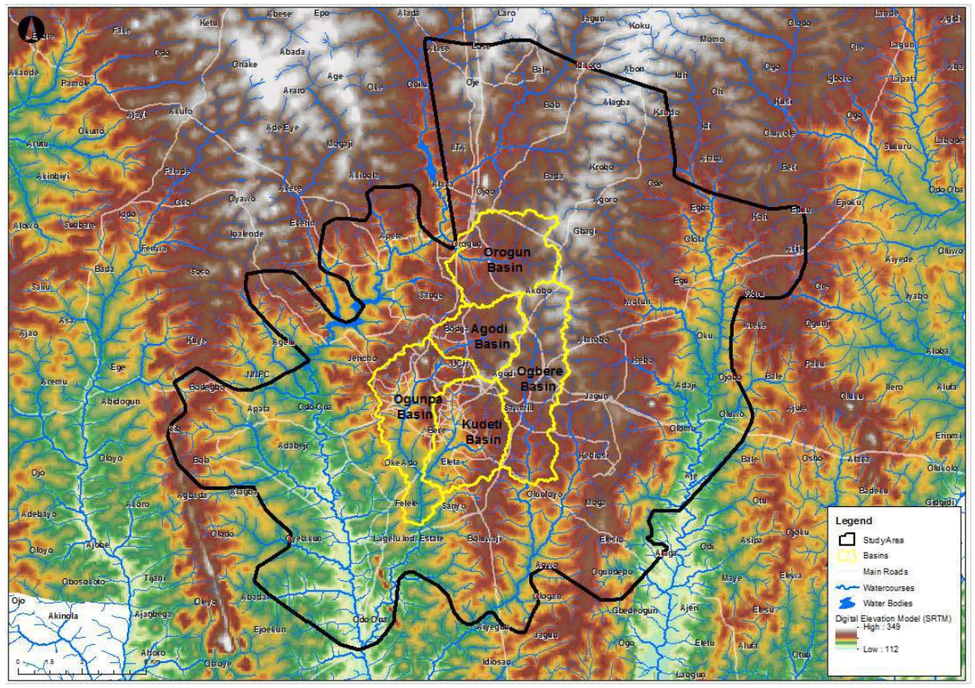

Figure 3-12: 30m SRTM Model for Ibadan City

After the completion of the LiDAR survey, the Consultants made use of the generated DEM and DTM tiles in further desktop analysis and hydrological mapping.

3.4.3 Land Use

The land use reveals the physical material composing the region and the land use involves the management and use of the natural environment by humans. This information assists in characterizing the project area (structure and activities).

The gathered information includes but is not limited to:

- Land Cover;
- Land Uses.

3.4.3.1 Land Cover Processing

The land cover classes were interpreted from the acquired medium resolution satellite imageries which record 8 bands in the visible, near infrared, mid-infrared and thermal infrared in addition to one panchromatic band.

The Stacking and Pan-sharpening techniques in Remote Sensing were used for merging the bands in order to benefit from the information of the multispectral real colour images. The Supervised Classification algorithm was used by selecting representative sample sites of known cover type called Training Areas. The computer algorithm then uses the spectral signatures from these training areas

to classify the whole image.. The outcomes of the remote sensing processing are recorded in the form of a raster file and then into a GIS layer made of land cover classes, as shown in below Figure 3-13 with different colours.

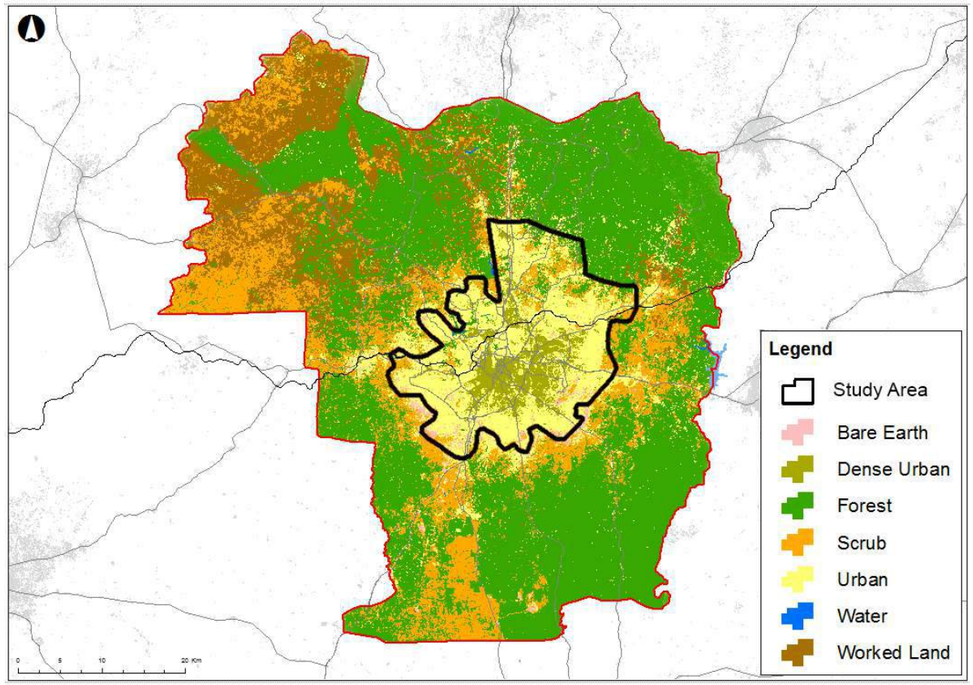

Figure 3-13: Land Cover Map

3.4.3.2 Land Uses Processing

The existing land uses were interpreted and mapped from the high resolution satellite imagery.

The process leaned on tracing the footprint of the forest and green areas, centreline of the rivers, streams and roads, generating their relevant corridors, mapping the footprint of the urban areas and defining their typology whether low, medium or high density, their use whether residential, commercial, industrial, etc.

The outcomes of the interpretation and mapping were subjected to onsite validation. Therefore, a field survey was conducted as part of the Ibadan City master Plan project where the aim was to validate in the field the mapped blocks of land uses along with their assigned land use classes. The surveyed information collated from the field along with the surveyors' notes were sketched on the prepared survey sheets. The land use layer was amended to include the updates.

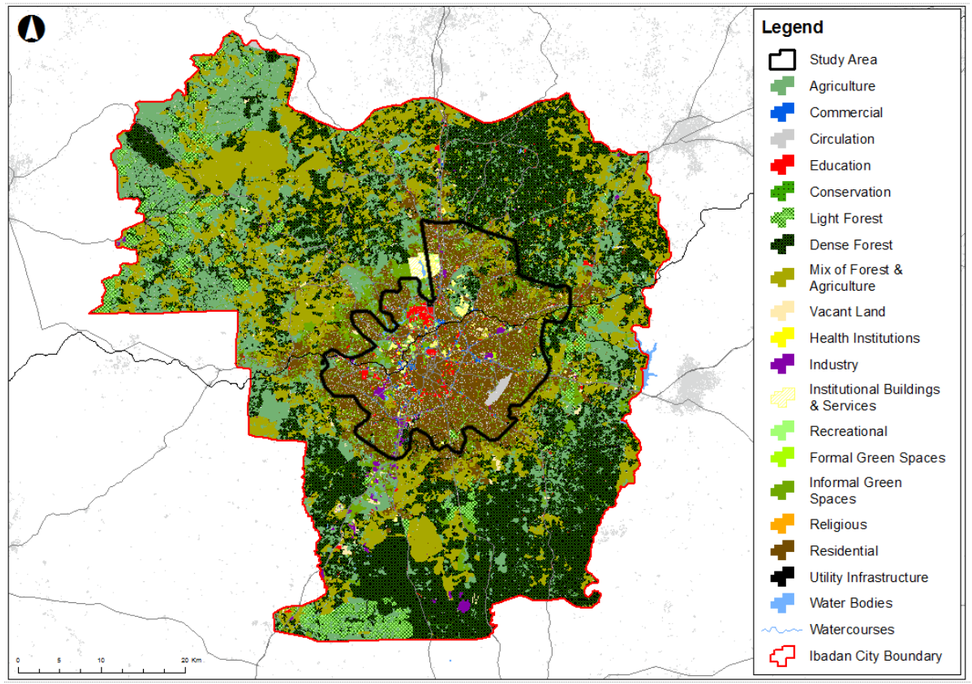

Figure 3-14: Land Use Map

3.4.4 Infrastructure

Infrastructure and utilities such as water, electricity and telecom networks are vital to a country's economic development and prosperity. In general, each project requires studying the infrastructure of its respective area in order to take advantages from every facility it provides.

The gathered information includes but is not limited to:

- Location of Hydraulic Structures (Bridges, Culverts, Irish Crossings, etc).

3.4.4.1 Hydraulic Structures Processing

The high resolution imagery, the rivers and the road network layers were used as base references to map drainage structures. These structures are located at the intersection of roads with the rivers or streams in Ibadan.

The mapped locations were validated in the field through handheld GPS devices and then adjusted according to the GPS readings. Survey sheets were prepared accordingly where the aim is to validate onsite the identified structures and collect detailed information for each of them.

By the end of the survey, the collated information were subjected to review and validation prior integration in the main GIS database. The survey methodology is described in Section 4.1.1. The outcomes of the survey were incorporated in the GIS database and used as input data in the developed models.

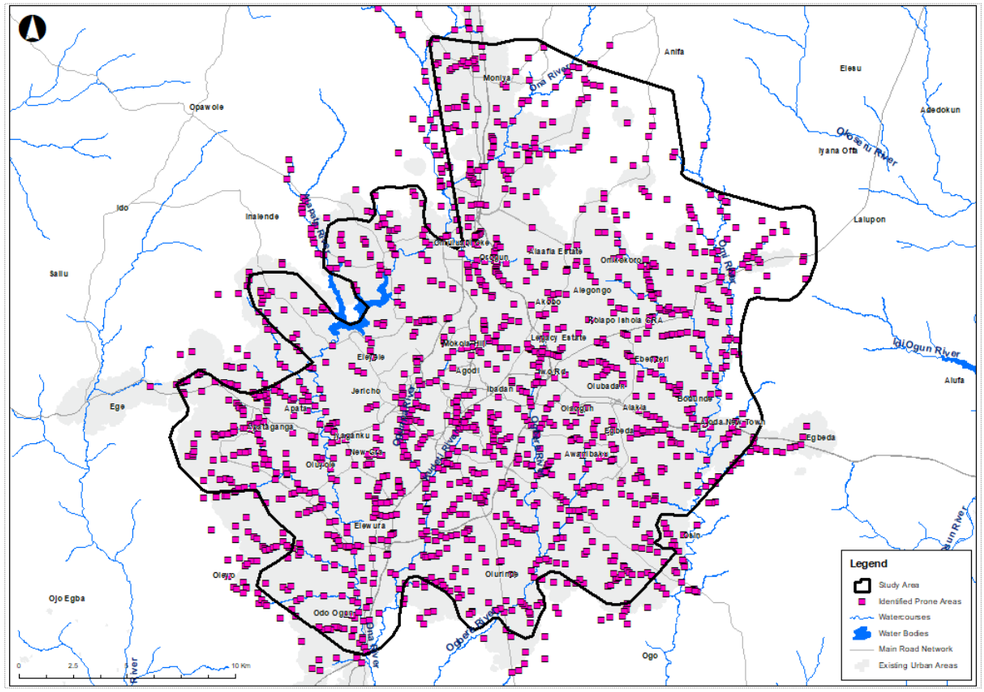

Figure 3-15: Identified Crossing Structures

3.4.5 Hydrology

The surface water characteristics of the region were determined, including descriptions of natural and artificial water bodies and watercourses in the region. This information assists in understanding the drainage system and identifying the risks of floods.

The gathered information includes but is not limited to:

- Catchments;
- Sub-Catchments;
- Water Bodies;
- Watercourses;
- Flood Plains and Flood Return Period (100-yr, 50-yr, 5-yr, etc.);
- Flood Prone Areas.

3.4.5.1 Watercourses Processing

A preliminary version of the watercourses layer was delineated from the SRTM using ArcHydro which is a set of data models and tools that operates within ArcGIS to support geospatial data analyses. The outcome of the model was overlaid over the high resolution satellite imagery and the topographic maps where a walk over visual inspection has been undertaken to check and amend the geometries.

The software assigned hierarchy for the watercourses where the major rivers, minor rivers, major streams and minor streams have been classified in the layer.

Reference to the outcomes of the structures survey, the name of the visited rivers and streams were collected and were manually assigned to their relevant features in the layer.

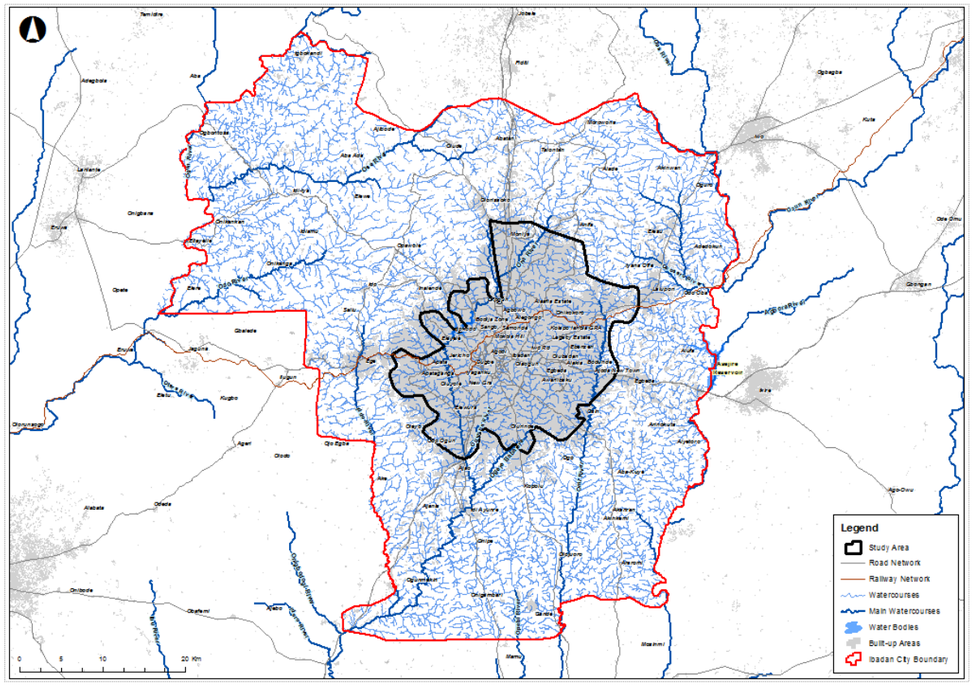

Figure 3-16: Delineated Watershed Network Covering Ibadan

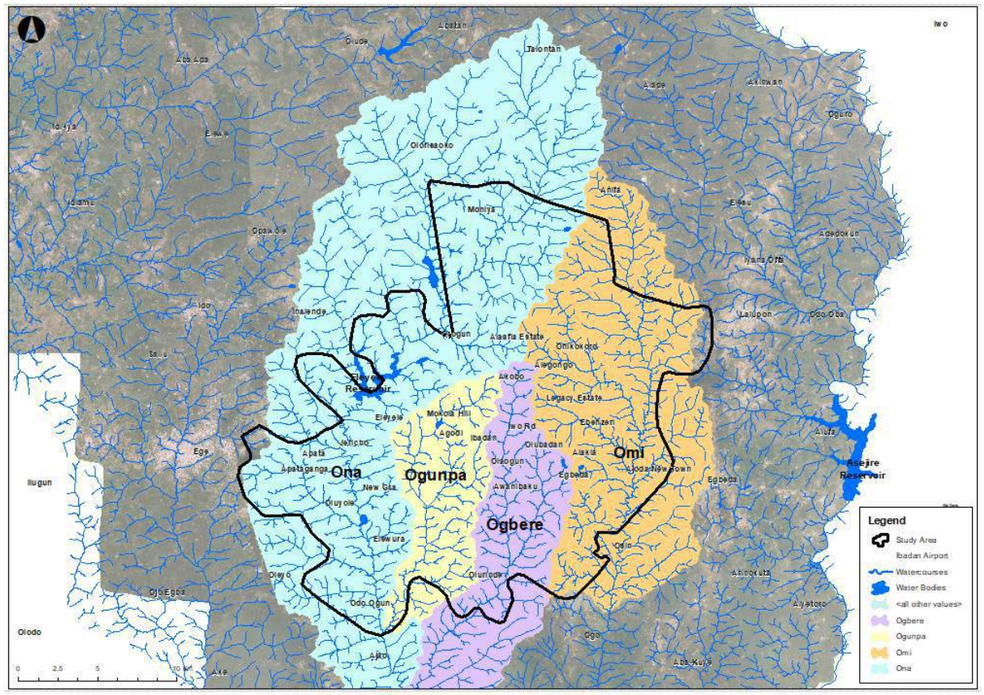

Figure 3-17: Catchment Areas and Watershed Network

3.4.5.2 *Catchment and Sub-catchments Delineation*

The ArcHydro model assisted also in delineating the catchment and sub-catchments boundaries. The overall modelling process consisted of different steps starting by the DEM reconditioning, then filling sinks, computing the flow direction, computing the flow accumulation, defining and segmenting the streams, delineating and processing the catchment grid, processing drainage lines, and at the end generating aggregated upstream catchments.

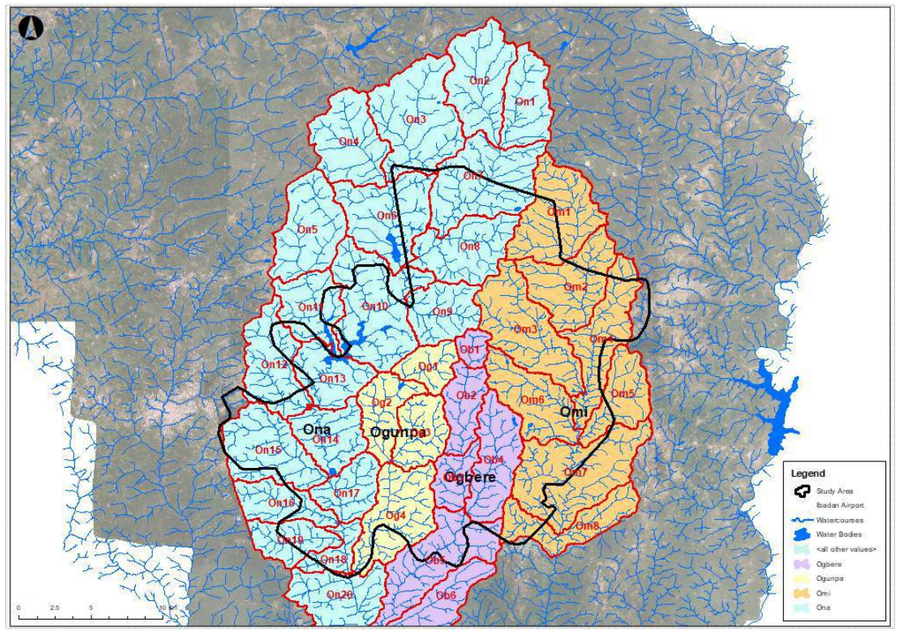

Figure 3-18: Delineated Catchment Boundaries

3.4.5.3 *Flood Plains and Flood Prone Areas Delineation*

Hydrologic, Hydraulic and Hydrodynamic models with model-parameters were developed. The LiDAR Digital Elevation Model (DEM), watershed, structures characteristics and other digital data were used as inputs in the developed models.

The aim of these developed models was to identify the flood-prone areas and to delineate the flood plain extent and water spread with different return periods, as well as, the floodwater depth, flood risk, velocity distribution, vulnerability and flood hazard layers. Basically, these layers are currently under processing and might be subject to further updates, therefore a preliminary version of the modelled layers was incorporated in the database.

The outcomes of the developed models and analysis include:

- Flood Extent for Different Return Periods (100-yr, 50-yr, 25-yr and 5-yr)
- Flood Depth for Different Return Periods (100-yr, 50-yr, 25-yr and 5-yr)
- Flood Hazard for Different Return Periods (100-yr, 50-yr, 25-yr and 5-yr)
- Flood Velocity for Different Return Periods (100-yr, 50-yr, 25-yr and 5-yr)
- Flood Extent after interventions for Different Return Periods (100-yr, 50-yr, 25-yr and 5-yr)
- Flood Depth after interventions for Different Return Periods (100-yr, 50-yr, 25-yr and 5-yr)
- Flood Hazard after interventions for Different Return Periods (100-yr, 50-yr, 25-yr and 5-yr)
- Flood Velocity after interventions for Different Return Periods (100-yr, 50-yr, 25-yr and 5-yr)
- Hotspots and Buildings expeosed to Moderate Hazard Zones for 100-yr Return Period

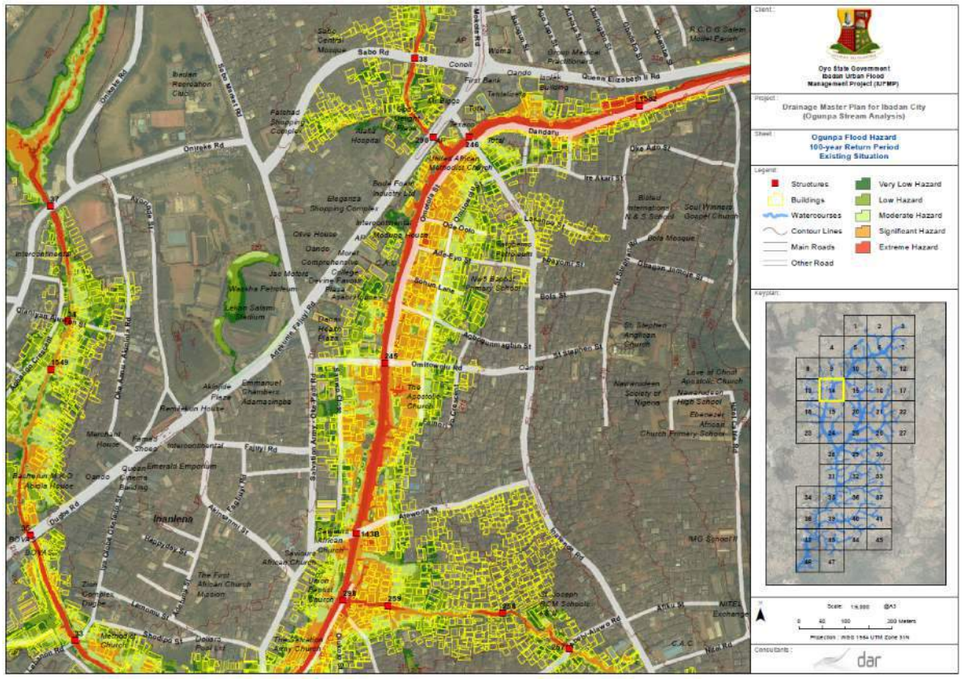

Figure 3-19: Sample Flood Hazard Map

3.4.6 Terrestrial

The acquired terrestrial information include geology and soil classification maps. This information assists in getting an indicator about the permeability of the ground.

The gathered information includes but is not limited to:

- Soil Structures;
- Geology Structures.

3.4.7 Transportation

The gathered baseline data related to transportation includes the infrastructure related to airports, roads and railways networks.

The gathered information includes but is not limited to:

- Existing Road Network;
- Roads Corridor;
- Existing Railway Network;
- Airports.

3.4.7.1 Road Network Processing

The existing road network layer was downloaded from Google Maps / OpenStreetMaps and overlaid over the high resolution satellite imagery where a walk over visual inspection has been undertaken to check and amend the geometry of the roads, as well as, to validate the precision and accuracy of the relevant information.

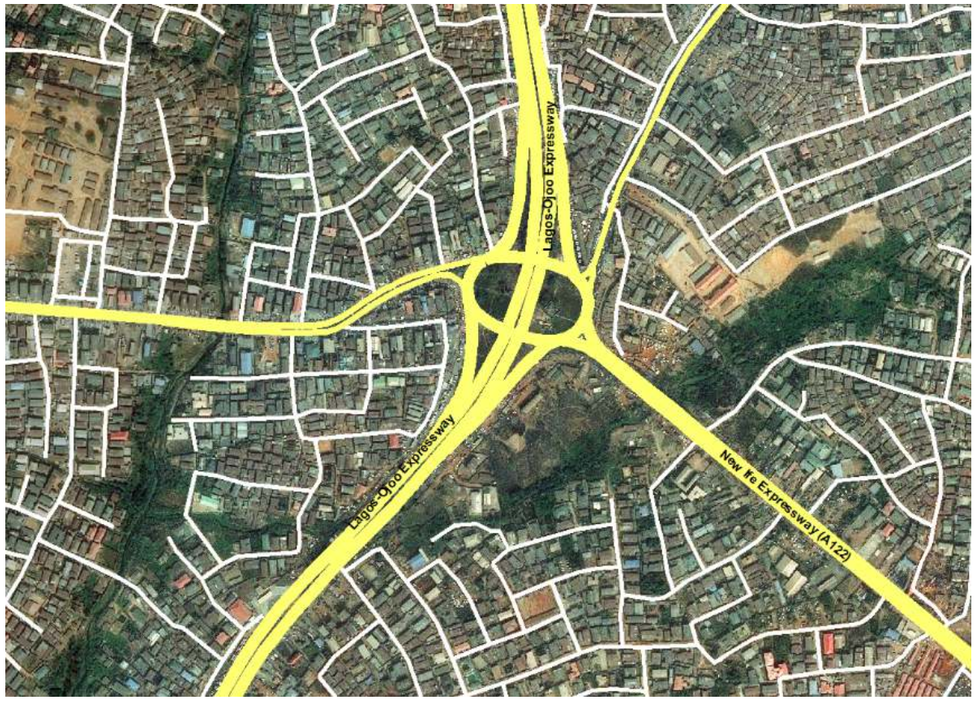

Figure 3-20: Sample Road Network

3.4.7.2 Roads Corridor Processing

A walk over visual inspection has been also undertaken on the road network where the aim was to measure the approximate width of the segments of roads from the satellite imagery. Based on the measured widths, the road corridors were drawn from the centreline of the roads.

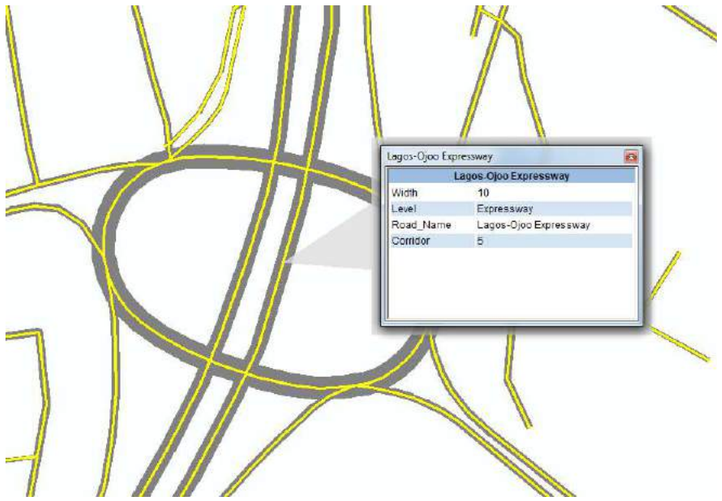

Figure 3-21: Road Width and Generated Corridors

3.4.8 Buildings Mapping

The Consultants made use of the high resolution aerial imagery as a reference and completed the digitization of the footprint of 174,686 buildings falling within the river flood extent of Ogbere, Agodi, Kudeti, Ogunpa and Orogun basins.

Survey sheets were prepared accordingly and field surveys were carried out. The survey methodology is described in Section 4.1.2. The outcomes of the survey were incorporated in the GIS database and were used as input data in the developed models and the assessment of floods impacts.

Figure 3-22: Mapping Buildings Footprint

3.5 Data Inventory

The primary purpose of the data inventory is to list and track the collated and developed GIS data in an organized portfolio, mainly known as Data Inventory document. This document describes the content, format, source, attributes and spatial description, and processing done on the raw data.

Reference to the data collection meetings, collated GIS information and developed data, a detailed GIS database inventory is presented in Appendix A.

4 Site Survey

4.1 Survey

In addition to the previous site surveys, two main surveys were simultaneously conducted by specialized surveyors, the hydraulic structures survey and the buildings survey.

4.1.1 Hydraulic Structures Survey

Several site visits were conducted in Ibadan in the past 3 years starting from the preparation of the Drainage Master Plan Proposal in February 2016 and till the preparation of this report. These site visits includes the following:

1- A 3-day site visit from February 27th to February 29th, 2016. This site visit was conducted during the preparation of the technical proposal. In this visit, the consultants visited 42 locations at intersections of roads with drainage channels.

2- A 6-day site visit from July 19th to July 24th. In this visit, the consultants visited 45 locations at intersections of roads with drainage channels to investigate the problems and drainage Issues within the study area.

3- A 3 weeks site-visit within the period from August 3rd to August 24th, 2016. In this visit, the consultants visited 159 selected locations based on a desk-study conducted by Dar for flood prone areas. Within this site visit, comprehensive interviews with the affected communities were done to assess the flooding problems within each location.

4- A 3-day site visit from January 25th to January 27th, 2017. In this visit, the consultants visited 39 selected locations based on the recommendations of the Task Force Report.

5- A 7-day site visit from March 1st to March 9th, 2017. In this visit, the consultants visited the 14 priority locations stated in the RFP, and 19 locations received from the Ministry of Environment including constructed structures such as (bridges or culverts) that were implemented following the flood of 2011, drainage structures under construction, and proposed drainage structure.

6- An intensive site visit initiated in April 1st, 2017 for all crossing structures within the urban area of Ibadan, refer to Figure 4.1.

7- A 1-day site visit in May 3rd to around 20 selected locations based on recommended sites of Ibadan City Master Plan.

8- A 1-day site in May 4th, 2017 with the PIU representatives to vulnerable areas in Olorungunwa, main channels such as Ogunpa, Kudeti, Ona Rivers and recommended bridges proposed by the PIU and sent to the World Bank for approval.

A detailed field survey was carried out for the hydraulic structures located at the crossings of roads with watercourses. The aim of the survey was to validate the geographic positions of the structures using handheld GPS devices, collect detailed information showing the characteristics, dimensions and conditions.

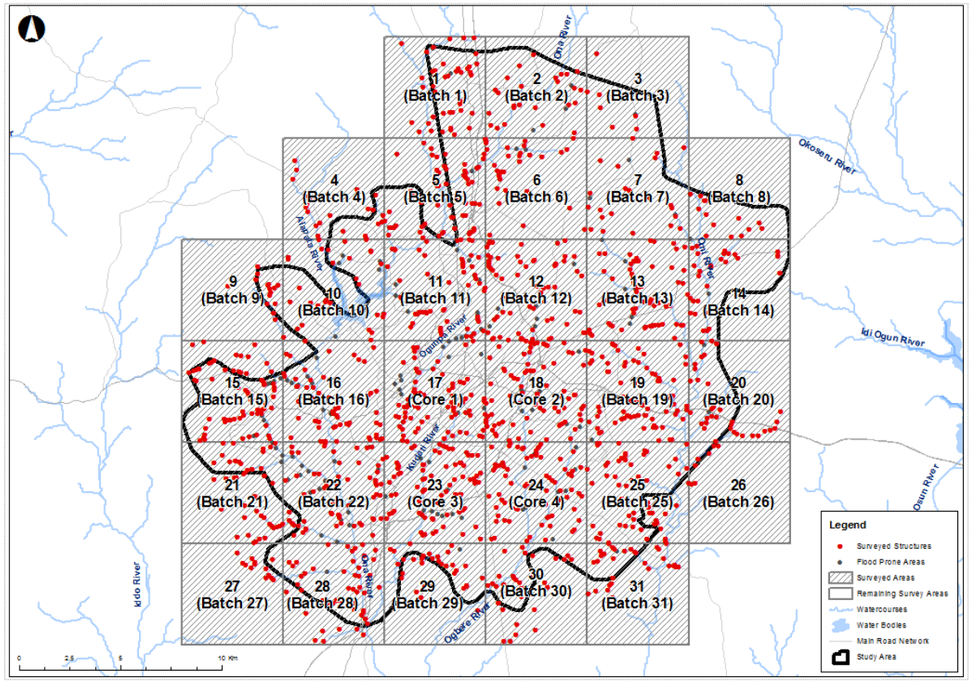

Figure 4-1: Surveyed Hydraulic Structures

4.1.2 Buildings Survey

A detailed buildings survey covering the buildings falling within the modelled flood plains of Ogbere, Agodi, Kudeti, Ogunpa and Orogun basins was carried out. The aim of this survey was to confirm the buildings digitized from the imagery, define their primary use such as Residential, Commercial, Governmental, Educational, Religious, etc., identify the number of floors and the main construction materials, specify the observed condition whether good, fair, poor or dilapidated and finally categorize the asset value (low, medium, high).

4.2 Survey Preparation

4.2.1 Survey Sheets

Series of survey maps and data collection forms were customized for each survey.

The maps covered the areas defined for the survey and included in addition to the main topical layers a background high resolution imagery, a reference key plan showing the distribution of the survey sheets, a legend describing the cartographic representation of the features shown on the maps, as well as, the main map elements such as the grid of coordinates, the north arrow and the scale bar.

Sample survey sheets are given in Figure 4-2 and Figure 4-3.

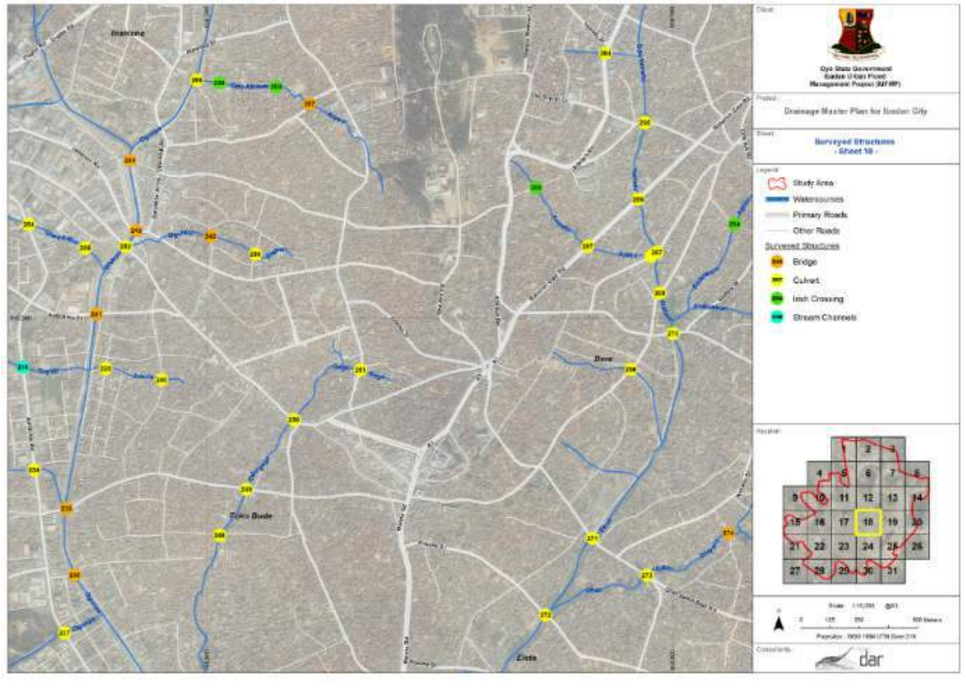

Figure 4-2: Structures Survey Sample Sheet

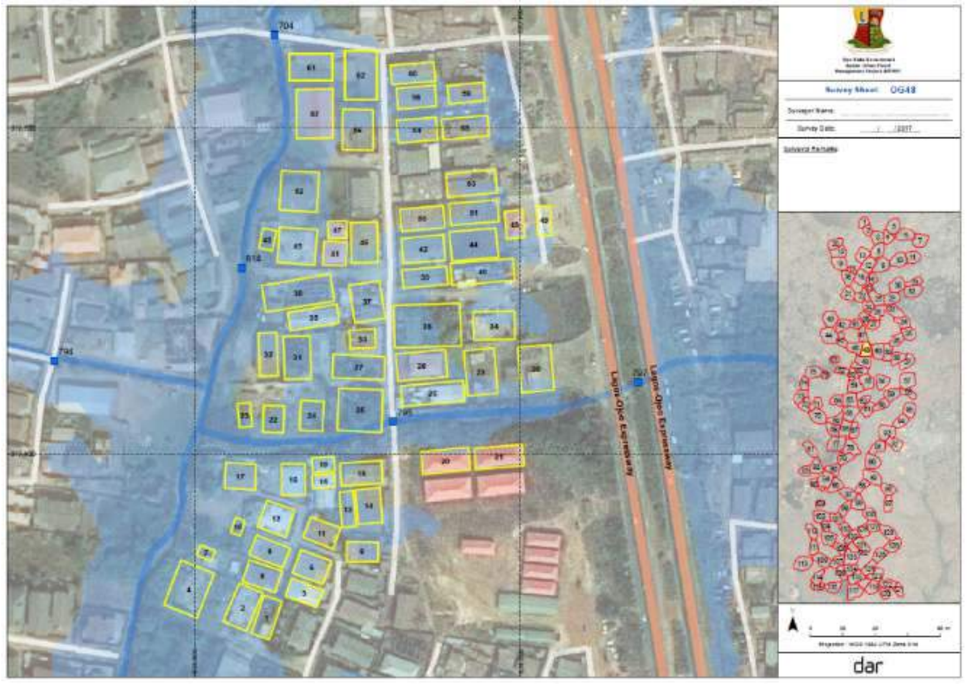

Figure 4-3: Buildings Survey Sample Sheet

4.2.2 Data Collection Forms

The data collection forms were customized with respect to the information to be collected in each survey. A main key field was implemented in both of the survey sheets and the forms to maintain the relationship between the surveyed features identified of the maps and the relevant information collected in the field. Samples of the data collection forms are given in Figure 4-4 and Figure 4-5. Refer also to Appendix B and C.

dar — Drainage Task For IBADAN

LEGEND : In Descriptions : S.C.= Stream Channels, D.C.= Drain Channels, Cv.= Culvert, Br.= Bridge, Ir.= Irish Crossing / In Conditions : G = Good, F = Fair, P = Poor, D = Depilated, E = Erosion / In Dimensions : NR = Number of Rings, DR = Diameter of Rings, N = number of cells, B = breadth of each cell, H = height of each cell, VD.RC. = Vertical Distance from Road Level to Culvert invert

BatchNo.	Points No.	Name Of The Location	Channel Name	Road Name	Descriptions					Conditions					Dimensions						UTM Coordinates WGS84	
					S.C.	D.C.	Cv.	Br.	Ir.	G	F	P	D	E	NR	DR	N	B	H	VD.RC.	Easting	Northing
6	536	Alapata	pata/aroro makinde bri	Alaafia road			Cv.			G					2	0.93				1.41	603468 m E	829432 m N
6	537	Arulogun		Arulogun					Ir.			P					1	6.8	1.5	0.5	603434 m E	829171 m N
6	538	Gospel Time Estate		Olomoyoyo			Cv.				F				1	0.8				1	602572 m E	829108 m N
6	539	Arulogun		Makinde		D.C.						P					2	0.7	0.65	0.65	602644 m E	828692 m N
6	540	Arulogun		Busari Street								P									602680 m E	828593 m N
6	541	sagbe	Sagbe river	omolasho area			Cv.			G					2	0.75				1.09	601531 m E	829417 m N
6	542	Sagbe	Sagbe river	omolasho area 2					Ir.			P					1	2.1	1.51	0.9	601557 m E	829317 m N
6	543	sagbe	Sagbe river	Sir Muibi Tiamiyu Road			Cv.					P					1	8.2	3.24	3.24	601561 m E	829020 m N
6	544	Aba Eko Ojoo		L.A. Adisa-Aba eko road			Cv.					P					1	2.4	1.94	2.25	601940 m E	828213 m N
6	545	Goodness Estate Ojoo		Jerusalem					Ir.			P					1	4.9	1.9	1.9	602069 m E	827935 m N
6	546	Ilupeju Community		Off Arulogun Road	S.C.							P					1	7.1	1.05	1.05	602169 m E	827733 m N
6	547	Ilupeju Community		Off Arulogun Road	S.C.							P					1	4	1.2	1.2	602164 m E	827694 m N
6	548	Arulogun		Arulogun Road			Cv.					P			1	1.2				1.97	602090 m E	827098 m N

Figure 4-4: Data Collection Sample Form for Hydraulic Structures Survey

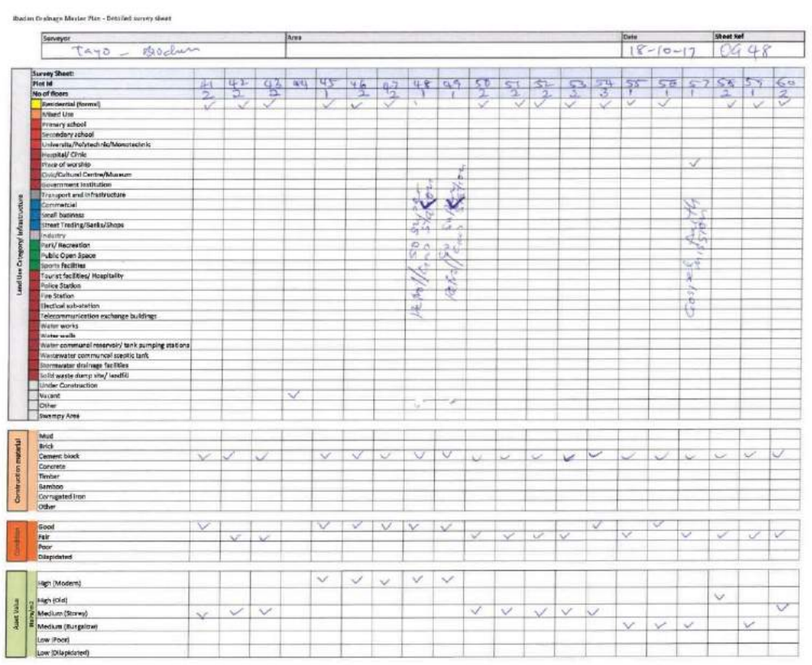

Figure 4-5: Data Collection Sample Form for Buildings Survey

4.3 Survey and Data Collection

The surveys were planned, scheduled and conducted based on the project's schedule and defined survey extent.

Qualified surveyors were assembled in teams and were trained to collect the required survey information. Each team was equipped by hardcopy survey sheets, data collection forms and a handheld GPS device.

A pilot survey was conducted at the beginning of each survey to validate the survey's methodology and ensure that the collected information meet the requirements.

The survey methodology comprised of using the maps as references for pinpointing the features to be surveyed, as well as, for marking the new features or any modifications observed onsite. As for the data collection forms, the methodology comprised of collating information from the site and hand-logging them on the forms. Each feature shown on the survey sheets has a unique identification Id used as a reference key to link the features to the information written on the forms.

The data collected as part of the Hydraulic Structures Survey comprised of identifying the geographic positions of the structures using GPS, collecting detailed information related to their status, condition, dimensions including the number of rings, diameter of rings, number of cells, breadth of each cell, height of each cell and vertical distance from the road level to the invert level of the culvert.

As for the data collected as part of the Buildings Survey, it comprises of defining the primary use of each surveyed building such as Residential, Commercial, Governmental, Educational, Religious, etc., identifying their number of floors, main construction materials, specify the observed condition whether good, fair, poor or dilapidated and finally categorize the asset value (low, medium, high).

4.4 Data Integration

The integration of the survey results into GIS leaned on amending the GIS layers with the corrections hand-written by the surveyors on the maps. The data collection forms were logged in digital forms, linked to their relative features and integrated into the GIS database.

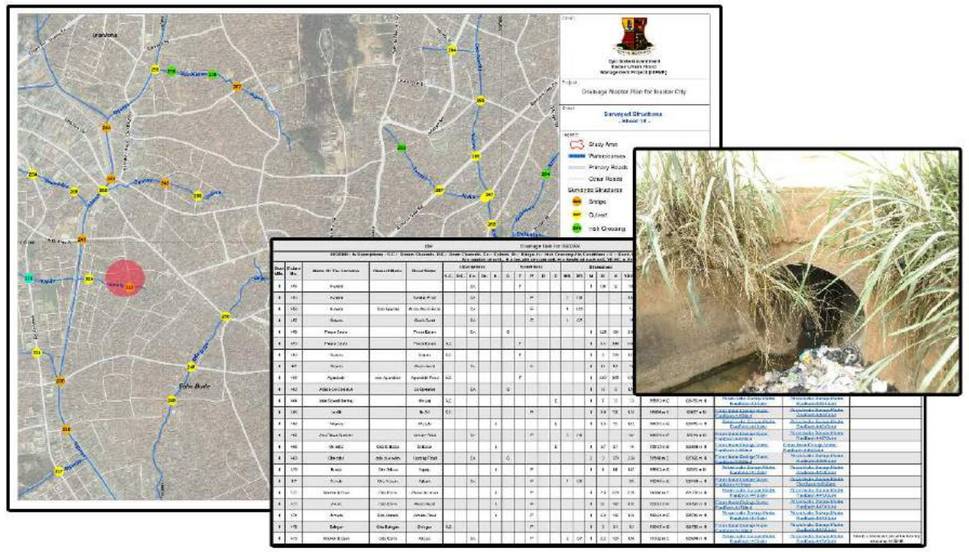

Figure 4-6: Sample of the Integrated Data

4.5 Data Validation

Assessments procedures were set to validate the collated data. The procedure comprised of checking the geographic location of surveyed features versus the satellite imagery.

Yet, the procedure also comprised of checking the consistency of the information. For example, if a structure is identified as a culvert, then the collated information should include the number of cells, breadth of each cell, height of each cell and vertical distance from the road level to the invert level of the culvert, or the collated information should include the number and diameter of rings. If a structure is identified as a bridge, then the collated information should include the number of vents, breadth of each span, height of each vent and vertical distance from the road level to the invert level of the bridge.

Same exercise was done for buildings. If the building is under construction, then the condition of the building cannot be defined.

5 Data Presentation

5.1 Layout Frame

Cartography is the main aspect of presenting data. It builds on the premise that reality can be modelled in ways that communicate spatial information effectively.

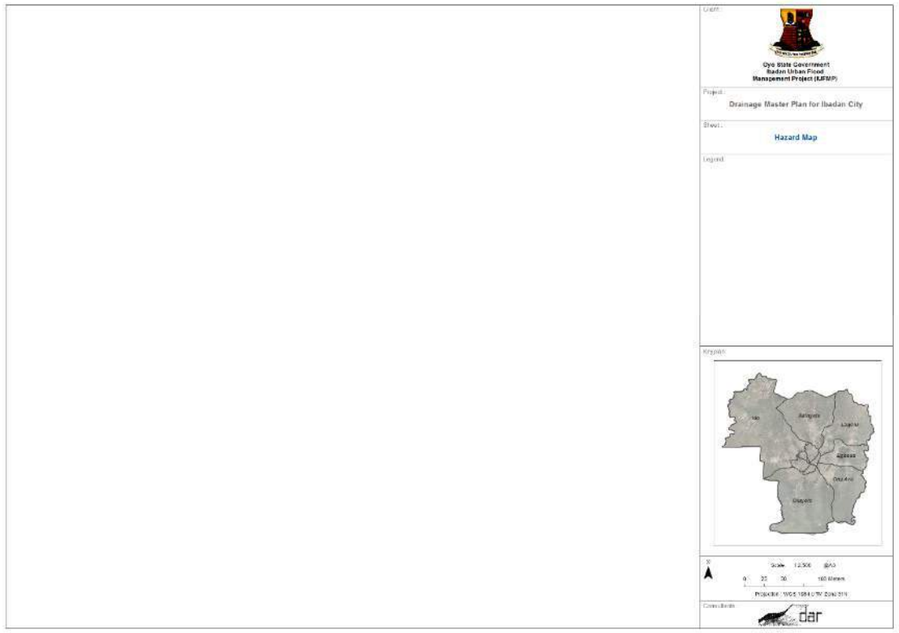

Figure 5-1: Layout Frame

A map Layout frame has been customized for the project in order to present the data in an efficient way. The main aspect of the layout is what you see on the layout is what you get if you print or export the map.

As shown in Figure 5-1, the frame consists of a section for the map and another section for the graphical elements where the logos, the project title, the scale bar, the north arrow, the map title, the index (when applicable) and the legend are presented.

5.2 Thematic Mapping

Based on the prepared Layout frame, thematic maps were prepared. The aim was to present the collected geographic information, the outcomes of the surveys, statistics, and complex analyses applied on the acquired layers in an efficient and readable way. Samples are presented in Figure 5-2.

In the case of surveys, maps were generated as mapbooks or catalogues of maps as described previously (Section 4.2).

5.2.1 Flood Extent Maps

Flood maps are prepared with a scale of 1:5000 and copied to the geodatabase of the project. Table 5-1 lists the name of each file. A sample of this sheet is shown in Figure 5-2.

Table 5-1: List of extent maps in the softcopy database

	File Name	No. of Maps
1	Ona Flood Extent Existing Condition.pdf	246
2	Ogunpa Flood Extent Existing Condition.pdf	47
3	Ogbere Flood Extent Existing Condition.pdf	64
4	Omi Flood Extent Existing Condition.pdf	117

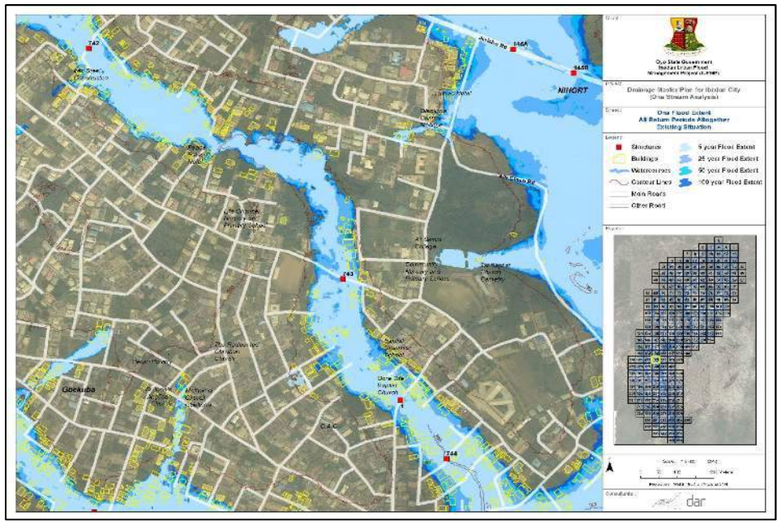

Figure 5-2: Flood Extent Maps for Different Return Periods

5.2.2 Flood Depth Maps

Flood depth maps are prepared with a scale of 1:5000 and copied to the geodatabase of the project. Table 5-2 lists the name of each file. An sample is shown in Figure 5-3.

Table 5-2: List of depth maps in the softcopy database

	File Name	No. of Maps
1	Ona Flood Depth (5-yrs Return Period) Existing Condition.pdf	246
2	Ona Flood Depth (25-yrs Return Period) Existing Condition.pdf	246
3	Ona Flood Depth (50-yrs Return Period) Existing Condition.pdf	246
4	Ona Flood Depth (100-yrs Return Period) Existing Condition.pdf	246
5	Ogunpa Flood Depth (5-yrs Return Period) Existing Condition.pdf	47
6	Ogunpa Flood Depth (25-yrs Return Period) Existing Condition.pdf	47
7	Ogunpa Flood Depth (50-yrs Return Period) Existing Condition.pdf	47
8	Ogunpa Flood Depth (100-yrs Return Period) Existing Condition.pdf	47
9	Ogbere Flood Depth (5-yrs Return Period) Existing Condition.pdf	64
10	Ogbere Flood Depth (25-yrs Return Period) Existing Condition.pdf	64
11	Ogbere Flood Depth (50-yrs Return Period) Existing Condition.pdf	64
12	Ogbere Flood Depth (100-yrs Return Period) Existing Condition.pdf	64
13	Omi Flood Depth (5-yrs Return Period) Existing Condition.pdf	117
14	Omi Flood Depth (25-yrs Return Period) Existing Condition.pdf	117
15	Omi Flood Depth (50-yrs Return Period) Existing Condition.pdf	117
16	Omi Flood Depth (100-yrs Return Period) Existing Condition.pdf	117

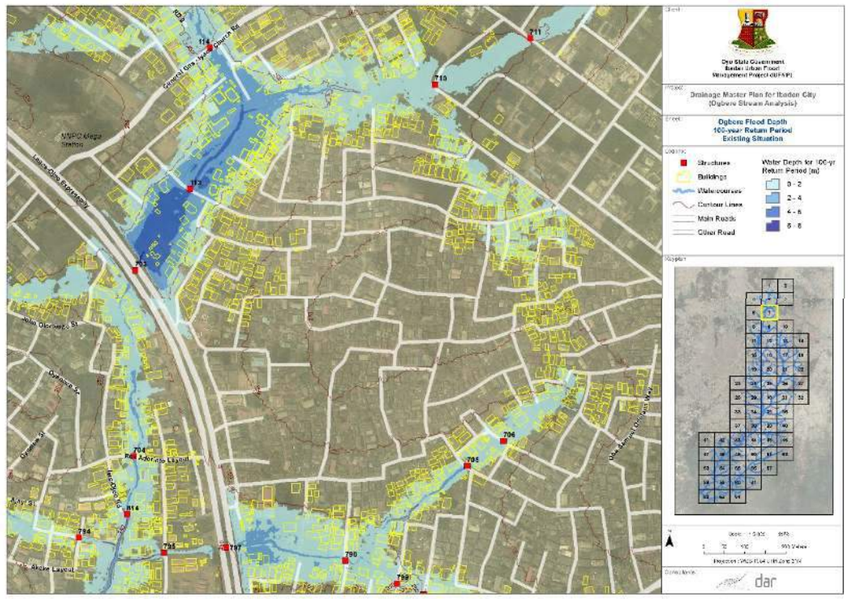

Figure 5-3: Sample of Flood Depth Maps, Upper Ogbere

5.2.3 Flood Velocity Maps

Flood maps are prepared with a scale of 1:5000 and copied to the geodatabase of the project. Table 5-3 lists the name of each file. A sample is shown in Figure 5-4.

Table 5-3: List of velocity maps in the softcopy database

	File Name	No. of Maps
1	Ona Flood Velocity (5-yrs Return Period) Existing Condition.pdf	246
2	Ona Flood Velocity (25-yrs Return Period) Existing Condition.pdf	246
3	Ona Flood Velocity (50-yrs Return Period) Existing Condition.pdf	246
4	Ona Flood Velocity (100-yrs Return Period) Existing Condition.pdf	246
5	Ogunpa Flood Velocity (5-yrs Return Period) Existing Condition.pdf	47
6	Ogunpa Flood Velocity (25-yrs Return Period) Existing Condition.pdf	47
7	Ogunpa Flood Velocity (50-yrs Return Period) Existing Condition.pdf	47
8	Ogunpa Flood Velocity (100-yrs Return Period) Existing Condition.pdf	47
9	Ogbere Flood Velocity (5-yrs Return Period) Existing Condition.pdf	64
10	Ogbere Flood Velocity (25-yrs Return Period) Existing Condition.pdf	64
11	Ogbere Flood Velocity (50-yrs Return Period) Existing Condition.pdf	64
12	Ogbere Flood Velocity (100-yrs Return Period) Existing Condition.pdf	64
13	Omi Flood Velocity (5-yrs Return Period) Existing Condition.pdf	117
14	Omi Flood Velocity (25-yrs Return Period) Existing Condition.pdf	117
15	Omi Flood Velocity (50-yrs Return Period) Existing Condition.pdf	117
16	Omi Flood Velocity (100-yrs Return Period) Existing Condition.pdf	117

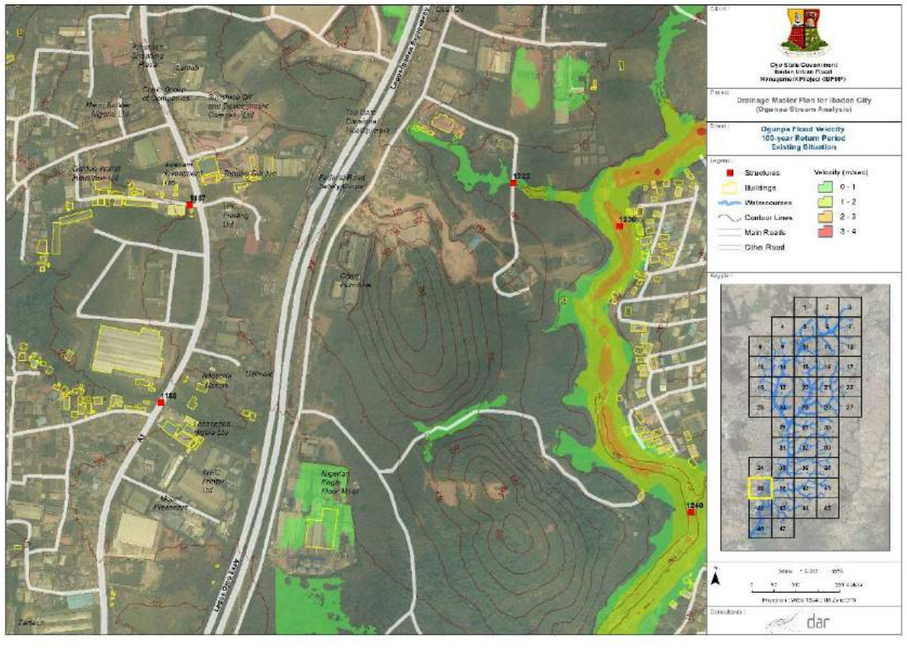

Figure 5-4: Sample of Flood Velocity Maps, Lower Ogunpa

5.3 Flood Hazard/Risk Maps

Flood hazard/risk maps are prepared with a scale of 1:5000 and copied to the geodatabase of the project. Table 5-4 lists the name of each file, a sample for these maps is shown in Figure 5-5.

Table 5-4: List of hazard maps in the softcopy database

	File Name	No. of Maps
1	Ona Flood Hazard (5-yrs Return Period) Existing Condition.pdf	246
2	Ona Flood Hazard (25-yrs Return Period) Existing Condition.pdf	246
3	Ona Flood Hazard (50-yrs Return Period) Existing Condition.pdf	246
4	Ona Flood Hazard (100-yrs Return Period) Existing Condition.pdf	246
5	Ogunpa Flood Hazard (5-yrs Return Period) Existing Condition.pdf	47
6	Ogunpa Flood Hazard (25-yrs Return Period) Existing Condition.pdf	47
7	Ogunpa Flood Hazard (50-yrs Return Period) Existing Condition.pdf	47
8	Ogunpa Flood Hazard (100-yrs Return Period) Existing Condition.pdf	47
9	Ogbere Flood Hazard (5-yrs Return Period) Existing Condition.pdf	64
10	Ogbere Flood Hazard (25-yrs Return Period) Existing Condition.pdf	64
11	Ogbere Flood Hazard (50-yrs Return Period) Existing Condition.pdf	64
12	Ogbere Flood Hazard (100-yrs Return Period) Existing Condition.pdf	64
13	Omi Flood Hazard (5-yrs Return Period) Existing Condition.pdf	117
14	Omi Flood Hazard (25-yrs Return Period) Existing Condition.pdf	117
15	Omi Flood Hazard (50-yrs Return Period) Existing Condition.pdf	117
16	Omi Flood Hazard (100-yrs Return Period) Existing Condition.pdf	117

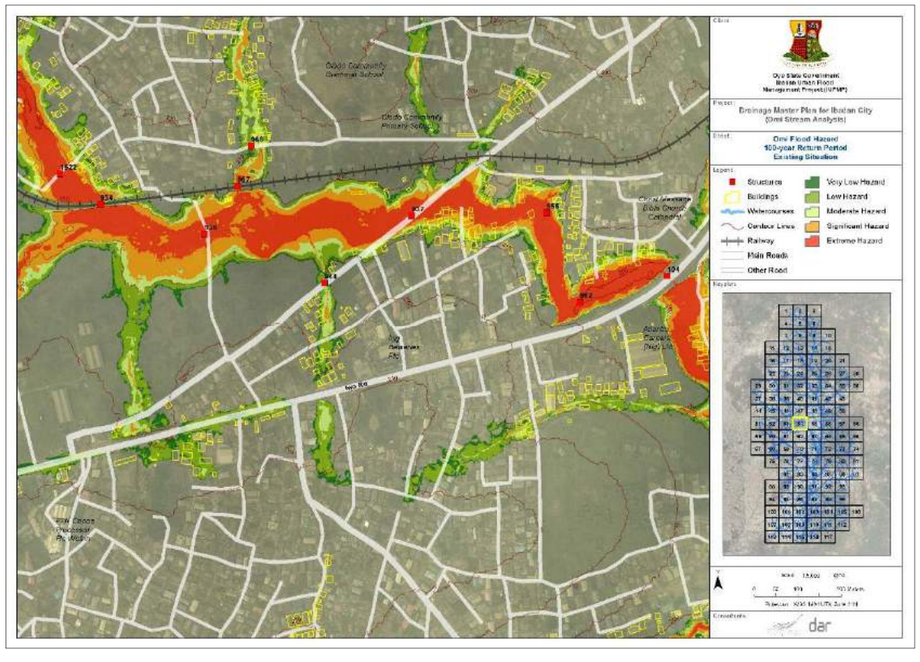

Figure 5-5: Sample of Flood Hazard/Risk Maps

APPENDICES

Appendix A: Database Inventory

Dataset	Feature Class	Geometry	Layer Description	Field Name	Field Type	Field Length	Field Description
Administrative	Administrative Cities	Point	This layer represents the location of the main administrative cities	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
				Name	String	255	This field represents the name of the feature in English
				Location	String	50	This field represents the location of the feature
	Administrative Country	Polygon	This layer represents the first administrative boundary of Nigeria	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
				Name	String	255	This field represents the name of the feature in English
	Administrative Ibadan District	Polygon	This layer represents the administrative boundary of Ibadan	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
				Name	String	255	This field represents the name of the feature in English
	Administrative LGAs	Polygon	This layer represents the local government boundaries of Ibadan	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
				Name	String	50	This field represents the name of the feature in English
	Administrative LGAs Original	Polygon	This layer represents the local government boundaries of Ibadan as received from the Surveyor General Office	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
				Name	String	50	This field represents the name of the feature in English
	Administrative Localities	Point	This layer represents the location of the administrative localities in Ibadan	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
				Name	String	255	This field represents the name of the feature in English
				Class	String	50	This field represents the class of the localities
	Landmarks	Point	This layer represents the location of the main landmarks in Ibadan	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
				Name	String	80	This field represents the name of the feature in English
				Category	String	64	This field represents the category of the features in English
Building Survey	Buildings Footprint	Polygon	This layer represents the footprint of the digitized buildings from the aerial imagery	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
				BLDG ID	Integer	4	This field represents the unique numbers assigned to the buildings
				Sheet	String	255	This field represents the unique numbers assigned to the survey sheets
				Catchment	String	50	This field represents the name of the catchment in English
				ID	String	50	This field represents the combination of the unique number assigned to the survey sheets and the unique number assigned to the buildings

Dataset	Feature Class	Geometry	Layer Description	Field Name	Field Type	Field Length	Field Description
				Landuse	String	254	This field represents the main use of the building identified by the surveyors during the survey
				Material	String	254	This field represents the construction material identified by the surveyors during the survey
				Condition	String	254	This field represents the condition of the building identified by the surveyors during the survey
				Floors	Integer	4	This field represents the number of floors identified by the surveyors during the survey
				Asset Value	String	254	This field represents the value of the building identified by the surveyors during the survey
				Remarks	String	254	This field represents the remarks mentioned by the surveyors during the survey
				Asset Value Factor	Integer	4	This field represents the asset factor defined by the modeller based on the identified asset value
				Asset Value USD	Integer	4	This field represents the value of the building in United States Dollar
				Sub-Basin ID	String	50	This field represents the ID of the sub-basin where the building is located
				KeyField	String	255	This field represents the unique numbers assigned to the buildings and the sub-basin
				Rate	Integer	4	This field represents the multiplication of the asset value factor by the number of floors
				Area Rate	Integer	4	This field represents the rounded area of the building in sq.m used for the calculation of the buildings rate
				New Value	Integer	4	This field represents the new calculated value of the building in United States Dollar based on the multiplication of the asset value factor by the number of floors by the Area Rate
				New Value Rounded	Integer	4	This field represents the rounded new value of the building in United States Dollar
				X	Double	8	This field represents the X coordinates of the centroid of the building
				Y	Double	8	This field represents the Y coordinates of the centroid of the building
Hydrology	Basins	Polygon	This layer represents the footprint of the main basins	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
				Name	String	50	This field represents the name of the basin in English
	SubBasins	Polygon	This layer represents the footprint of the sub-basins	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
				Name	String	50	This field represents the name of the sub-basin in English
				Area Km²	String	50	This field represents the area of the sub-basin in Km²
				Index	String	50	This field represents the unique Model Id assigned to the sub-basins
	Water Bodies	Polygon	This layer represents the location of the water bodies in Ibadan	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				SHAPE	Geometry	0	This field represents the type of the geometry
				Type	String	255	This field represents the type of the water bodies
				Name	String	255	This field represents the name of the feature in English
	Watercourses	Polyline	This layer represents the alignment of the watercourses in Ibadan	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.

Dataset	Feature Class	Geometry	Layer Description	Field Name	Field Type	Field Length	Field Description
				Shape	Geometry	0	This field represents the type of the geometry
				Level	String	50	This field represents the level of the watercourses
				Name	String	255	This field represents the name of the feature in English
				Source	String	50	This field represents the source of the features whether delineated from the LiDAR survey or mapped from the satellite imagery/SRTM
	Flood Plain	Polygon	This layer represents the flood plains 100yr extent for the existing situation	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
	Proposed Junctions	Point	This layer represents the location of junctions to distinguish between the identies of adjacent systems	FID	OID	0	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
				ID	Integer	4	This field represents the unique number assigned to the junction
				Junction	String	20	This field represents the unique ID. It has a similar to the number ID of its upstream system
	Proposed System Naming 5k	Polyline	This layer represents the proposed system naming of 5k streams	FID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
				Length Km	Float	0	This field represents the length of the proposed system in Km
				System	Integer	4	This field represents the unique number assigned by the Model to the system
				Name	String	50	This field represents the name of the related basin
				Index	String	50	This field represents the unique Model Id assigned to the sub-basins
	Drainage Categories Connected Streams	Polyline	This layer represents the connected drainage streams disributed in categories according to a specified watershed threshold. The streams are generated from the LiDAR delineation	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
				Category	String	50	This field represents the category according to a specified wateshed threshold
	Drainage Categories Separated Streams	Polyline	This layer represents the separated drainage streams disributed in categories according to a specified watershed threshold. The streams are generated from the LiDAR delineation	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
				Category	String	50	This field represents the category according to a specified wateshed threshold
	Ponds	Polygon	This layer representts the footprint of the existing pond areas	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the the type of geometry
	Catchments Structures	Polygon	This layer represents the watersheds of the existing crossing structures	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the the type of geometry
				Shape Area	Double	8	This field represents the area of the watershed of the crossing structure
				Name	String	50	This field represents the ID of the Crossing structure
Flood Risk Analysis	Flood Extent	Polygon	This layer represents the flood extent with different return periods (100, 50, 25 and 5 yrs)	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
				Return Period	String	50	This field represents the return period of the flood extent
				Rule ID	Integer	4	This field is a system field created by the software to maintain the proper representation of the features

Dataset	Feature Class	Geometry	Layer Description	Field Name	Field Type	Field Length	Field Description
	Flood Extent After Intervention	Polygon	This layer represents the flood extent after interventions with different return periods (100, 50, 25 and 5 yrs)	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
				Return Period	String	50	This field represents the return period of the flood extent after interventions
				Rule ID	Integer	4	This field is a system field created by the software to maintain the proper representation of the features
	Buildings Exposed to Hazard	Polygon	This layer represents the density of the buildings that are exposed to moderate hazard areas	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
				Density	Float	0	This field represents the density of buildings exposed to moderate hazard areas
				Basin	String	50	This field represents the name of the related basin
				Rule ID	Integer	4	This field is a system field created by the software to maintain the proper representation of the features
	Catchment Buildings Ogunpa	Polygon	This layer shows losses of the buildings in Ogunpa catchment for different return periods in the Existing Situation	Depth5yr	Double	8	This field represents the flood depth at the centroid of the building for the 5years return period
				Damage5yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 5years return period
				Loss5yr	Double	8	This field represents the losses of the building for the 5years return period
				Depth25yr	Double	8	This field represents the flood depth at the centroid of the building for the 25years return period
				Damage25yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 25years return period
				Loss25yr	Double	8	This field represents the losses of the building for the 25years return period
				Depth50yr	Double	8	This field represents the flood depth at the centroid of the building for the 50years return period
				Damage50yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 50years return period
				Loss50yr	Double	8	This field represents the losses of the building for the 50years return period
				Depth100yr	Double	8	This field represents the flood depth at the centroid of the building for the 100years return period
				Damage100yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 100years return period
				Loss100yr	Double	8	This field represents the losses of the building for the 100years return period
	Catchment Buildings Omi	Polygon	This layer shows losses of the buildings in Omi catchment for different return periods in the Existing Situation	Depth5yr	Double	8	This field represents the flood depth at the centroid of the building for the 5years return period
				Damage5yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 5years return period
				Loss5yr	Double	8	This field represents the losses of the building for the 5years return period
				Depth25yr	Double	8	This field represents the flood depth at the centroid of the building for the 25years return period
				Damage25yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 25years return period
				Loss25yr	Double	8	This field represents the losses of the building for the 25years return period

Dataset	Feature Class	Geometry	Layer Description	Field Name	Field Type	Field Length	Field Description
				Depth50yr	Double	8	This field represents the flood depth at the centroid of the building for the 50years return period
				Damage50yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 50years return period
				Loss50yr	Double	8	This field represents the losses of the building for the 50years return period
				Depth100yr	Double	8	This field represents the flood depth at the centroid of the building for the 100years return period
				Damage100yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 100years return period
				Loss100yr	Double	8	This field represents the losses of the building for the 100years return period
	Agodi channel Ex buildings Loss	Polygon	This layer shows losses of the buildings in Agodi Channel for different return periods in the Existing Situation	Depth5yr	Double	8	This field represents the flood depth at the centroid of the building for the 5years return period
				Damage5yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 5years return period
				Loss5yr	Double	8	This field represents the losses of the building for the 5years return period
				Depth25yr	Double	8	This field represents the flood depth at the centroid of the building for the 25years return period
				Damage25yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 25years return period
				Loss25yr	Double	8	This field represents the losses of the building for the 25years return period
				Depth50yr	Double	8	This field represents the flood depth at the centroid of the building for the 50years return period
				Damage50yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 50years return period
				Loss50yr	Double	8	This field represents the losses of the building for the 50years return period
				Depth100yr	Double	8	This field represents the flood depth at the centroid of the building for the 100years return period
				Damage100yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 100years return period
				Loss100yr	Double	8	This field represents the losses of the building for the 100years return period
	Agodi channel Ch buildings Loss	Polygon	This layer shows losses of the buildings in Agodi Channel for different return periods after interventions	Depth5yr	Double	8	This field represents the flood depth at the centroid of the building for the 5years return period
				Damage5yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 5years return period
				Loss5yr	Double	8	This field represents the losses of the building for the 5years return period
				Depth25yr	Double	8	This field represents the flood depth at the centroid of the building for the 25years return period
				Damage25r	Double	8	This field represents the damage factor of the building for the corresponding depth in the 25years return period
				Loss25yr	Double	8	This field represents the losses of the building for the 25years return period
				Depth50yr	Double	8	This field represents the flood depth at the centroid of the building for the 50years return period
				Damage50yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 50years return period

Dataset	Feature Class	Geometry	Layer Description	Field Name	Field Type	Field Length	Field Description
				Loss50yr	Double	8	This field represents the losses of the building for the 50years return period
				Depth100yr	Double	8	This field represents the flood depth at the centroid of the building for the 100years return period
				Damage100yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 100years return period
				Loss100yr	Double	8	This field represents the losses of the building for the 100years return period
	Kudeti channel Ex buildings Loss	Polygon	This layer shows losses of the buildings in Kudeti Channel for different return periods in the Existing Situation	Depth5yr	Double	8	This field represents the flood depth at the centroid of the building for the 5years return period
				Damage5yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 5years return period
				Loss5yr	Double	8	This field represents the losses of the building for the 5years return period
				Depth25yr	Double	8	This field represents the flood depth at the centroid of the building for the 25years return period
				Damage25r	Double	8	This field represents the damage factor of the building for the corresponding depth in the 25years return period
				Loss25yr	Double	8	This field represents the losses of the building for the 25years return period
				Depth50yr	Double	8	This field represents the flood depth at the centroid of the building for the 50years return period
				Damage50yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 50years return period
				Loss50yr	Double	8	This field represents the losses of the building for the 50years return period
				Depth100yr	Double	8	This field represents the flood depth at the centroid of the building for the 100years return period
				Damage100yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 100years return period
				Loss100yr	Double	8	This field represents the losses of the building for the 100years return period
	Kudeti channel Ch buildings Loss	Polygon	This layer shows losses of the buildings in Kudeti Channel for different return periods after interventions	Depth5yr	Double	8	This field represents the flood depth at the centroid of the building for the 5years return period
				Damage5yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 5years return period
				Loss5yr	Double	8	This field represents the losses of the building for the 5years return period
				Depth25yr	Double	8	This field represents the flood depth at the centroid of the building for the 25years return period
				Damage25r	Double	8	This field represents the damage factor of the building for the corresponding depth in the 25years return period
				Loss25yr	Double	8	This field represents the losses of the building for the 25years return period
				Depth50yr	Double	8	This field represents the flood depth at the centroid of the building for the 50years return period
				Damage50yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 50years return period
				Loss50yr	Double	8	This field represents the losses of the building for the 50years return period
				Depth100yr	Double	8	This field represents the flood depth at the centroid of the building for the 100years return period

Dataset	Feature Class	Geometry	Layer Description	Field Name	Field Type	Field Length	Field Description
				Damage100yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 100years return period
				Loss100yr	Double	8	This field represents the losses of the building for the 100years return period
	Catchment Buildings Ogbere	Polygon	This layer shows losses of the buildings in Ogbere catchment for different return periods in the Existing Situation	Depth5yr	Double	8	This field represents the flood depth at the centroid of the building for the 5years return period
				Damage5yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 5years return period
				Loss5yr	Double	8	This field represents the losses of the building for the 5years return period
				Depth25yr	Double	8	This field represents the flood depth at the centroid of the building for the 25years return period
				Damage25yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 25years return period
				Loss25yr	Double	8	This field represents the losses of the building for the 25years return period
				Depth50yr	Double	8	This field represents the flood depth at the centroid of the building for the 50years return period
				Damage50yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 50years return period
				Loss50yr	Double	8	This field represents the losses of the building for the 50years return period
				Depth100yr	Double	8	This field represents the flood depth at the centroid of the building for the 100years return period
				Damage100yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 100years return period
				Loss100yr	Double	8	This field represents the losses of the building for the 100years return period
	Ogbere channel Ex buildings Loss	Polygon	This layer shows losses of the buildings in Ogbere Channel for different return periods in the Existing Situation	Depth5yr	Double	8	This field represents the flood depth at the centroid of the building for the 5years return period
				Damage5yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 5years return period
				Loss5yr	Double	8	This field represents the losses of the building for the 5years return period
				Depth25yr	Double	8	This field represents the flood depth at the centroid of the building for the 25years return period
				Damage25r	Double	8	This field represents the damage factor of the building for the corresponding depth in the 25years return period
				Loss25yr	Double	8	This field represents the losses of the building for the 25years return period
				Depth50yr	Double	8	This field represents the flood depth at the centroid of the building for the 50years return period
				Damage50yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 50years return period
				Loss50yr	Double	8	This field represents the losses of the building for the 50years return period
				Depth100yr	Double	8	This field represents the flood depth at the centroid of the building for the 100years return period
				Damage100yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 100years return period
				Loss100yr	Double	8	This field represents the losses of the building for the 100years return period

Dataset	Feature Class	Geometry	Layer Description	Field Name	Field Type	Field Length	Field Description
	Ogbere channel Ch buildings Loss	Polygon	This layer shows losses of the buildings in Ogbere Channel for different return periods after interventions	Depth5yr	Double	8	This field represents the flood depth at the centroid of the building for the 5years return period
				Damage5yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 5years return period
				Loss5yr	Double	8	This field represents the losses of the building for the 5years return period
				Depth25yr	Double	8	This field represents the flood depth at the centroid of the building for the 25years return period
				Damage25r	Double	8	This field represents the damage factor of the building for the corresponding depth in the 25years return period
				Loss25yr	Double	8	This field represents the losses of the building for the 25years return period
				Depth50yr	Double	8	This field represents the flood depth at the centroid of the building for the 50years return period
				Damage50yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 50years return period
				Loss50yr	Double	8	This field represents the losses of the building for the 50years return period
				Depth100yr	Double	8	This field represents the flood depth at the centroid of the building for the 100years return period
				Damage100yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 100years return period
				Loss100yr	Double	8	This field represents the losses of the building for the 100years return period
	Catchment Buildings Ona	Polygon	This layer shows losses of the buildings in Ona catchment for different return periods in the Existing Situation	Depth5yr	Double	8	This field represents the flood depth at the centroid of the building for the 5years return period
				Damage5yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 5years return period
				Loss5yr	Double	8	This field represents the losses of the building for the 5years return period
				Depth25yr	Double	8	This field represents the flood depth at the centroid of the building for the 25years return period
				Damage25r	Double	8	This field represents the damage factor of the building for the corresponding depth in the 25years return period
				Loss25yr	Double	8	This field represents the losses of the building for the 25years return period
				Depth50yr	Double	8	This field represents the flood depth at the centroid of the building for the 50years return period
				Damage50yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 50years return period
				Loss50yr	Double	8	This field represents the losses of the building for the 50years return period
				Depth100yr	Double	8	This field represents the flood depth at the centroid of the building for the 100years return period
				Damage100yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 100years return period
				Loss100yr	Double	8	This field represents the losses of the building for the 100years return period
	Ona1 channel Ex buildings Loss	Polygon	This layer shows losses of the buildings in Ona1 Channel for different return periods in the Existing Situation	Depth5yr	Double	8	This field represents the flood depth at the centroid of the building for the 5years return period
				Damage5yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 5years return period

Dataset	Feature Class	Geometry	Layer Description	Field Name	Field Type	Field Length	Field Description
				Loss5yr	Double	8	This field represents the losses of the building for the 5years return period
				Depth25yr	Double	8	This field represents the flood depth at the centroid of the building for the 25years return period
				Damage25r	Double	8	This field represents the damage factor of the building for the corresponding depth in the 25years return period
				Loss25yr	Double	8	This field represents the losses of the building for the 25years return period
				Depth50yr	Double	8	This field represents the flood depth at the centroid of the building for the 50years return period
				Damage50yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 50years return period
				Loss50yr	Double	8	This field represents the losses of the building for the 50years return period
				Depth100yr	Double	8	This field represents the flood depth at the centroid of the building for the 100years return period
				Damage100yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 100years return period
				Loss100yr	Double	8	This field represents the losses of the building for the 100years return period
	Ona1 channel Ch buildings Loss	Polygon	This layer shows losses of the buildings in Ona1 Channel for different return periods after interventions	Depth5yr	Double	8	This field represents the flood depth at the centroid of the building for the 5years return period
				Damage5yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 5years return period
				Loss5yr	Double	8	This field represents the losses of the building for the 5years return period
				Depth25yr	Double	8	This field represents the flood depth at the centroid of the building for the 25years return period
				Damage25r	Double	8	This field represents the damage factor of the building for the corresponding depth in the 25years return period
				Loss25yr	Double	8	This field represents the losses of the building for the 25years return period
				Depth50yr	Double	8	This field represents the flood depth at the centroid of the building for the 50years return period
				Damage50yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 50years return period
				Loss50yr	Double	8	This field represents the losses of the building for the 50years return period
				Depth100yr	Double	8	This field represents the flood depth at the centroid of the building for the 100years return period
				Damage100yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 100years return period
				Loss100yr	Double	8	This field represents the losses of the building for the 100years return period
	Orogun channel Ex buildings Loss	Polygon	This layer shows losses of the buildings in Orogun Channel for different return periods in the Existing Situation	Depth5yr	Double	8	This field represents the flood depth at the centroid of the building for the 5years return period
				Damage5yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 5years return period
				Loss5yr	Double	8	This field represents the losses of the building for the 5years return period
				Depth25yr	Double	8	This field represents the flood depth at the centroid of the building for the 25years return period

Dataset	Feature Class	Geometry	Layer Description	Field Name	Field Type	Field Length	Field Description
				Damage25r	Double	8	This field represents the damage factor of the building for the corresponding depth in the 25years return period
				Loss25yr	Double	8	This field represents the losses of the building for the 25years return period
				Depth50yr	Double	8	This field represents the flood depth at the centroid of the building for the 50years return period
				Damage50yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 50years return period
				Loss50yr	Double	8	This field represents the losses of the building for the 50years return period
				Depth100yr	Double	8	This field represents the flood depth at the centroid of the building for the 100years return period
				Damage100yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 100years return period
				Loss100yr	Double	8	This field represents the losses of the building for the 100years return period
	Orogun channel Ch buildings Loss	Polygon	This layer shows losses of the buildings in Orogun Channel for different return periods after interventions	Depth5yr	Double	8	This field represents the flood depth at the centroid of the building for the 5years return period
				Damage5yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 5years return period
				Loss5yr	Double	8	This field represents the losses of the building for the 5years return period
				Depth25yr	Double	8	This field represents the flood depth at the centroid of the building for the 25years return period
				Damage25r	Double	8	This field represents the damage factor of the building for the corresponding depth in the 25years return period
				Loss25yr	Double	8	This field represents the losses of the building for the 25years return period
				Depth50yr	Double	8	This field represents the flood depth at the centroid of the building for the 50years return period
				Damage50yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 50years return period
				Loss50yr	Double	8	This field represents the losses of the building for the 50years return period
				Depth100yr	Double	8	This field represents the flood depth at the centroid of the building for the 100years return period
				Damage100yr	Double	8	This field represents the damage factor of the building for the corresponding depth in the 100years return period
				Loss100yr	Double	8	This field represents the losses of the building for the 100years return period
	Subbasins people losses	Polygon	This layer shows the injuries and deaths to people in each subbasin according to different return periods	Area km2	Double	8	This field represents the area in sq.km
				Name	String	50	This field represents the name
				Index	String	50	This field represents the index
				Injury 5yr	Double	8	This field represents the estimated injuries in the subbasin corresponding to a 5years return period in the existing situation
				Death 5yr	Double	8	This field represents the estimated deaths in the subbasin corresponding to a 5years return period in the existing situation
				Injury 25yr	Double	8	This field represents the estimated injuries in the subbasin corresponding to a 25years return period in the existing situation

Dataset	Feature Class	Geometry	Layer Description	Field Name	Field Type	Field Length	Field Description
				Death 25yr	Double	8	This field represents the estimated deaths in the subbasin corresponding to a 25years return period in the existing situation
				Injury 50yr	Double	8	This field represents the estimated injuries in the subbasin corresponding to a 50years return period in the existing situation
				Death 50yr	Double	8	This field represents the estimated deaths in the subbasin corresponding to a 50years return period in the existing situation
				Injury 100yr	Double	8	This field represents the estimated injuries in the subbasin corresponding to a 100years return period in the existing situation
				Death 100yr	Double	8	This field represents the estimated deaths in the subbasin corresponding to a 100years return period in the existing situation
	Channels People Losses	Polygon	This layer shows the injuries and deaths to people in each proposed channel before and after interventions and according to different return periods	Index	String	50	This field represents the index of the proposed channelization
				Ex Injury 5yr	Double	8	This field represents the estimated injuries corresponding to a 5years return period in the existing situation
				Ex Death 5yr	Double	8	This field represents the estimated deaths corresponding to a 5years return period in the existing situation
				Ex Injury 25yr	Double	8	This field represents the estimated injuries corresponding to a 25years return period in the existing situation
				Ex Death 25yr	Double	8	This field represents the estimated deaths corresponding to a 25years return period in the existing situation
				Ex Injury 50yr	Double	8	This field represents the estimated injuries corresponding to a 50years return period in the existing situation
				Ex Death 50yr	Double	8	This field represents the estimated deaths corresponding to a 50years return period in the existing situation
				Ex Injury 100yr	Double	8	This field represents the estimated injuries corresponding to a 100years return period in the existing situation
				Ex Death 100yr	Double	8	This field represents the estimated deaths corresponding to a 100years return period in the existing situation
				Ch Injury 5yr	Double	8	This field represents the estimated injuries corresponding to a 5years return period after interventions
				Ch Death 5yr	Double	8	This field represents the estimated deaths corresponding to a 5years return period after interventions
				Ch Injury 25yr	Double	8	This field represents the estimated injuries corresponding to a 25years return period after interventions
				Ch Death 25yr	Double	8	This field represents the estimated deaths corresponding to a 25years return period after interventions
				Ch Injury 50yr	Double	8	This field represents the estimated injuries corresponding to a 50years return period after interventions
				Ch Death 50yr	Double	8	This field represents the estimated deaths corresponding to a 50years return period after interventions
				Ch Injury 100yr	Double	8	This field represents the estimated injuries corresponding to a 100years return period after interventions
				Ch Death 100yr	Double	8	This field represents the estimated deaths corresponding to a 100years return period after interventions
Infrastructure	Existing Structures	Point	This layer represents the location of the surveyed structures along the main rivers and streams	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
				Road Name	String	255	This field represents the name of the road

Dataset	Feature Class	Geometry	Layer Description	Field Name	Field Type	Field Length	Field Description
				Type	String	255	This field represents the type of the structures
				Condition	String	255	This field represents the condition of the structures
				NR	Double	8	This field represents the number of rings
				DR	Double	8	This field represents the diameter of rings
				N	Double	8	This field represents the number of cells
				B	Double	8	This field represents the breadth of each cell
				H	Double	8	This field represents the height of each cell
				VD RC	Double	8	This field represents the vertical Distance from Road Level to Culvert invert
				Easting	Integer	4	This field represents the Easting coordinates of the structure
				Northing	Integer	4	This field represents the Northing coordinates of the structure
				Remarks	String	255	This field represents the remarks marked onsite by the surveyors
				Batch ID	String	50	This field represents the ID of the batch
				Structure	String	50	This field represents the ID of the structure
				Channel	String	255	This field represents the name of the channel
				Road Name	String	255	This field represents the name of the road
				Location	String	255	This field represents the name of the location
	Proposed Channels Priority Works	Polygon	This layer represents the designed channel corridors according to the priority works	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
				Name	String	50	This field represents the name of the designed channel
				Basin	String	50	This field represents the name of the related basin
	Proposed Dikes	Polyline	This layer represents the proposed dike axis based on the Ona RiverFlood Risk Reduction Report (Lot3)	FID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
				Length m	Float	0	This field represents the length of the proposed dike
	Lakes of Proposed Dikes	Polygon	This layer represents the lakes of the proposed dikes (Lot3) based on a 5m dike height	FID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
				Length m	Float	0	This field represents the area of the impounding reservoir
Landuse	Landuse	Polygon	This layer represents the distribution of land uses covering Ibadan	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
				Type	String	50	This field represents the type of land uses
	Landcover	Polygon	This layer represents the distribution of land covers covering Ibadan	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
				Type	String	50	This field represents the type of land covers
Study Area	Study Area	Polygon	This layer represents the boundary of the study area	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
				Name	String	254	This field represents the name of the feature in English
	Survey 1990 Extent	Polygon	This layer represents the extent of the survey dated 1990	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry

Dataset	Feature Class	Geometry	Layer Description	Field Name	Field Type	Field Length	Field Description
Terrestrial	Geology Structures	Polygon	This layer represents the classification of geology formations covering Ibadan	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
				Type	String	255	This field represents the type of the geology structures
				Label	String	20	This field represents the name of the geology structures to be used in the prepared of maps
	Soil Structures	Polygon	This layer represents the classification of soil formations covering Ibadan	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
				Type	String	50	This field represents the type of the soil structures
				Subtype	String	50	This field represents the subtype of the soil structures
				Label	String	50	This field represents the name of the soil structures to be used in the prepared of maps
Topography	Contours 50cm	Polyline	This layer represents the contour lines with interval 50 cm	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
				Elevation	Double	8	This field represents the elevation of the contour lines
Transportation	Airport	Point	This layer represents the location of the main airport in Ibadan	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				SHAPE	Geometry	0	This field represents the type of the geometry
				Name	String	255	This field represents the name of the feature in English
	Existing Railway Network	Polyline	This layer represents the alignment of the existing railway network crossing Ibadan	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
	Existing Railway Station	Point	This layer represents the location of the existing 2 railway stations in Ibadan	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				SHAPE	Geometry	0	This field represents the type of the geometry
				Name	String	255	This field represents the name of the feature in English
	Existing Road Network	Polyline	This layer represents the alignment and hierarchy of the existing road network in Ibadan	OBJECTID	OID	4	Sequential unique whole numbers that are automatically generated.
				Shape	Geometry	0	This field represents the type of the geometry
				Width	Integer	4	This field represents the width of the roads measured from the satellite imagery
				Corridor	Double	8	This field represents the width of the road corridors
				Level	String	255	This field represents the hierarchy of the roads
				Name	String	255	This field represents the name of the feature in English
	DEM	Raster	This layer represents the digital elevation model generated from the contours 50cm interval	-	-	-	-
	Depth 100yrs Ogbere	Raster	This raster represents the flood Depth in Ogbere basin for 100-yrs return period	-	-	-	-
	Depth 100yrs Ogunpa	Raster	This raster represents the flood Depth in Ogunpa basin for 100-yrs return period	-	-	-	-
	Depth 100yrs Omi	Raster	This raster represents the flood Depth in Omi basin for 100-yrs return period	-	-	-	-
	Depth 100yrs Ona	Raster	This raster represents the flood Depth in Ona basin for 100-yrs return period	-	-	-	-
	Depth 50yrs Ogbere	Raster	This raster represents the flood Depth in Ogbere basin for 50-yrs return period	-	-	-	-
	Depth 50yrs Ogunpa	Raster	This raster represents the flood Depth in Ogunpa basin for 50-yrs return period	-	-	-	-

Dataset	Feature Class	Geometry	Layer Description	Field Name	Field Type	Field Length	Field Description
	Depth 50yrs Omi	Raster	This raster represents the flood Depth in Omi basin for 50-yrs return period	-	-	-	-
	Depth 50yrs Ona	Raster	This raster represents the flood Depth in Ona basin for 50-yrs return period	-	-	-	-
	Depth 25yrs Ogbere	Raster	This raster represents the flood Depth in Ogbere basin for 25-yrs return period	-	-	-	-
	Depth 25yrs Ogunpa	Raster	This raster represents the flood Depth in Ogunpa basin for 25-yrs return period	-	-	-	-
	Depth 25yrs Omi	Raster	This raster represents the flood Depth in Omi basin for 25-yrs return period	-	-	-	-
	Depth 25yrs Ona	Raster	This raster represents the flood Depth in Ona basin for 25-yrs return period	-	-	-	-
	Depth 5yrs Ogbere	Raster	This raster represents the flood Depth in Ogbere basin for 5-yrs return period	-	-	-	-
	Depth 5yrs Ogunpa	Raster	This raster represents the flood Depth in Ogunpa basin for 5-yrs return period	-	-	-	-
	Depth 5yrs Omi	Raster	This raster represents the flood Depth in Omi basin for 5-yrs return period				
	Depth 5yrs Ona	Raster	This raster represents the flood Depth in Ona basin for 5-yrs return period				
	Depth 100yrs After Intervention Ogbere	Raster	This raster represents the flood Depth in Ogbere basin for 100-yrs return period after Interventions	-	-	-	-
	Depth 100yrs After Intervention Ogunpa	Raster	This raster represents the flood Depth in Ogunpa basin for 100-yrs return period after Interventions	-	-	-	-
	Depth 100yrs After Intervention Ona Ona1	Raster	This raster represents the flood Depth in Ona Ona1 basin for 100-yrs return period after Interventions	-	-	-	-
	Depth 100yrs After Intervention Ona Orogun	Raster	This raster represents the flood Depth in Ona Orogun basin for 100-yrs return period after Interventions	-	-	-	-
	Depth 50yrs After Intervention Ogbere	Raster	This raster represents the flood Depth in Ogbere basin for 50-yrs return period after Interventions	-	-	-	-
	Depth 50yrs After Intervention Ogunpa	Raster	This raster represents the flood Depth in Ogunpa basin for 50-yrs return period after Interventions	-	-	-	-
	Depth 50yrs After Intervention Ona Ona1	Raster	This raster represents the flood Depth in Ona Ona1 basin for 50-yrs return period after Interventions	-	-	-	-
	Depth 50yrs After Intervention Ona Orogun	Raster	This raster represents the flood Depth in Ona Orogun basin for 50-yrs return period after Interventions	-	-	-	-
	Depth 25yrs After Intervention Ogbere	Raster	This raster represents the flood Depth in Ogbere basin for 25-yrs return period after Interventions	-	-	-	-
	Depth 25yrs After Intervention Ogunpa	Raster	This raster represents the flood Depth in Ogunpa basin for 25-yrs return period after Interventions	-	-	-	-
	Depth 25yrs After Intervention Ona Ona1	Raster	This raster represents the flood Depth in Ona Ona1 basin for 25-yrs return period after Interventions	-	-	-	-
	Depth 25yrs After Intervention Ona Orogun	Raster	This raster represents the flood Depth in Ona Orogun basin for 25-yrs return period after Interventions	-	-	-	-
	Depth 5yrs After Intervention Ogbere	Raster	This raster represents the flood Depth in Ogbere basin for 5-yrs return period after Interventions	-	-	-	-
	Depth 5yrs After Intervention Ogunpa	Raster	This raster represents the flood Depth in Ogunpa basin for 5-yrs return period after Interventions	-	-	-	-
	Depth 5yrs After Intervention Ona Ona1	Raster	This raster represents the flood Depth in Ona Ona1 basin for 5-yrs return period after Interventions	-	-	-	-
	Depth 5yrs After Intervention Ona Orogun	Raster	This raster represents the flood Depth in Ona Orogun basin for 5-yrs return period after Interventions	-	-	-	-

Dataset	Feature Class	Geometry	Layer Description	Field Name	Field Type	Field Length	Field Description
	Hazard 100yrs Ogbere	Raster	This raster represents the flood Hazard in Ogbere basin for 100-yrs return period	-	-	-	-
	Hazard 100yrs Ogunpa	Raster	This raster represents the flood Hazard in Ogunpa basin for 100-yrs return period	-	-	-	-
	Hazard 100yrs Omi	Raster	This raster represents the flood Hazard in Omi basin for 100-yrs return period	-	-	-	-
	Hazard 100yrs Ona	Raster	This raster represents the flood Hazard in Ona basin for 100-yrs return period	-	-	-	-
	Hazard 50yrs Ogbere	Raster	This raster represents the flood Hazard in Ogbere basin for 50-yrs return period	-	-	-	-
	Hazard 50yrs Ogunpa	Raster	This raster represents the flood Hazard in Ogunpa basin for 50-yrs return period	-	-	-	-
	Hazard 50yrs Omi	Raster	This raster represents the flood Hazard in Omi basin for 50-yrs return period	-	-	-	-
	Hazard 50yrs Ona	Raster	This raster represents the flood Hazard in Ona basin for 50-yrs return period	-	-	-	-
	Hazard 25yrs Ogbere	Raster	This raster represents the flood Hazard in Ogbere basin for 25-yrs return period	-	-	-	-
	Hazard 25yrs Ogunpa	Raster	This raster represents the flood Hazard in Ogunpa basin for 25-yrs return period	-	-	-	-
	Hazard 25yrs Omi	Raster	This raster represents the flood Hazard in Omi basin for 25-yrs return period	-	-	-	-
	Hazard 25yrs Ona	Raster	This raster represents the flood Hazard in Ona basin for 25-yrs return period	-	-	-	-
	Hazard 5yrs Ogbere	Raster	This raster represents the flood Hazard in Ogbere basin for 5-yrs return period	-	-	-	-
	Hazard 5yrs Ogunpa	Raster	This raster represents the flood Hazard in Ogunpa basin for 5-yrs return period	-	-	-	-
	Hazard 5yrs Omi	Raster	This raster represents the flood Hazard in Omi basin for 5-yrs return period	-	-	-	-
	Hazard 5yrs Ona	Raster	This raster represents the flood Hazard in Ona basin for 5-yrs return period	-	-	-	-
	Hazard 100yrs After Intervention Ogbere	Raster	This raster represents the flood Hazard in Ogbere basin for 100-yrs return period after Interventions	-	-	-	-
	Hazard 100yrs After Intervention Ogunpa	Raster	This raster represents the flood Hazard in Ogunpa basin for 100-yrs return period after Interventions	-	-	-	-
	Hazard 100yrs After Intervention Ona Ona1	Raster	This raster represents the flood Hazard in Ona Ona1 basin for 100-yrs return period after Interventions	-	-	-	-
	Hazard 100yrs After Intervention Ona Orogun	Raster	This raster represents the flood Hazard in Ona Orogun basin for 100-yrs return period after Interventions	-	-	-	-
	Hazard 50yrs After Intervention Ogbere	Raster	This raster represents the flood Hazard in Ogbere basin for 50-yrs return period after Interventions	-	-	-	-
	Hazard 50yrs After Intervention Ogunpa	Raster	This raster represents the flood Hazard in Ogunpa basin for 50-yrs return period after Interventions	-	-	-	-
	Hazard 50yrs After Intervention Ona Ona1	Raster	This raster represents the flood Hazard in Ona Ona1 basin for 50-yrs return period after Interventions	-	-	-	-
	Hazard 50yrs After Intervention Ona Orogun	Raster	This raster represents the flood Hazard in Ona Orogun basin for 50-yrs return period after Interventions	-	-	-	-
	Hazard 25yrs After Intervention Ogbere	Raster	This raster represents the flood Hazard in Ogbere basin for 25-yrs return period after Interventions	-	-	-	-
	Hazard 25yrs After Intervention Ogunpa	Raster	This raster represents the flood Hazard in Ogunpa basin for 25-yrs return period after Interventions	-	-	-	-

Dataset	Feature Class	Geometry	Layer Description	Field Name	Field Type	Field Length	Field Description
	Hazard 25yrs After Intervention Ona Ona1	Raster	This raster represents the flood Hazard in Ona Ona1 basin for 25-yrs return period after Interventions	-	-	-	-
	Hazard 25yrs After Intervention Ona Orogun	Raster	This raster represents the flood Hazard in Ona Orogun basin for 25-yrs return period after Interventions	-	-	-	-
	Hazard 5yrs After Intervention Ogbere	Raster	This raster represents the flood Hazard in Ogbere basin for 5-yrs return period after Interventions	-	-	-	-
	Hazard 5yrs After Intervention Ogunpa	Raster	This raster represents the flood Hazard in Ogunpa basin for 5-yrs return period after Interventions	-	-	-	-
	Hazard 5yrs After Intervention Ona Ona1	Raster	This raster represents the flood Hazard in Ona Ona1 basin for 5-yrs return period after Interventions	-	-	-	-
	Hazard 5yrs After Intervention Ona Orogun	Raster	This raster represents the flood Hazard in Ona Orogun basin for 5-yrs return period after Interventions	-	-	-	-
	Velocity 100yrs Ogbere	Raster	This raster represents the flood Velocity in Ogbere basin for 100-yrs return period	-	-	-	-
	Velocity 100yrs Ogunpa	Raster	This raster represents the flood Velocity in Ogunpa basin for 100-yrs return period	-	-	-	-
	Velocity 100yrs Omi	Raster	This raster represents the flood Velocity in Omi basin for 100-yrs return period	-	-	-	-
	Velocity 100yrs Ona	Raster	This raster represents the flood Velocity in Ona basin for 100-yrs return period	-	-	-	-
	Velocity 50yrs Ogbere	Raster	This raster represents the flood Velocity in Ogbere basin for 50-yrs return period	-	-	-	-
	Velocity 50yrs Ogunpa	Raster	This raster represents the flood Velocity in Ogunpa basin for 50-yrs return period	-	-	-	-
	Velocity 50yrs Omi	Raster	This raster represents the flood Velocity in Omi basin for 50-yrs return period	-	-	-	-
	Velocity 50yrs Ona	Raster	This raster represents the flood Velocity in Ona basin for 50-yrs return period	-	-	-	-
	Velocity 25yrs Ogbere	Raster	This raster represents the flood Velocity in Ogbere basin for 25-yrs return period	-	-	-	-
	Velocity 25yrs Ogunpa	Raster	This raster represents the flood Velocity in Ogunpa basin for 25-yrs return period	-	-	-	-
	Velocity 25yrs Omi	Raster	This raster represents the flood Velocity in Omi basin for 25-yrs return period	-	-	-	-
	Velocity 25yrs Ona	Raster	This raster represents the flood Velocity in Ona basin for 25-yrs return period	-	-	-	-
	Velocity 5yrs Ogbere	Raster	This raster represents the flood Velocity in Ogbere basin for 5-yrs return period	-	-	-	-
	Velocity 5yrs Ogunpa	Raster	This raster represents the flood Velocity in Ogunpa basin for 5-yrs return period	-	-	-	-
	Velocity 5yrs Omi	Raster	This raster represents the flood Velocity in Omi basin for 5-yrs return period	-	-	-	-
	Velocity 5yrs Ona	Raster	This raster represents the flood Velocity in Ona basin for 5-yrs return period	-	-	-	-
	Velocity 100yrs After Intervention Ogbere	Raster	This raster represents the flood Velocity in Ogbere basin for 100-yrs return period after Interventions	-	-	-	-
	Velocity 100yrs After Intervention Ogunpa	Raster	This raster represents the flood Velocity in Ogunpa basin for 100-yrs return period after Interventions	-	-	-	-
	Velocity 100yrs After Intervention Ona Ona1	Raster	This raster represents the flood Velocity in Ona Ona1 basin for 100-yrs return period after Interventions	-	-	-	-
	Velocity 100yrs After Intervention Ona Orogun	Raster	This raster represents the flood Velocity in Ona Orogun basin for 100-yrs return period after Interventions	-	-	-	-

Dataset	Feature Class	Geometry	Layer Description	Field Name	Field Type	Field Length	Field Description
	Velocity 50yrs After Intervention Ogbere	Raster	This raster represents the flood Velocity in Ogbere basin for 50-yrs return period after Interventions	-	-	-	-
	Velocity 50yrs After Intervention Ogunpa	Raster	This raster represents the flood Velocity in Ogunpa basin for 50-yrs return period after Interventions	-	-	-	-
	Velocity 50yrs After Intervention Ona Ona1	Raster	This raster represents the flood Velocity in Ona Ona1 basin for 50-yrs return period after Interventions	-	-	-	-
	Velocity 50yrs After Intervention Ona Orogun	Raster	This raster represents the flood Velocity in Ona Orogun basin for 50-yrs return period after Interventions	-	-	-	-
	Velocity 25yrs After Intervention Ogbere	Raster	This raster represents the flood Velocity in Ogbere basin for 25-yrs return period after Interventions	-	-	-	-
	Velocity 25yrs After Intervention Ogunpa	Raster	This raster represents the flood Velocity in Ogunpa basin for 25-yrs return period after Interventions	-	-	-	-
	Velocity 25yrs After Intervention Ona Ona1	Raster	This raster represents the flood Velocity in Ona Ona1 basin for 25-yrs return period after Interventions	-	-	-	-
	Velocity 25yrs After Intervention Ona Orogun	Raster	This raster represents the flood Velocity in Ona Orogun basin for 25-yrs return period after Interventions	-	-	-	-
	Velocity 5yrs After Intervention Ogbere	Raster	This raster represents the flood Velocity in Ogbere basin for 5-yrs return period after Interventions	-	-	-	-
	Velocity 5yrs After Intervention Ogunpa	Raster	This raster represents the flood Velocity in Ogunpa basin for 5-yrs return period after Interventions	-	-	-	-
	Velocity 5yrs After Intervention Ona Ona1	Raster	This raster represents the flood Velocity in Ona Ona1 basin for 5-yrs return period after Interventions	-	-	-	-
	Velocity 5yrs After Intervention Ona Orogun	Raster	This raster represents the flood Velocity in Ona Orogun basin for 5-yrs return period after Interventions	-	-	-	-

Appendix B: Sample of Buildings Survey (Sheet OG48)

Ibadan Drainage Master Plan - Detailed survey sheet

Surveyor	Area	Date	Sheet Ref
Tayo – Bodun		18-10-17	OG 48

	Survey Sheet:																			
	Plot Id	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
	No of floors	2	2	2		1	2	2	1	1	2	2	2	2	3	1	1	1	2	1	2
Land Use Category/ Infrastructure	Residential (formal)	✓	✓	✓		✓	✓	✓	.		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
	Mixed Use																				
	Primary school																				
	Secondary school																				
	University/Polytechnic/Monotechnic																				
	Hospital/ Clinic																				
	Place of worship																	✓			
	Civic/Cultural Centre/Museum																				
	Government Institution																				
	Transport and Infrastructure																				
	Commercial																				
	Small business																				
	Street Trading/Banks/Shops																				
	Industry																				
	Park/ Recreation																				
	Public Open Space																				
	Sports facilities																				
	Tourist facilities/ Hospitality																				
	Police Station																				
	Fire Station																				
	Electical sub-station																				
	Telecommunication exchange buildings																				
	Water works																				
	Water wells																				
	Water communal reservoir/ tank pumping stations																				
	Wastewater communcal sceptic tank																				
	Stormwater drainage facilities																				
	Solid waste dump site/ landfill																				
	Under Construction																				
	Vacant				✓																
	Other																				
	Swampy Area																				
Construction material	Mud																				
	Brick																				
	Cement block	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Concrete																				
	Timber																				
	Bamboo																				
	Corrugated Iron																				
	Other																				
Condition	Good	✓				✓	✓	✓	✓	✓					✓		✓				
	Fair		✓	✓							✓	✓	✓	✓		✓		✓	✓	✓	✓
	Poor																				
	Dilapidated																				
Asset Value Naira/m2	High (Modern)					✓	✓	✓	✓	✓											
	High (Old)																		✓		
	Medium (Storey)	✓	✓	✓							✓	✓	✓	✓	✓						✓
	Medium (Bungalow)															✓	✓	✓		✓	
	Low (Poor)																				
	Low (Dilapidated)																				

Appendix C: Sample of Asset Valuation for Buildings lying in the Floodplains (Sheet OG48)

Assets										Land				Total Land and Asset Values (USD)	X	Y
ID	Floors	Type	Material	Condition	Classification	Description	Area (m2)	Rate (USD/m2/Floor)	Value (USD)	Area (m2)	RATE	Rate (USD/m2)	Value (USD)			
OG48-1	1	Residential	Cement Block	Fair	Medium (Bungalow)		40	70	20000	40	70	6	2800	22800	603839.99	819296.11
OG48-2	1	Residential	Cement Block	Fair	Medium (Bungalow)		258	70	27000	258	70	6	18100	45100	603826.41	819311.00
OG48-3	1	Residential	Cement Block	Fair	Medium (Bungalow)		227	70	16500	227	70	6	15900	32400	603864.30	819319.07
OG48-5	2	Residential	Cement Block	Fair	Medium (Storey)		245	100	58000	245	100	8	49000	107000	603838.71	819328.60
OG48-6	1	Residential	Cement Block	Fair	Medium (Bungalow)		227	70	21000	227	70	6	15900	36900	603869.57	819335.45
OG48-8	2	Residential	Cement Block	Fair	Medium (Storey)		275	100	46300	275	100	8	55000	101300	603900.07	819346.04
OG48-9	1	Residential	Cement Block	Fair	Medium (Bungalow)		237	70	20100	237	70	6	16600	36700	603842.84	819344.14
OG48-10	1	Residential	Cement Block	Fair	Medium (Bungalow)		83	70	4100	83	70	6	5800	9900	603824.15	819354.07
OG48-11	1	Residential	Cement Block	Fair	Medium (Bungalow)		205	70	18500	205	70	6	14400	32900	603875.06	819357.78
OG48-12	1	Residential	Cement Block	Fair	Medium (Bungalow)		327	70	22200	327	70	6	22900	45100	603843.83	819365.51
OG48-13	1	Residential	Cement Block	Fair	Medium (Bungalow)		138	70	12900	138	70	6	9700	22600	603890.50	819370.13
OG48-14	2	Residential	Cement Block	Fair	Medium (Storey)		323	100	63200	323	100	8	64600	127800	603904.23	819370.44
OG48-15	2	Residential	Cement Block	Good	High (Modern)		260	150	33800	260	150	25	78000	111800	603876.73	819382.38
OG48-16	1	Residential	Cement Block	Fair	Medium (Bungalow)		234	70	19000	234	70	6	16400	35400	603857.40	819387.75
OG48-17	1	Place of Worship	Cement Block	Fair	Medium (Bungalow)		353	70	20750	353	70	6	24700	45450	603822.25	819390.61
OG48-18	2	Residential	Cement Block	Good	High (Old)		297	135	94600	297	135	25	80200	174800	603900.32	819391.58
OG48-19	2	Residential	Cement Block	Good	High (Modern)		87	150	35300	87	151	25	26100	61400	603877.14	819397.87
OG48-20	1	Commercial	Cement Block	Good	High (Modern)	Arije Fafunlayo Market	362	150	61000	362	150	25	54300	115300	603951.21	819400.38
OG48-21	1	Commercial	Cement Block	Good	High (Modern)	Market	361	150	57000	361	150	25	54200	111200	603984.02	819402.81
OG48-26	1	Residential	Cement Block	Fair	Medium (Bungalow)		231	70	33900	231	70	6	16200	50100	603953.32	819441.25
OG48-27	1	Residential	Cement Block	Fair	Medium (Bungalow)		132	70	31700	132	70	6	9200	40900	603886.22	819470.04
OG48-28	1	Residential	Cement Block	Fair	Medium (Bungalow)		259	70	35900	259	70	6	18100	54000	603938.89	819459.19
OG48-30	1	Commercial	Cement Block	Fair	Medium (Bungalow)	Barly Gas Station	99	70	39000	99	70	6	6900	45900	604007.25	819449.73
OG48-32	2	Residential	Cement Block	Fair	Medium (Storey)		406	100	59800	406	100	8	81200	141000	603842.49	819466.10
OG48-33	2	Residential	Cement Block	Fair	Medium (Storey)		162	100	35200	162	100	8	32400	67600	603900.35	819474.37
OG48-34	2	Small business	Cement Block	Fair	Medium (Storey)		295	100	87600	295	100	8	59000	146600	603978.55	819482.67
OG48-35	1	Residential	Cement Block	Fair	Medium (Bungalow)		347	70	24150	347	70	6	24300	48450	603870.34	819487.72
OG48-36	1	Residential	Cement Block	Fair	Medium (Bungalow)		180	70	74775	180	70	6	12600	87375	603931.87	819480.11
OG48-37	1	Residential	Mud	Poor	Low (Poor)		166	50	21700	166	50	6	8300	30000	603903.51	819489.01
OG48-38	1	Residential	Cement Block	Fair	Medium (Bungalow)		147	70	30300	147	70	6	10300	40600	603872.82	819502.81
OG48-39	1	Residential	Cement Block	Fair	Medium (Bungalow)		250	70	21400	250	70	6	17500	38900	603936.63	819513.06
OG48-40	2	Commercial	Cement Block	Fair	Medium (Storey)	Doja Funeral Home	230	100	103500	230	100	8	46000	149500	603973.99	819515.98
OG48-41	2	Residential	Cement Block	Good	Medium (Storey)		172	100	40600	172	100	8	34400	75000	603882.44	819526.62
OG48-42	2	Residential	Cement Block	Fair	Medium (Storey)		278	100	80400	278	100	8	55600	136000	603937.25	819531.35
OG48-45	1	Residential	Cement Block	Good	High (Modern)		291	150	75700	291	150	25	43700	119400	603860.18	819532.35
OG48-46	2	Residential	Cement Block	Good	High (Modern)		376	150	123100	376	150	25	112800	235900	603899.72	819532.39
OG48-47	2	Residential	Cement Block	Good	High (Modern)		128	150	37500	128	150	25	38400	75900	603884.20	819539.70
OG48-48	1	Commercial	Cement Block	Good	High (Modern)	So Super Gas Station	186	150	29000	186	150	25	27900	56900	603994.31	819545.50
OG48-49	1	Commercial	Cement Block	Good	High (Modern)	So Super Gas Station	142	150	22700	142	150	25	21300	44000	604012.52	819547.01
OG48-50	2	Residential	Cement Block	Fair	Medium (Storey)		372	100	72800	372	100	8	74400	147200	603935.43	819548.45
OG48-51	2	Residential	Cement Block	Fair	Medium (Storey)		248	100	77700	248	100	8	49600	127300	603964.43	819550.95
OG48-53	2	Residential	Cement Block	Fair	Medium (Storey)		280	100	85700	280	100	8	56000	141700	603965.71	819567.24
OG48-54	3	Residential	Cement Block	Good	Medium (Storey)		287	100	101800	287	100	8	86100	187900	603935.19	819604.33
OG48-55	1	Residential	Cement Block	Fair	Medium (Bungalow)		187	70	24300	187	70	6	13100	37400	603968.05	819604.30
OG48-56	1	Residential	Cement Block	Good	Medium (Bungalow)		292	70	32300	292	70	6	20400	52700	603896.87	819603.08
OG48-57	1	Place of Worship	Cement Block	Fair	Medium (Bungalow)	Gospel Faith Mission	612	70	47400	612	70	6	42800	90200	603870.04	819611.29
OG48-58	2	Residential	Cement Block	Fair	High (Old)		284	135	82802	284	135	25	76700	159502	603932.34	819622.49
OG48-59	1	Residential	Cement Block	Fair	Medium (Bungalow)		247	70	17500	247	70	6	17300	34800	603964.20	819626.69
OG48-60	2	Residential	Cement Block	Fair	Medium (Storey)		300	100	63500	300	100	8	60000	123500	603930.31	819637.05
OG48-61	2	Residential	Cement Block	Fair	Medium (Storey)		175	100	86700	175	100	8	35000	121700	603870.35	819645.96
OG48-62	1	Residential	Cement Block	Fair	Medium (Bungalow)		155	70	41000	155	70	6	10900	51900	603889.69	819636.77

Annex

6

Dikes and Dams

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1 Introduction

This section investigates different alternatives to attenuate the flow by studying the implementation of dikes and dams in Ona/Omi basins. The dikes are small in heights (4-8m) for flow attenuation while dams have heights greater than 10m for multi-purposes such as storage for water supply and attenuation. Each structure is associated with an embankment that detains the flow in a reservoir and a culvert (bottom outlet) that releases the flow to the downstream.

1.1 Identification Parameters of Dikes and Dams

Based on LiDAR topographic data, the Rivers and Tributaries of Ona/Omi Rivers that contribute in providing a significant flow are investigated. The following identification criteria is set for selection of dike or dam locations:

1.2 Identification of Proposed Dams/Dikes Locations

Based on identification criteria, all possible sites for construction of dikes or dams in Ona/Omi have been evaluated and screened to select the optimum locations. In Ona basin; The screening process provide only 2 locations to be considered as a multipurpose dam, and 17 Locations to be considered as dikes.

In addition; Omi basin does not have any locations to construct attenuation dikes and has only 2 locations in rural areas will be considered as a multipurpose dam.

Table 1.1 presents the characteristic of the 17 selected dikes in Ona while Table 1.2 shows the characteristic of proposed dams and dikes in Ona and Omi basins. The following characteristics are indicated.

- The position of each dike location (Easting, Northing) based on a WGS1984 UTM Zone 31N coordinate system,
- The bed level and the potential crest level
- The potential height and the corresponding maximum surface area of the expected impounding reservoir and its maximum capacity.

Table 1.1: Characteristics of Proposed Dikes in Ona basin

No.	Dike Code	Easting (m)	Northing (m)	Bed Level	Potential Crest Level	Potential Height (m)	Maximum Surface Area (km2)	Maximum Reservoir Capacity (MCM)
1	24	592,191	828,764	246.5	256	9.5	0.42	1.50
2	25	593,622	831,138	255.5	265.5	10	0.67	2.69
3	37	604,657	839,138	273.5	283.5	10	0.38	1.27
4	38	604,872	839,131	274.5	284.5	10	0.27	1.07
5	39	604,732	838,135	260	271	11	0.73	2.54
6	41	607,318	838,476	270	280	10	0.14	0.37
7	42	606,961	836,883	266	275	9	0.13	0.47
8	43	606,585	835,736	255	265	10	0.12	0.48
9	44	606,131	834,797	250	258	8	0.13	0.36
10	45	605,675	833,497	248.3	258.3	10	0.12	0.45
11	46	605,312	833,258	244.5	254.5	10	0.12	0.43
12	49	599,270	835,951	251	262	11	0.36	1.33
13	50	599,530	835,933	249	258	9	0.32	1.11
14	54	595,912	835,904	252	261	9	0.33	1.04
15	55	595,649	835,569	250	257	7	0.17	0.56
16	56	596,869	834,510	244	251	7	0.16	0.40
17	61	593,590	823,821	210.5	221	10.5	0.10	0.41

Table 1.2: Characteristics of Proposed Dams in Ona and Omi basins

No.	Dam Code	Easting (m)	Northing (m)	Bed Level	Potential Crest Level	Potential Height (m)	Maximum Surface Area (km2)	Maximum Reservoir Capacity (MCM)
1	4	599582.9	835375.5	244	264	20	24	15
2	22	605991.9	834971.3	246	277	31	9.4	86
3	74	613699.1	817637.8	192	218	26	4.2	32
4	77	611216.8	828810.4	220	243	23	2.9	19.5

** Easting, Northing and Elevations are based on WGS1984 UTM Zone 31N Coordinate System*

2 Attenuation Dikes

This section investigates the identified potential dikes in Ona and Omi basin. The section presents their function, design criteria, their hydrological analysis, selected dike sites, results and their attenuation effect.

2.1 Function

The function of dikes is to delay the flow without restricting it to the downstream. The dikes shall not stop any flow either in the low/dry period or flooding period as each dike shall be associated with an open culvert placed at the channel's bed that releases the flow during dry periods and during flood events, refer to Figure 2.1 and Figure 2.2 for different storm events.

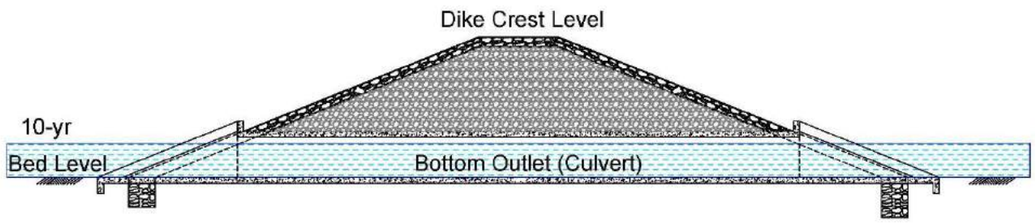


Figure 2.1: Dike Cross-Section with a 10-year storm event

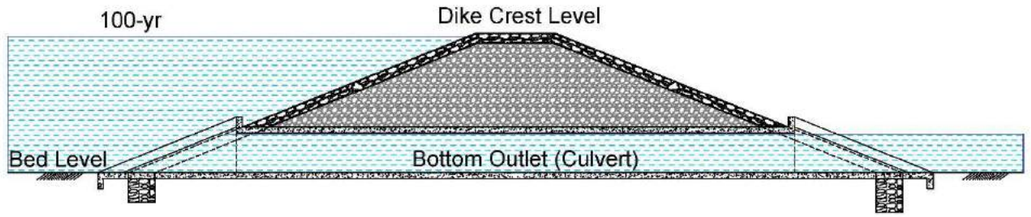


Figure 2.2: Dike Cross-Section with a 100-year storm event

2.2 Design Criteria

Following the identification of dike locations, the following design criteria is set to allow further hydrological analysis:

- Dikes should have a maximum height of 8m to allow a feasible economic dike.
- The embankment of the dike is not overtopped during a significant flood event such as the 100-year return period.
- A bottom outlet using a culvert is designed to convey both low and high flows without allowing the dike's embankment to be overtopped.
- In low flows and short return periods such as 5-, 10-year storm events, the culvert conveys the flow freely as an open channel.
- In high flows and longer return periods such as the 25-, 50- and 100-year storm events, the culvert becomes submerged causing an impounding reservoir upstream the dike. In this case, the culvert acts as an orifice and conveys a surcharged flow without causing any overtopping to the dike's embankment.
- Nevertheless, and in case of any possible overtopping, the surface of the dike's embankment is protected by an economic lining material.

2.3 Hydrological Analysis

The hydrologic analysis of the dikes and their associative bottom outlets (culverts) is processed using a free hydrological model "HEC-HMS". Table 2.1 presents the dike characteristics including the inflow and outflow at each dike location as extracted from the hydrological model.

Table 2.1: Hydrological Characteristics of Potential Dikes

No.	Dike Code	Upper Catchment Area (km2)	Inflow (m3/s)	Outflow (m3/s)	Attenuation (m3/s)	Storage volumex1000 m3
1	24	4.41	35.4	5.8	29.6	488.3
2	25	6.22	46	5.7	40.3	750.2
3	37	9.9	57.3	26.3	31	545.8
4	38	4.98	37.3	10	27.3	415.5
5	39	23.15	81.3	44.7	36.6	631
6	41	2.47	27	14.7	12.3	87.4
7	42	3.24	23.7	6.5	17.2	285.1
8	43	2.51	22.8	6.4	16.4	210.8
9	44	3.28	25.1	6.5	18.6	297.7
10	45	2.45	19.6	6.3	13.3	193.7
11	46	2.53	20.6	6.5	14.1	193.6
12	49	7.86	52	25.4	26.6	354.6
13	50	16.3	98.7	57.6	41.1	660.9
14	54	6.67	56.6	15.1	41.5	538.3
15	55	6.64	46.2	24.3	21.9	448
16	56	4.6	38.7	10	28.7	394.9
17	61	3.92	34.5	16.4	18.1	188.8

2.4 Selection of Dike Sites

Several criteria are used to select the optimum ones as follows:

- Higher capacities are favored over lower capacities for the same dike location.
- Dikes with small filling volume and high attenuation are favored over other ones in order to reach an economic dike; this is examined by dividing the dike's volume by the magnitude of the flow reduction (attenuation).

Based on the above, 17 dikes are selected for flow reduction and attenuation in Ona basin. However, no feasible dikes were chosen for Omi basin. Figure 2.3 presents the layout of the selected dikes, while Table 2.2 shows the characteristics of the proposed dikes in Ona River, their bottom outlet dimensions and their 100-year Flood Routing Effects.

It is worth to note that the selected 17 dikes are included in the ongoing priority works in Ibadan under the 2nd pool of priority investments (Lot3), refer to annex 7.

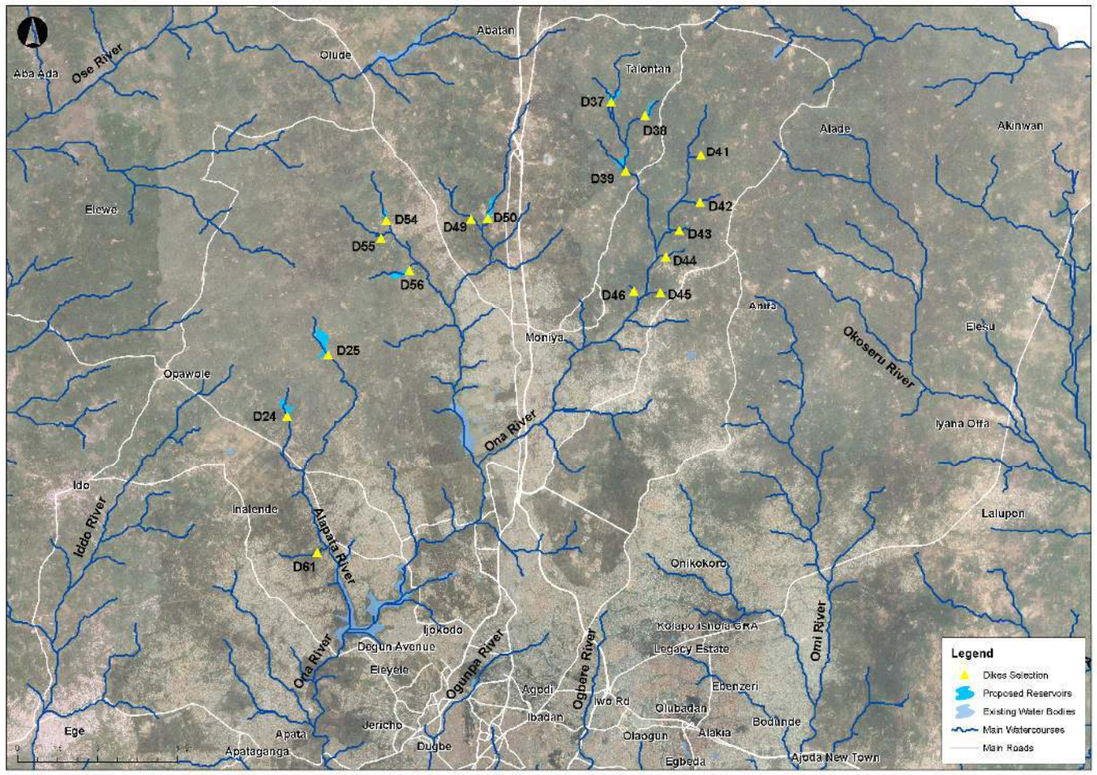


Figure 2.3: Selected dikes in Ona basin

Table 2.2: Proposed Dikes and their 100-year Flood Routing Effects

Dike						Bottom Outlet							
No.	Dike Code	Bed Level	Selected Height (m)	Dike Length	Dike Crest Level (m)	No	Span	Rise	Upper Catchment Area (km2)	Inflow m3/s	Outflow m3/s	Attenuation m3/s	Storage Volume m3 x 1000
1	24	246.5	6.63	189	252.8	1	1	1	4.41	35.4	5.8	29.6	488.3
2	25	255.5	6	201	261.6	1	1	1	6.22	46	5.7	40.3	750.2
3	37	273.5	7.35	272	281.1	1	2.4	1.5	9.9	57.3	26.3	31	545.8
4	38	274.5	6.64	225	281.7	1	1.5	1	4.98	37.3	10	27.3	415.5
5	39	260.0	6.84	169	267	1	2.6	2.5	23.15	81.3	44.7	36.6	631
6	41	270.0	6.8	134	276.8	1	1.5	1.5	2.47	27	14.7	12.3	87.4
7	42	266.0	7.71	233	273.5	1	1	1	3.24	23.7	6.5	17.2	285.1
8	43	255.0	7.34	178	262.3	1	1	1	2.51	22.8	6.4	16.4	210.8
9	44	250.0	8	184	257.6	1	1	1	3.28	25.1	6.5	18.6	297.7
10	45	248.3	7.08	209	255.4	1	1	1	2.45	19.6	6.3	13.3	193.7
11	46	244.5	7.28	170	252	1	1	1	2.53	20.6	6.5	14.1	193.6
12	49	251.0	7.21	251	258.4	1	2	1.8	7.86	52	25.4	26.6	354.6
13	50	249.0	7.7	270	256.4	1	3	3	16.3	98.7	57.6	41.1	660.9
14	54	252.0	6.75	239	263	1	1.5	1.5	6.67	56.6	15.1	41.5	538.3
15	55	250.0	7.23	345	257	1	1.5	1.5	6.64	46.2	24.3	21.9	448
16	56	244.0	6.78	247	251.1	1	1.5	1	4.6	38.7	10	28.7	394.9
17	61	210.5	7.95	107	218.5	1	1.5	1.5	3.92	34.5	16.4	18.1	188.8

2.5 Results

The layouts of proposed dikes with their expected impounding reservoir is presented in Section 6 at the end of this annex. In addition, charts presenting the dike's hydrological characteristics such as the area-capacity curve is also presented. These curves are used to determine the potential capacity of each impounding reservoir and its expected flooded area. The area-capacity curves are based on LiDAR topographic data. The area-capacity curves are also used to determine the bed level and the maximum allowable crest level for each dike.

Moreover, the estimated inflow and outflow at each dam location, the attenuation/flow difference and the storage volume are also presented in Section 6.

2.6 Effects of the Proposed Dikes in Ona basin at Eleyele Dam

The combined effect of the proposed dikes for the 100-year flood flows at the Eleyele dam is shown in Figure 2.4. The figure shows that a significant reduction of the 100 years peak flow is achieved downstream Eleyele dam. The outflow is reduced from a value of 919m^3/s to a value of 738 m^3/s; which is considered as a reduction of around 20%. Based on the calibrated hydrological model, the 100-year peak flow downstream Eleyele dam has been reduced by 20% (738 CMS instead of 918 CMS) due to the proposed dikes.

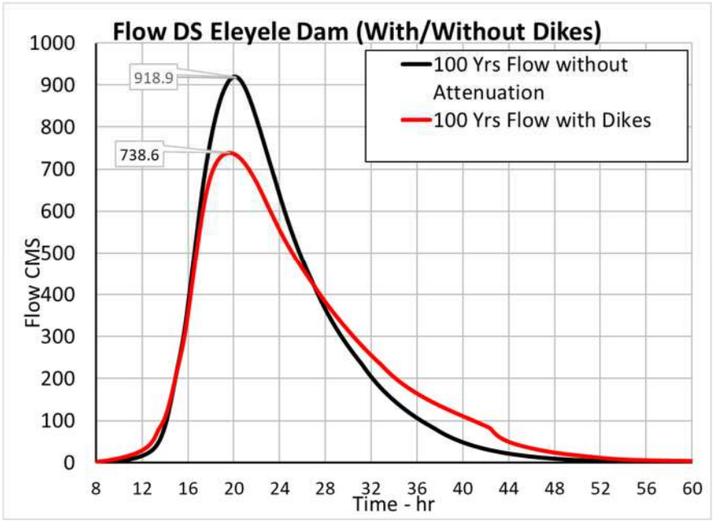


Figure 2.4: Impact of the proposed 17 dikes on the outflow downstream Eleyele dam

3 Multi-Purpose Dams in Ona and Omi Basins

This section investigates the identified potential dams in Ona and Omi basin. The section presents their function, design criteria, their hydrological analysis, selected dam sites, results and their attenuation effect.

3.1 Function

Reservoirs created by dams can be used for multi-purpose facilities such as flood suppression, provide water activities such as irrigation, human consumption, industrial use, and hydro-power. The inundated areas behind the dams are selected in undeveloped zones where expropriation of land is at the low-side.

3.2 Design Criteria

Following the identification of the dam locations, the following design criteria is set to allow further hydrological analysis:

- Dams should have height up to 40m to allow it to store sufficient water for future purposes and to be considered as a feasible economic dam.
- A controlled bottom outlet is designed to provide a specific flow for various water demands such as domestic purposes, irrigation and ecological needs.
- The embankment of the dam is not overtopped during the event of the Probable Maximum Flood (PMF).
- An emergency spillway is designed to assure that the dike's embankment is not overtopped.
- In high flows and long return periods such as the 25-, 50- and 100-year storm events, the dam stores stormwater and impounds a reservoir in its upstream. The reservoir should not dry out.
- In longer return periods such as the 200-year, 500, 1000 and the PMF, the spillway is overtopped and conveys a free flow without causing any overtopping to the dam's embankment.

3.3 Selection of Dam Sites

Based on the identification criteria (location, urbanization ratio in reservoir area, upstream catchment, potential storage…etc), two dams for flow reduction and multi-purpose facilities are selected in Ona basin (D4 and D22), and two other dams are selected in Omi Basin (D74 and D77). Figure 3.1 presents the layout of the selected dams.

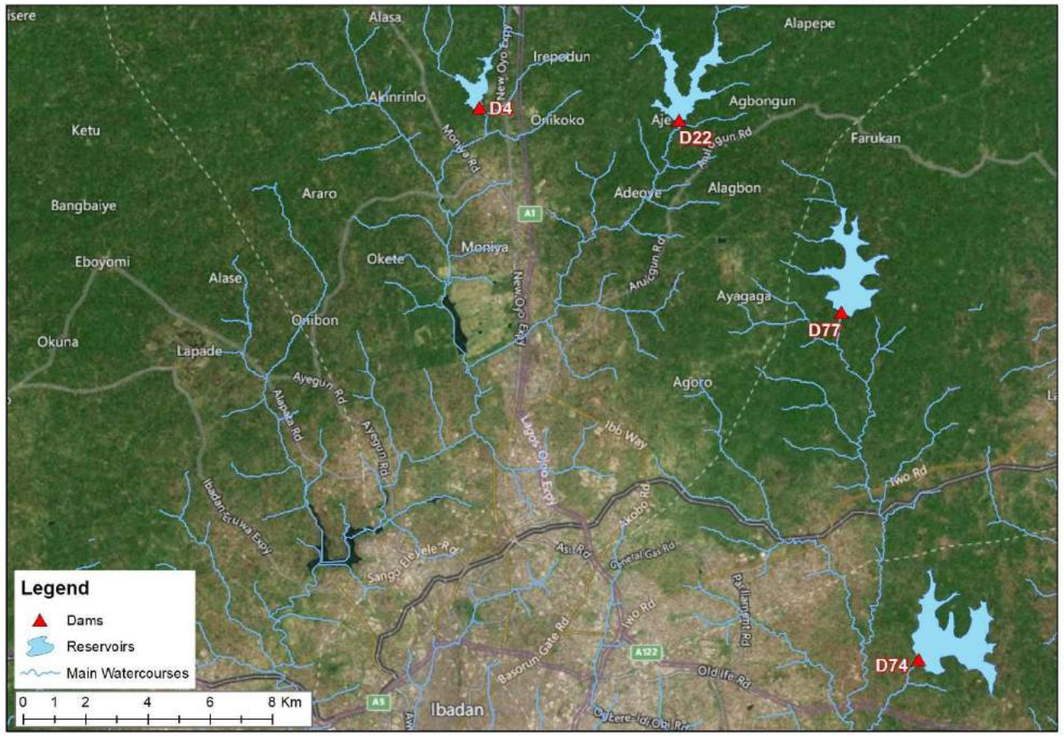


Figure 3.1: Layout of the Proposed Dams in Ona/Omi basins

The selected dams in Ona and Omi are multi-purpose dams, these dams provide the following:

1- Attenuation to decrease the peak flow conveying through the main river of Ona and Omi. The impact of the dams on the peak flow is further elaborated in section 4 for Omi and 0 for Ona.

2- Water supply in order to contribute with the available reservoirs in Ibadan such as Eleyele reservoir in providing water supply for the city. Table 3.2 provides the possible quantities of water that can be withdrawn from the reservoirs of each dam in million cubic meters per year.

3.4 Hydrological Analysis

The hydrologic analysis of the dams and their associative bottom outlets and spillways are processed using the hydrological model "HEC-HMS". Based on the dimensions of the dams, their spillway dimensions and bottom outlet (Table 3.1), the consultant processed the hydrological model and estimated the inflow and outflow at each dam location, the attenuation/flow difference and the storage volume. The charts of the inflow/outflow of each dam and their corresponding attenuation and storage are presented in Section 7 at the end of this Annex.

Table 3.1 show the characteristics of the proposed dams in Ona and Omi Basins, their bottom outlet dimensions, spillway dimensions and their 100-year Flood Routing Effects. The Reliability calculation for proposed Dams and how much daily water will be drafted have been illustrated in Table 3.2.

Table 3.1: Proposed Dams and their 100-year Flood Routing Effects

Dam					Bottom Outlet									
Dam Code	Bed Level	Selected Height (m)	Dam Length	Dam Crest Level (m)	No	Span	Rise	Upper Catchment Area (km2)	Inflow m3/s	Outflow m3/s	Attenuation %	Storage Volume MCM	Spillway Level	Spillway Width
4	244	20	552	264	1	1	1	24.7	150	0.17	100	9.5	261	100
22	246	23	2000	269	1	1	1	53.5	294.5	0.36	100	19.6	266	100
74	192	24	593	216	1	1	1	12.3	101.2	0.09	100	15.56	213	100
77	220	21	525	241	1	1	1	21	101.1	0.15	100	7.98	238	100

Table 3.2: Reliability calculation for proposed Dams in Ibadan

Reservoir	Yield (MCM/y)	Draft (MCM/y)	Draft (m^3/d)	Reliability %	HWL	Gross Volume	Dead Volume	Live Volume
Dam 4	6.8	5.44	14,688.00	80	258.7	6	0.8	5.2
Dam 22	14	11.2	31,104.00	80	263	12.2	1.7	10.5
Dam74	3.7	2.96	7,776.00	90	212	13	0.4	12.6
Dam 77	5.9	4.72	12,960.00	80	235.5	5.1	0.5	4.6

3.5 Results

The layouts of proposed dams with their expected impounding reservoir is presented in Section 7 at the end of this annex. In addition, charts presenting the dam's hydrological characteristics such as the area-capacity curve is also presented. Moreover, the estimated inflow and outflow at each dam location, the attenuation/flow difference and the storage volume are also presented.

4 Effects of the Dams in Ona at Eleyele Dam

The combined effect of the proposed dams/dikes on the 100-year flood flows at the Eleyele dam is shown in Figure 4.1. The 100-year peak flow downstream Eleyele dam is estimated at about 919 m^3/sec without any attenuation caused by dikes or dams. This flow is reduced to 737 m^3/sec due to effect of dikes. However, the flow is further reduced to 681.2 m^3/sec due to the combined effect of the proposed dams and dikes.

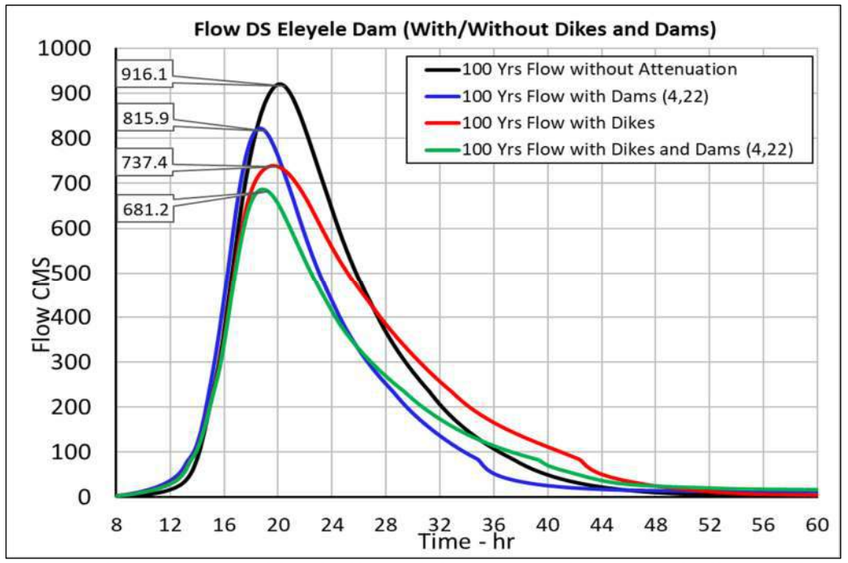


Figure 4.1: Combined effect of the proposed dams and Dikes at the Eleyele dam.

5 Effects of the Dams in Omi

The effect of the proposed dams in Omi are examined at structure no. 1141 near Orisunmbare community market; the structure is located downstream the confluence of System 40 and System 41 and along Omi Main River, refer to Figure 5.1.

Based on the hydrological model, the effect of the proposed dams on the 100-year flood flow is shown in Figure 5.2. The flow is reduced from a value of 574m^3/s to a value of 490m^3/s; which is considered as a reduction of around 15%.

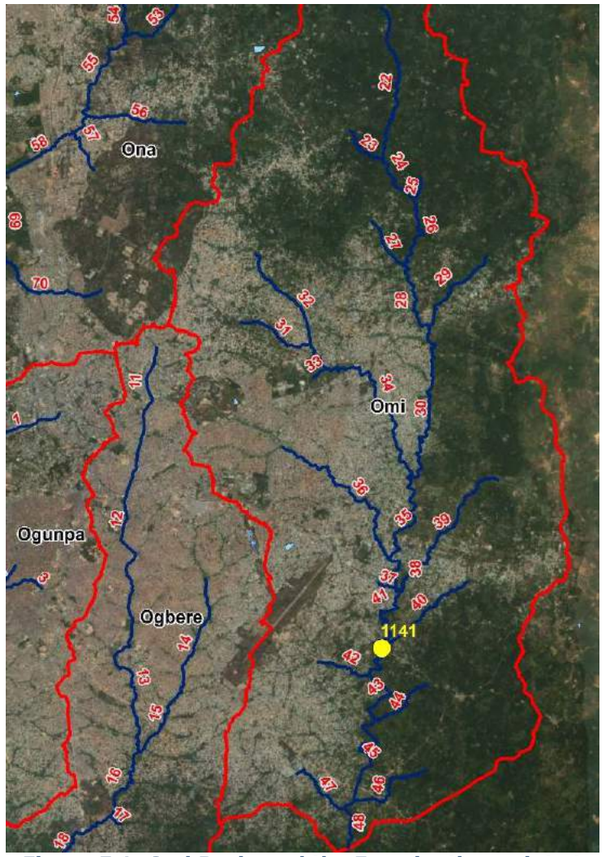


Figure 5.1: Omi Basin and the Examination point at Structure no. 1141

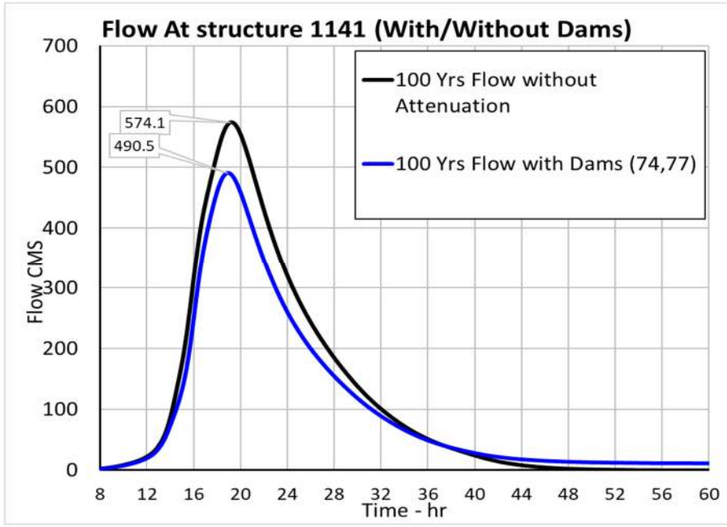
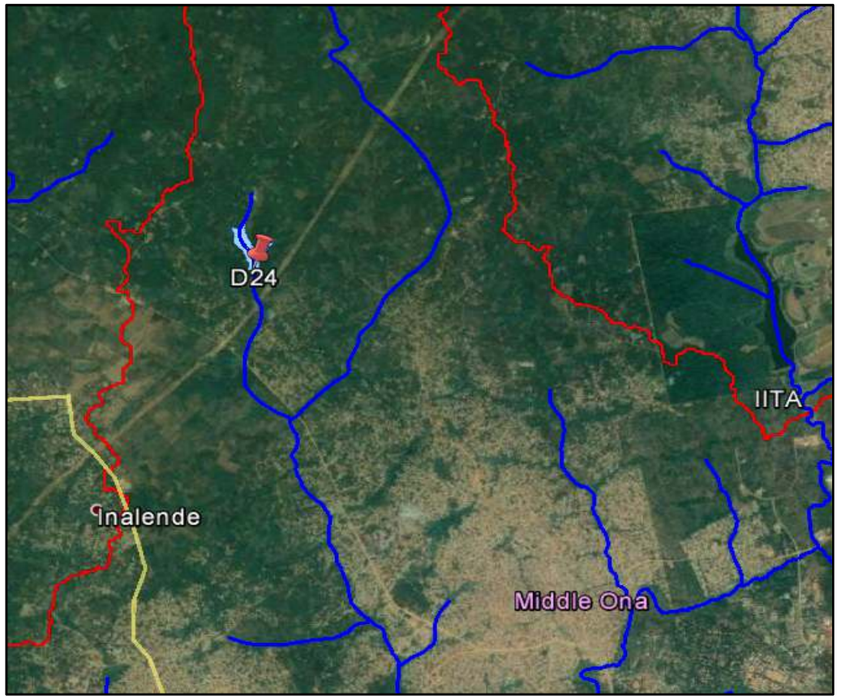
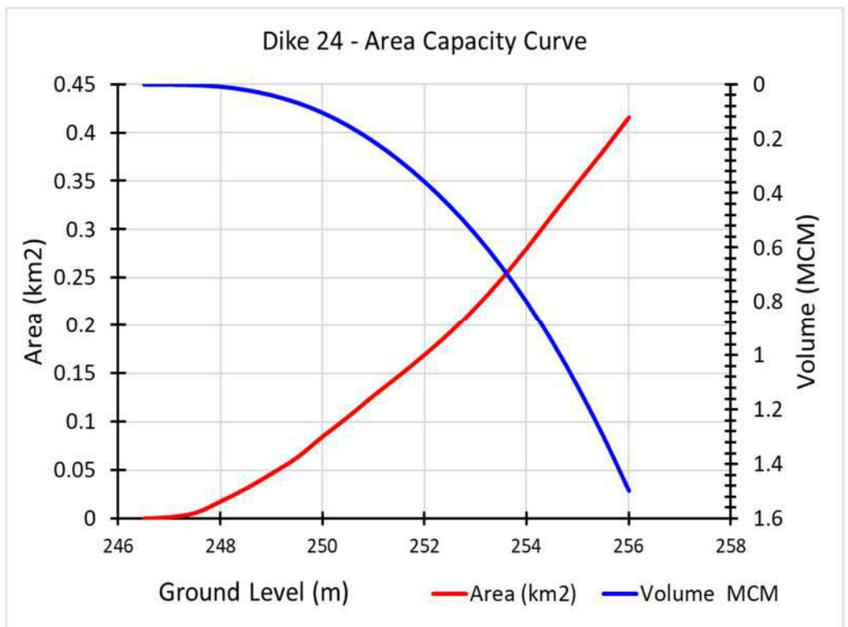


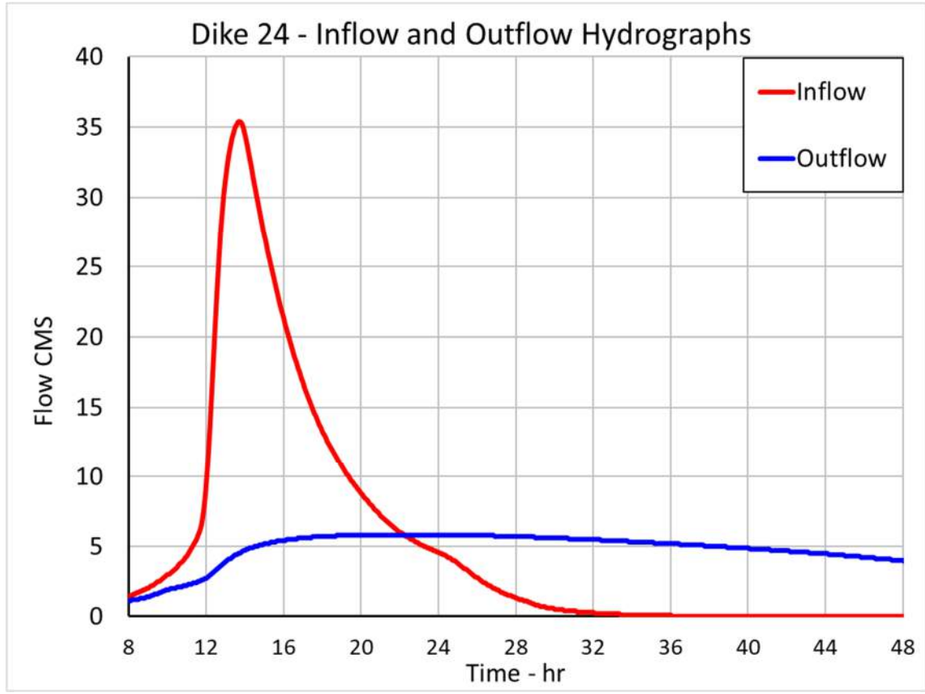
Figure 5.2: Combined effect of the proposed dams at Omi basin.

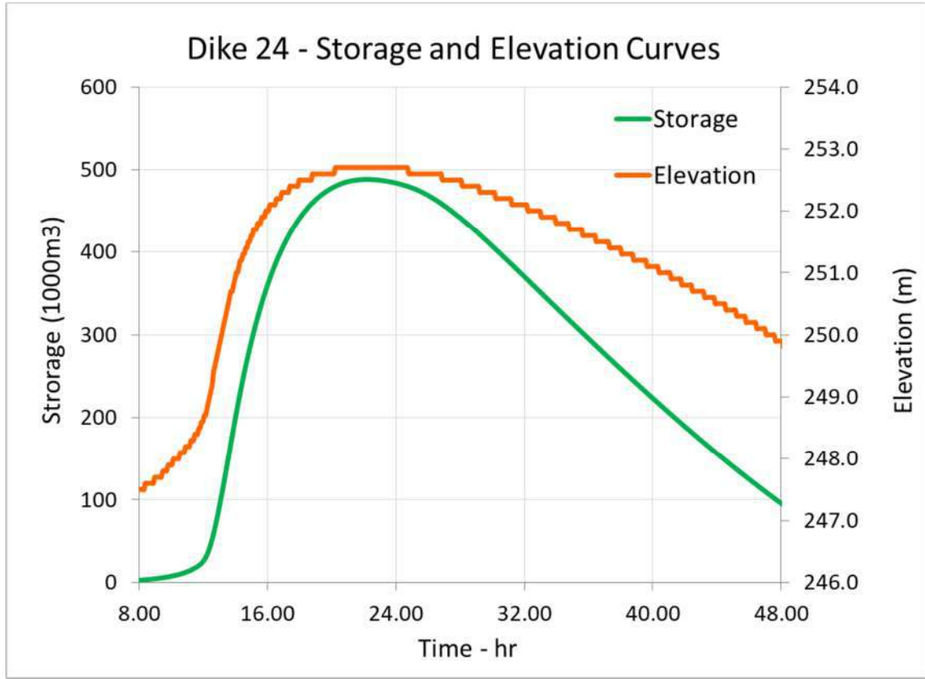
6 Layouts and Graphs of Proposed Dikes

6.1 Dike 24

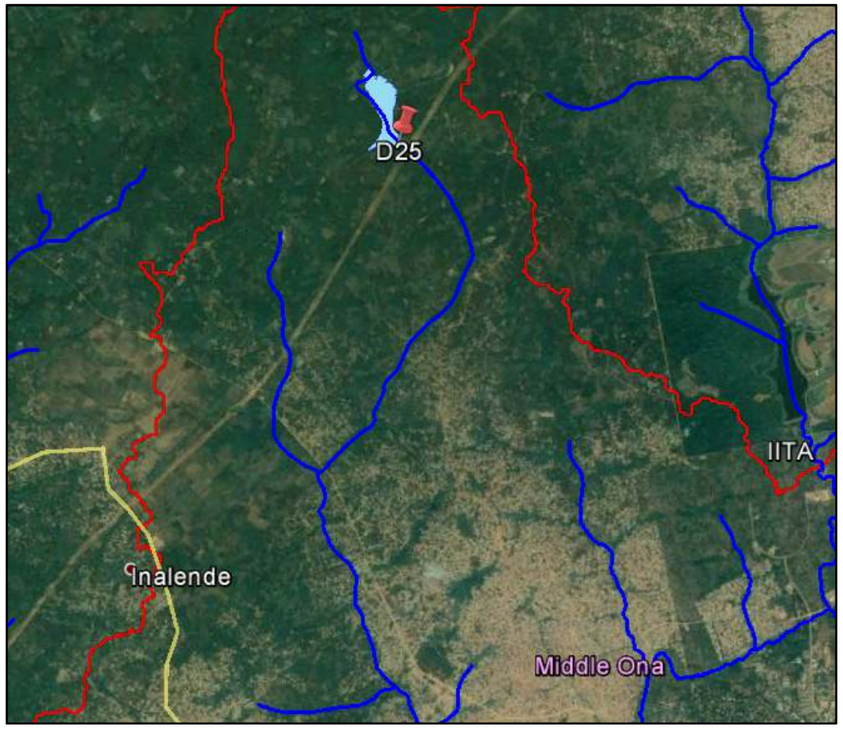


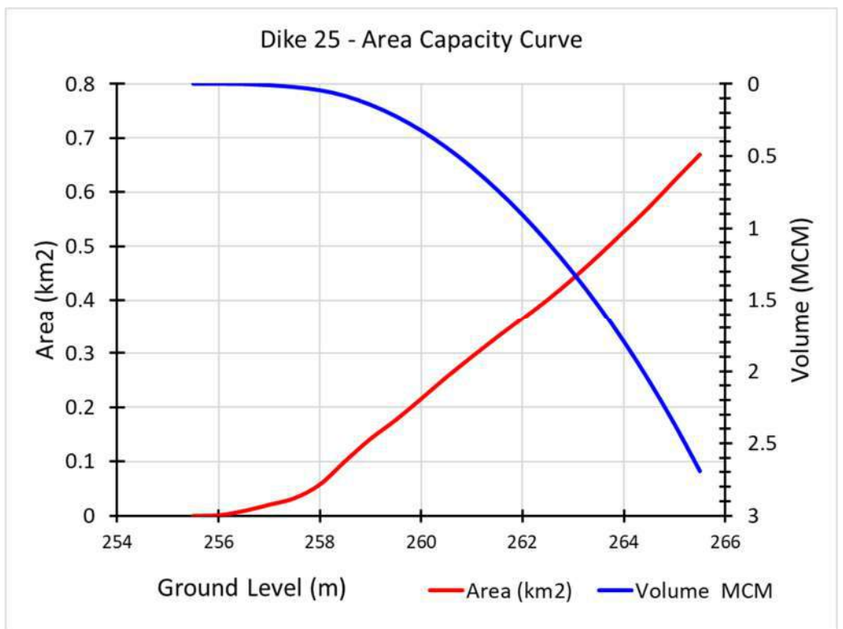


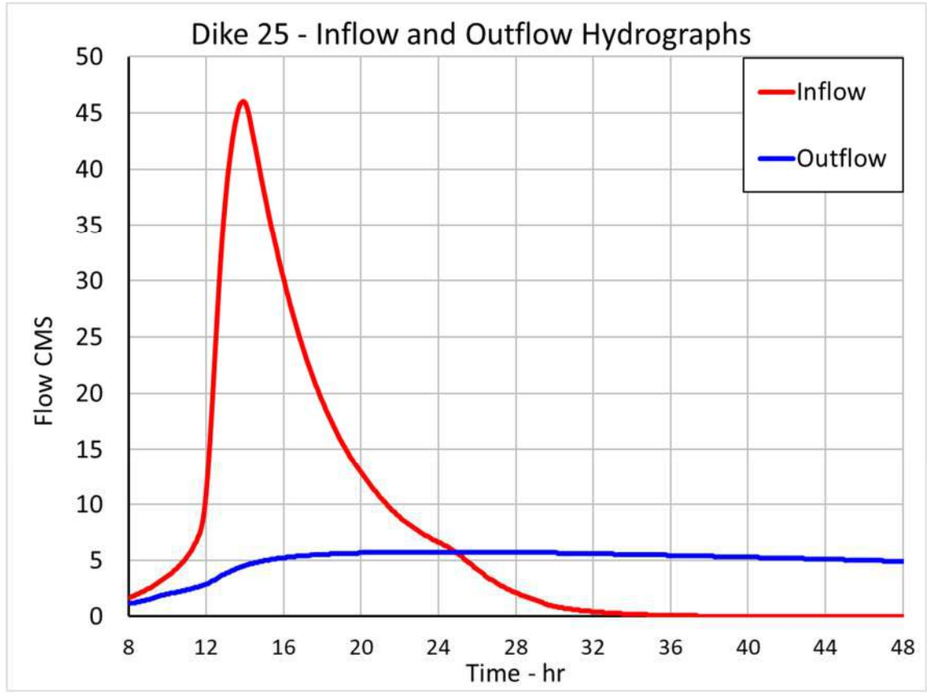


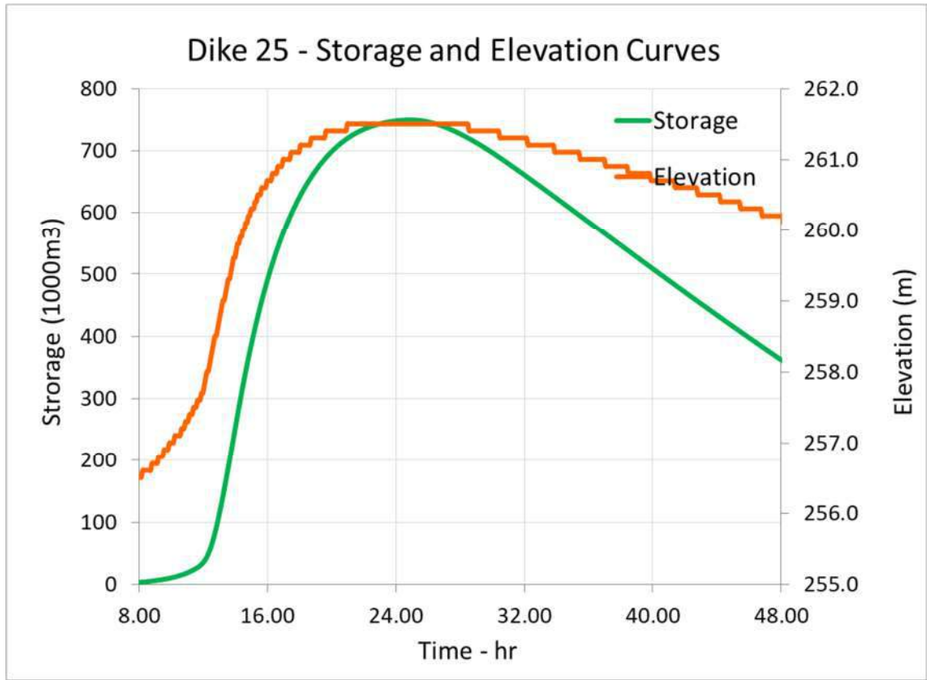


6.2 Dike 25


D25
IITA
Inalende
Middle Ona

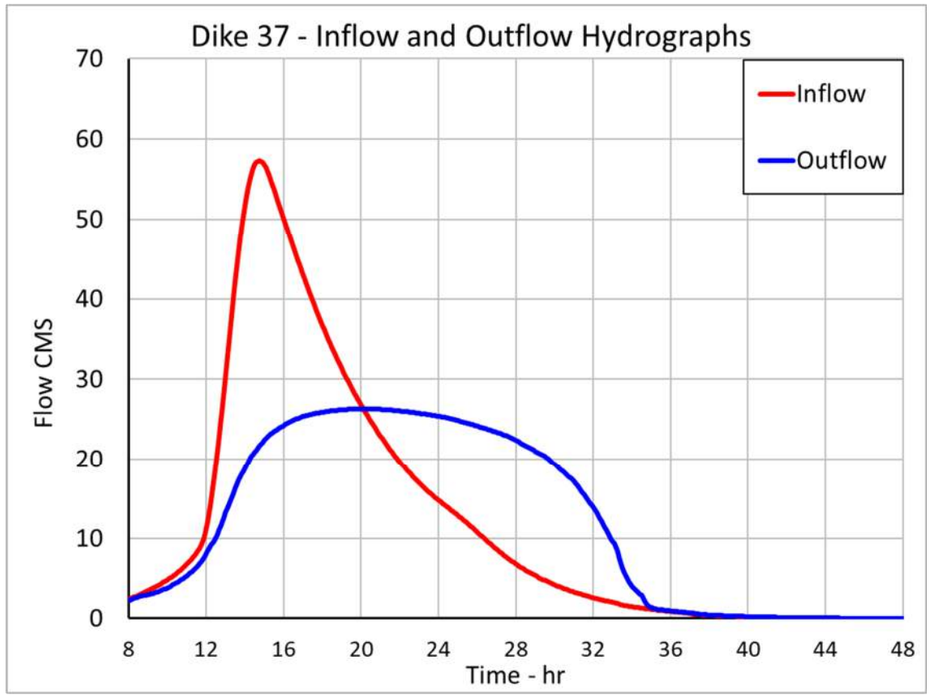

Dike 25 - Area Capacity Curve
Area (km2)
Volume (MCM)
Ground Level (m)
Area (km2)
Volume MCM

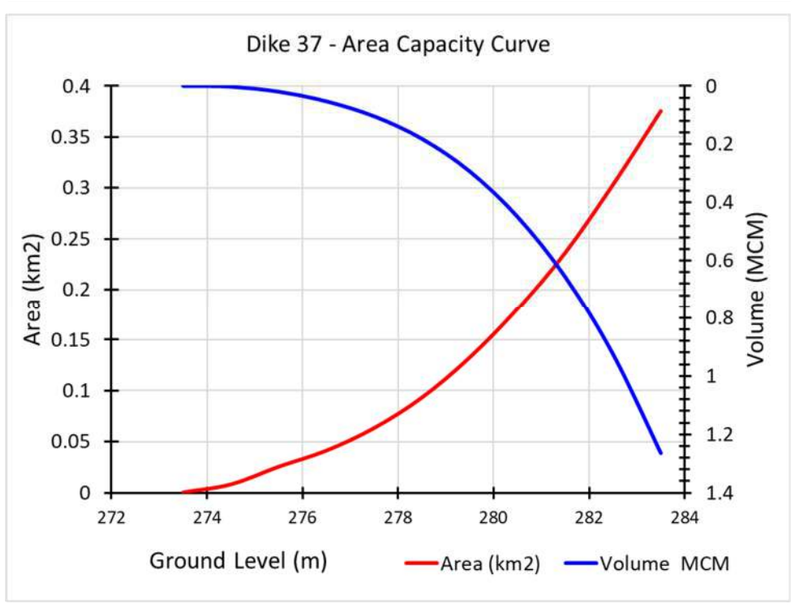

Dike 25 - Inflow and Outflow Hydrographs
Flow CMS
Time - hr
Inflow
Outflow

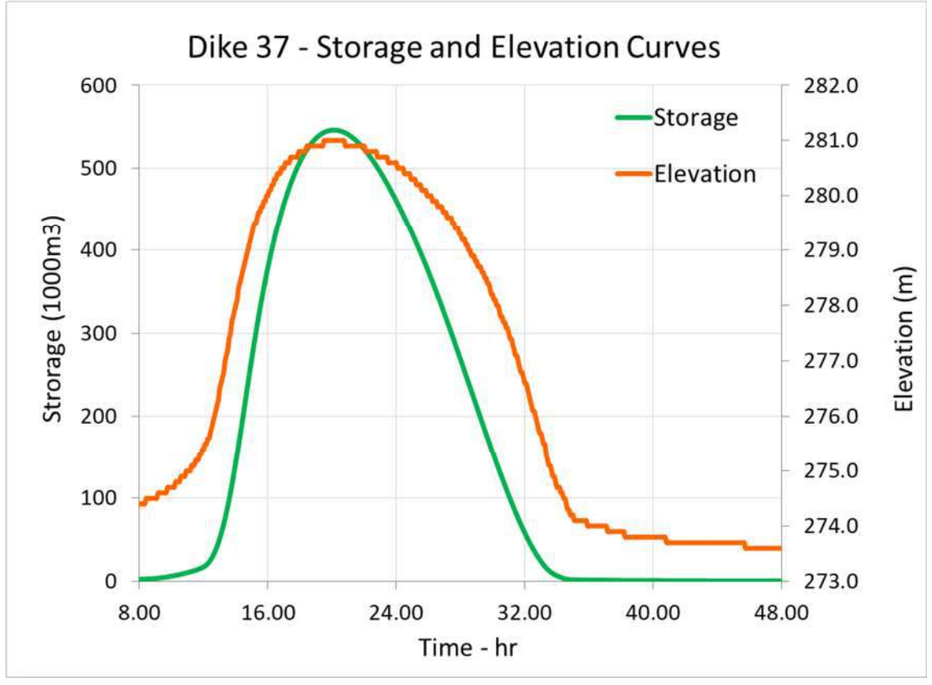

Dike 25 - Storage and Elevation Curves
Strorage (1000m3)
Elevation (m)
Time - hr
Storage
Elevation

6.3 Dike 37

Talontan
A1
D37
Ibadan-Oyo Rd
Olorisaoko
Upper Ona

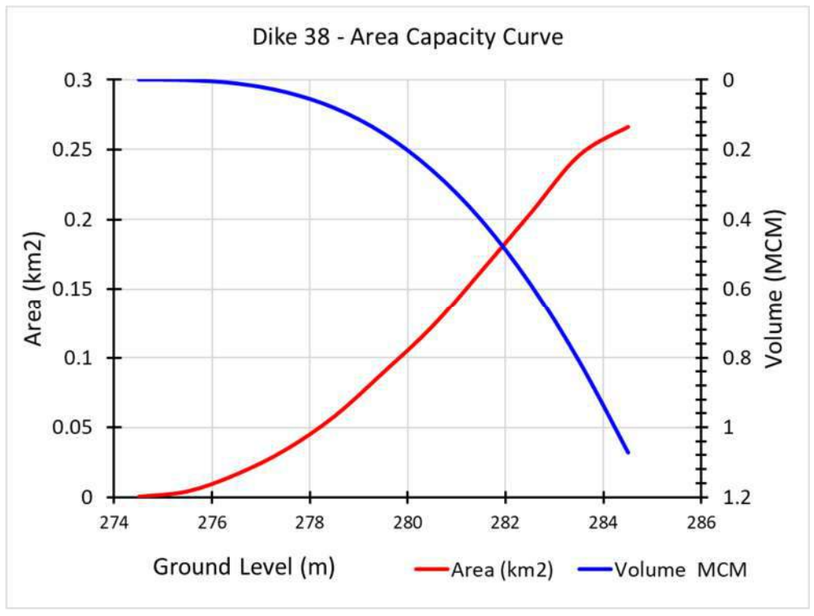

Dike 37 - Inflow and Outflow Hydrographs
Inflow
Outflow
Flow CMS
Time - hr

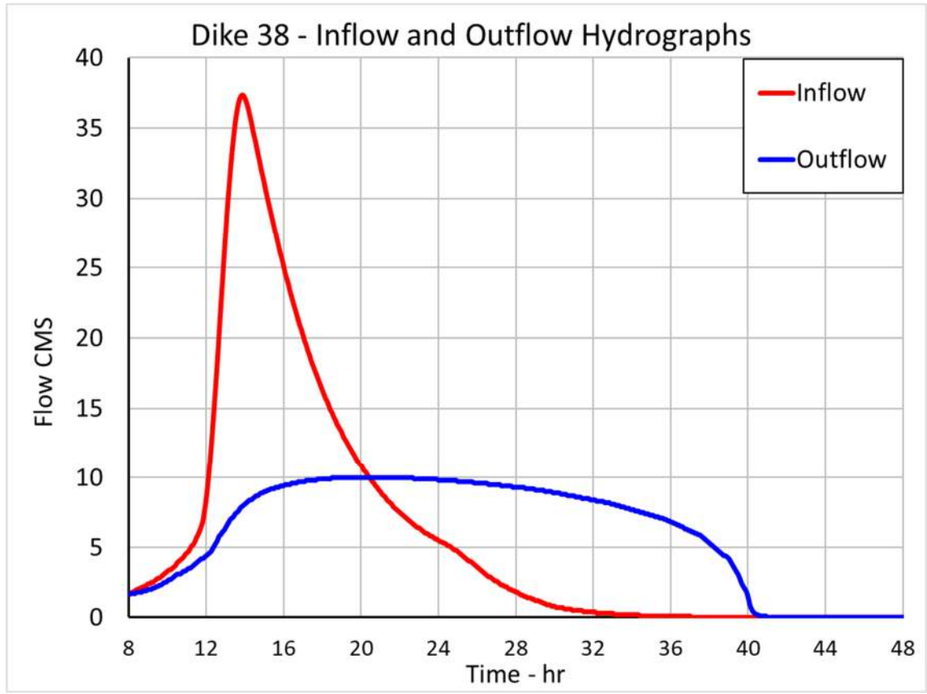

Dike 37 - Area Capacity Curve
Area (km2)
Volume (MCM)
Ground Level (m)
Area (km2)
Volume MCM

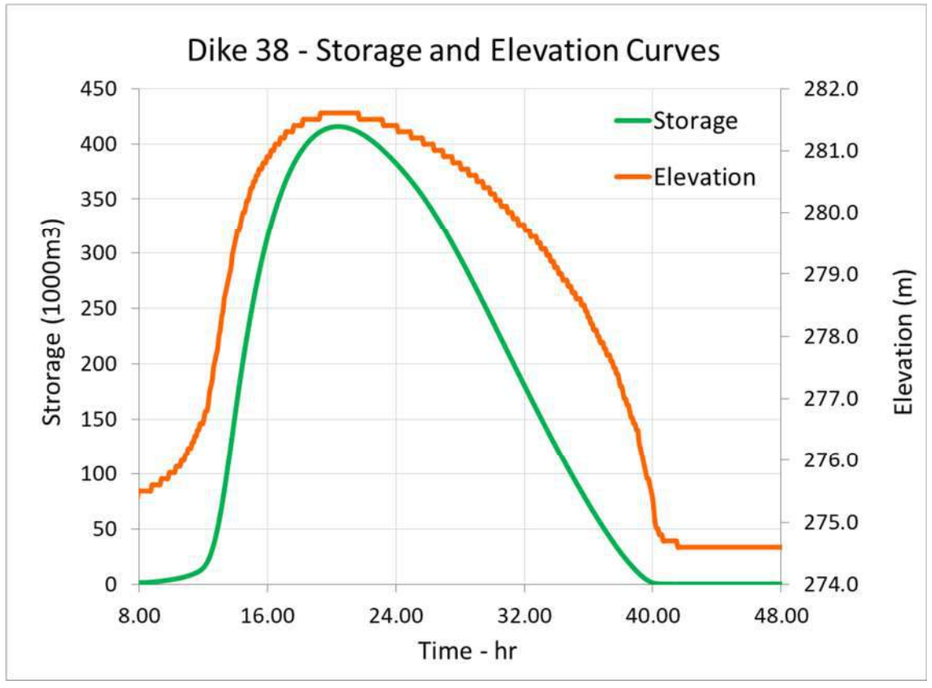

Dike 37 - Storage and Elevation Curves
Storage
Elevation
Strorage (1000m3)
Elevation (m)
Time - hr

6.4 Dike 38

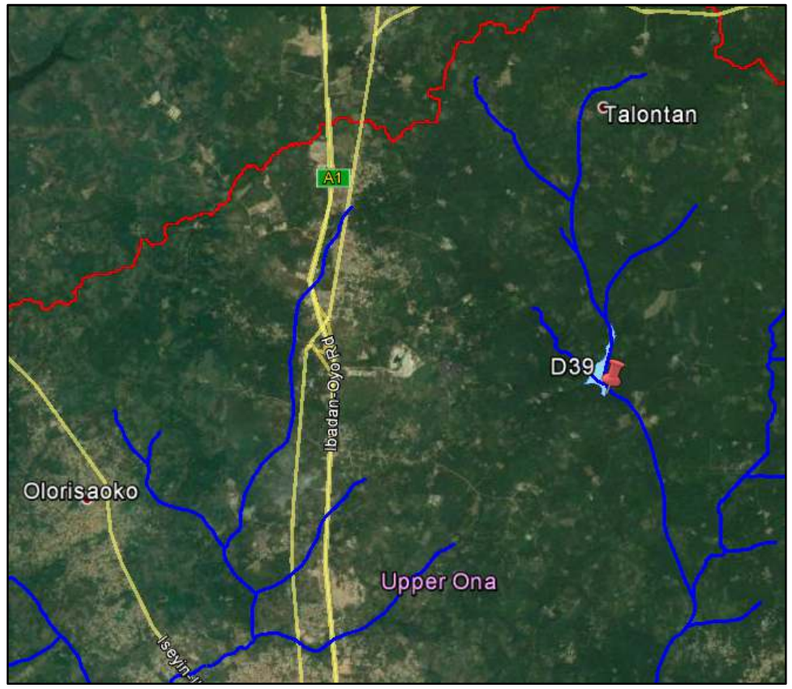
Talontan
A1
D38
Ibadan-Oyo Rd
Olorisaoko
Upper Ona

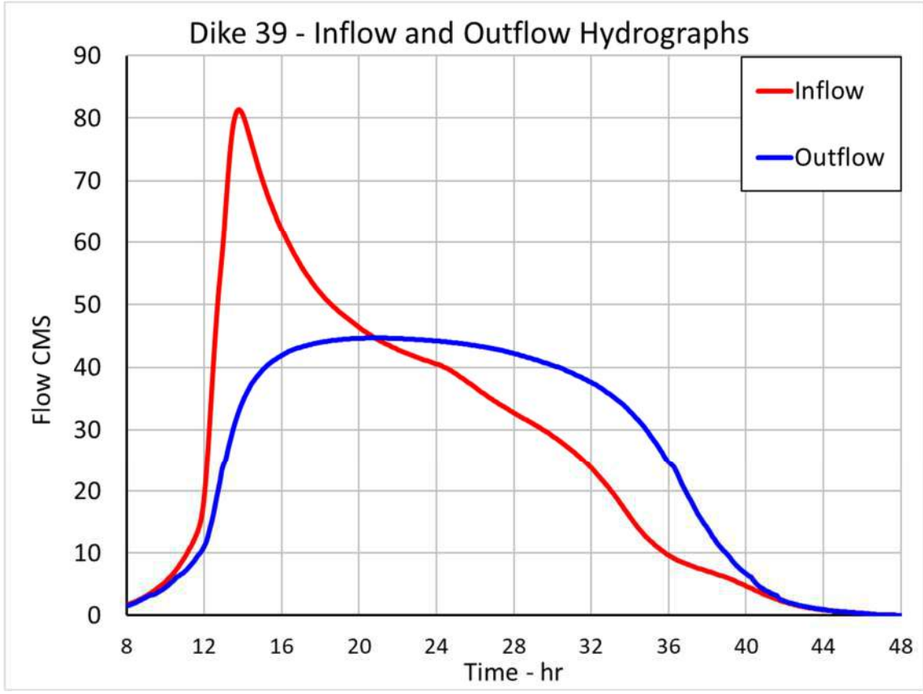

Dike 38 - Area Capacity Curve
Area (km2)
Volume (MCM)
Ground Level (m)
Area (km2)
Volume MCM

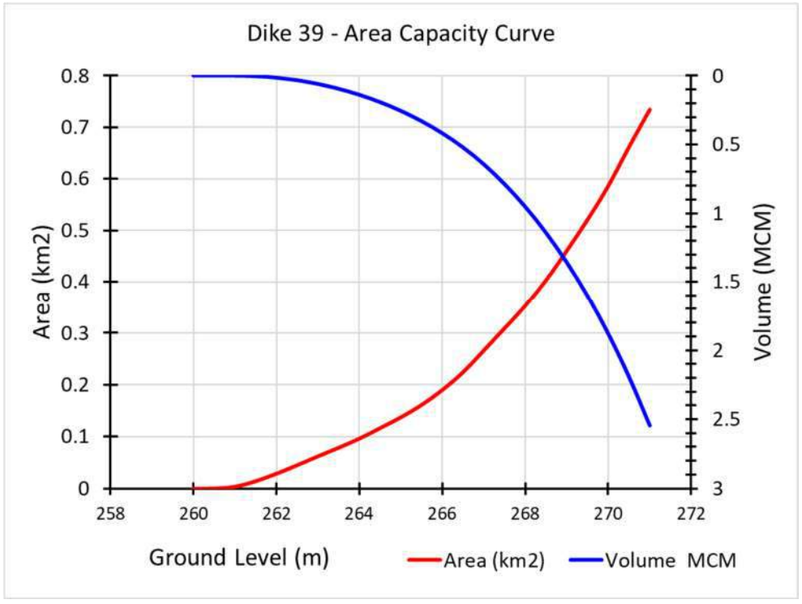

Dike 38 - Inflow and Outflow Hydrographs
Flow CMS
Time - hr
Inflow
Outflow

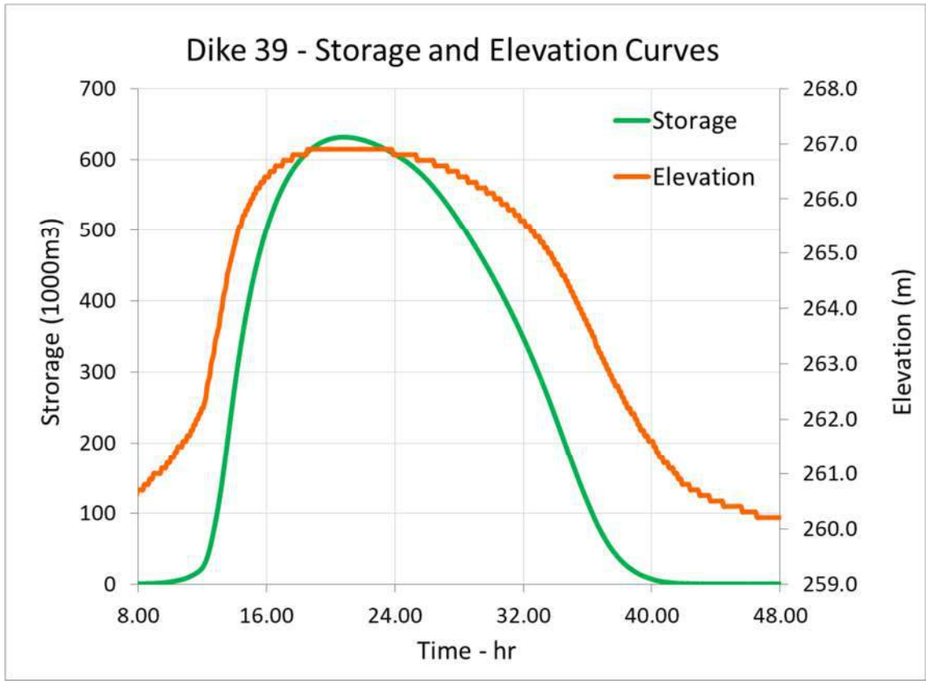

Dike 38 - Storage and Elevation Curves
Strorage (1000m3)
Elevation (m)
Time - hr
Storage
Elevation

6.5 Dike 39

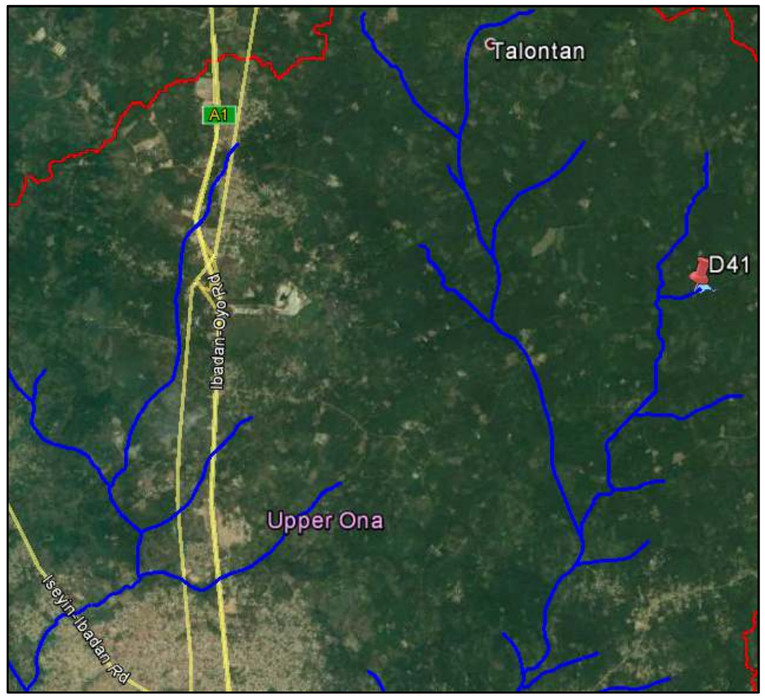

Talontan
A1
D39
Ibadan-Ojo Rd
Olorisaoko
Upper Ona

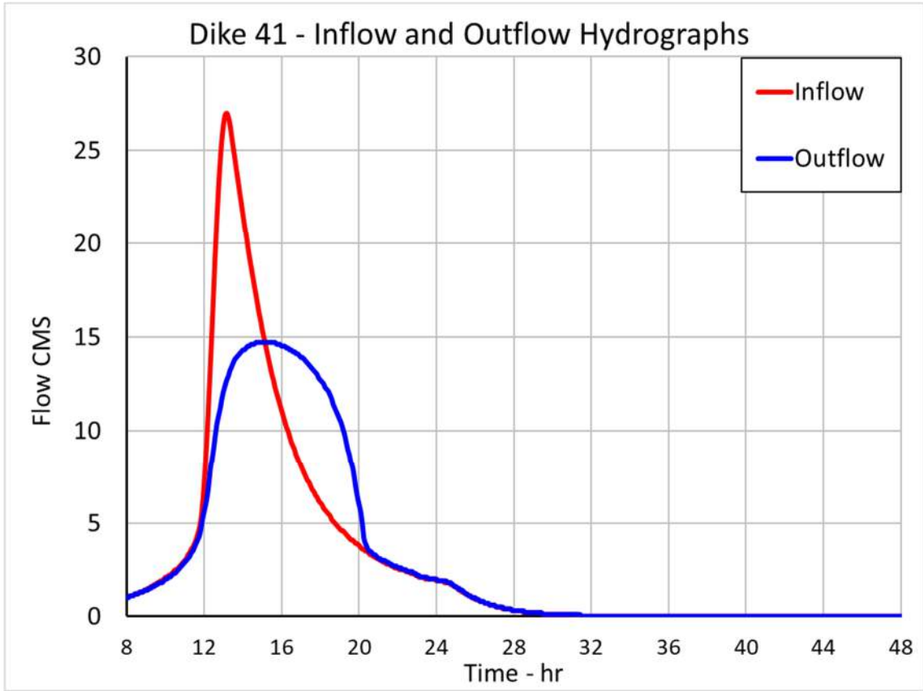

Dike 39 - Inflow and Outflow Hydrographs
Inflow
Outflow
Flow CMS
Time - hr
0
10
20
30
40
50
60
70
80
90
8
12
16
20
24
28
32
36
40
44
48

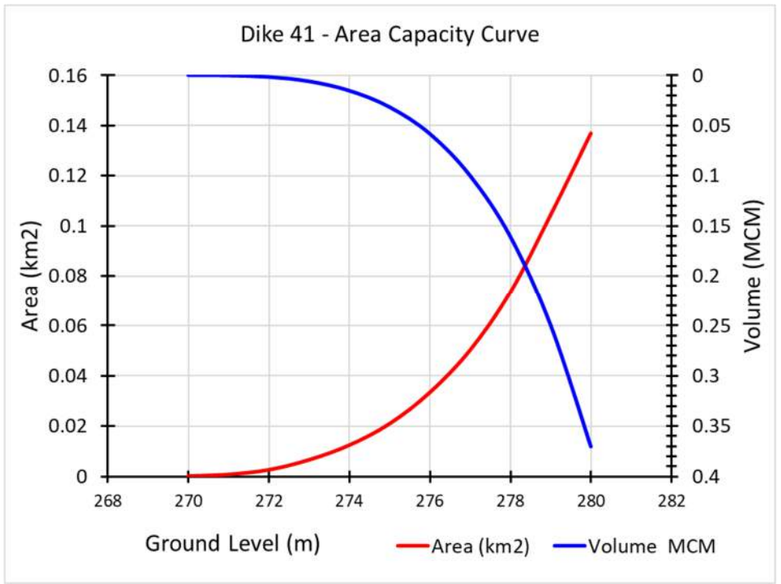

Dike 39 - Area Capacity Curve
Area (km2)
Volume (MCM)
Ground Level (m)
Area (km2)
Volume MCM
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0
0.5
1
1.5
2
2.5
3
258
260
262
264
266
268
270
272

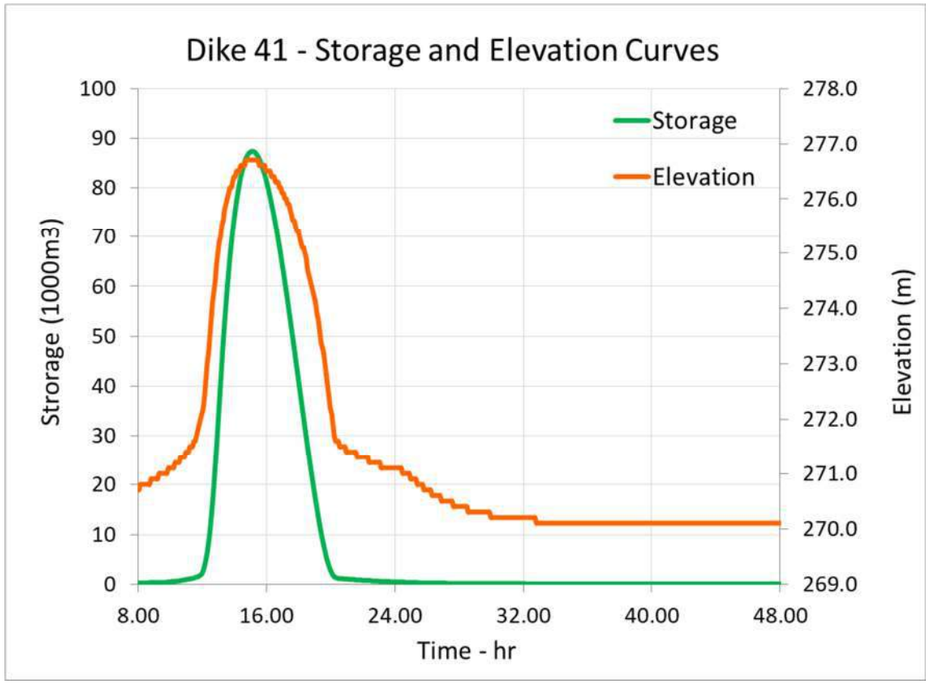

Dike 39 - Storage and Elevation Curves
Storage
Elevation
Strorage (1000m3)
Elevation (m)
Time - hr
0
100
200
300
400
500
600
700
259.0
260.0
261.0
262.0
263.0
264.0
265.0
266.0
267.0
268.0
8.00
16.00
24.00
32.00
40.00
48.00

6.6 Dike 41

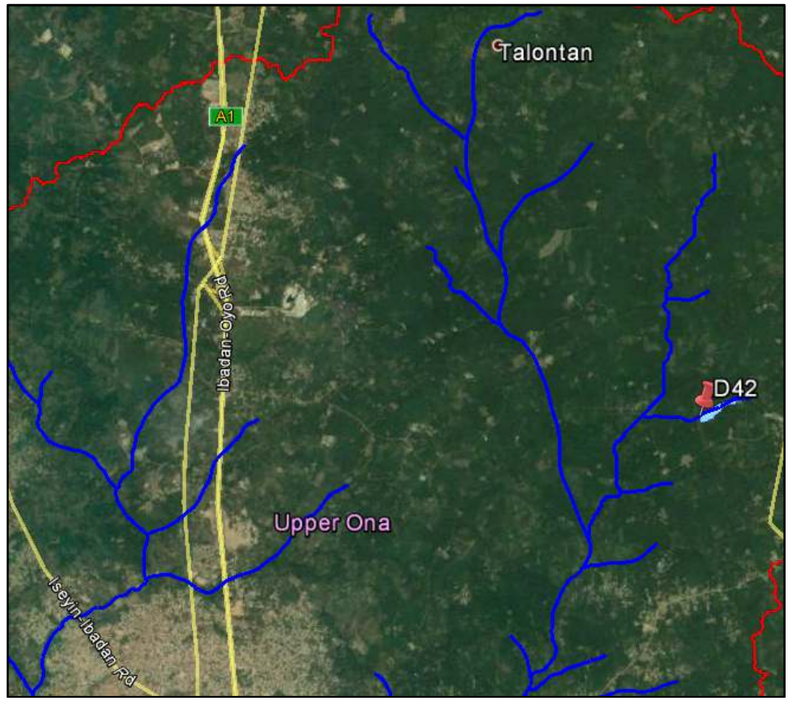

Talontan
A1
D41
Ibadan-Oyo Rd
Upper Ona
Iseyin-Ibadan Rd

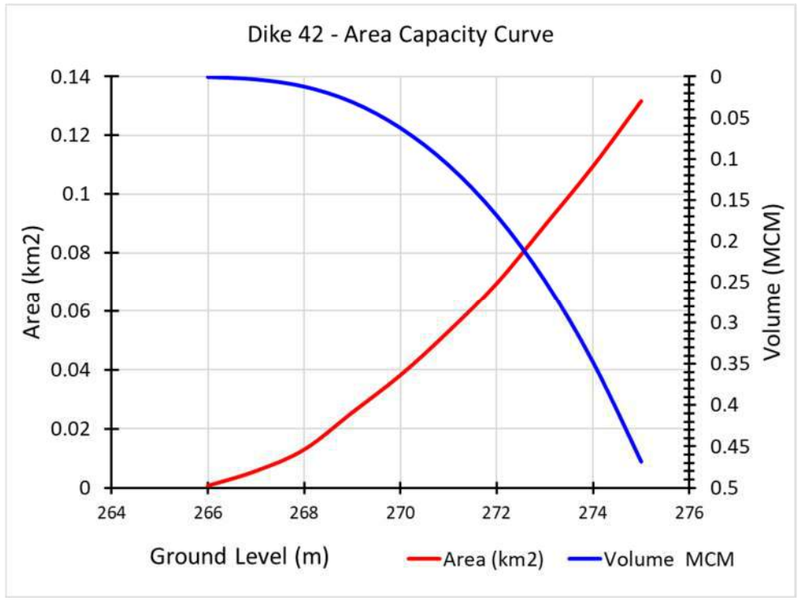

Dike 41 - Inflow and Outflow Hydrographs
Inflow
Outflow
Flow CMS
Time - hr

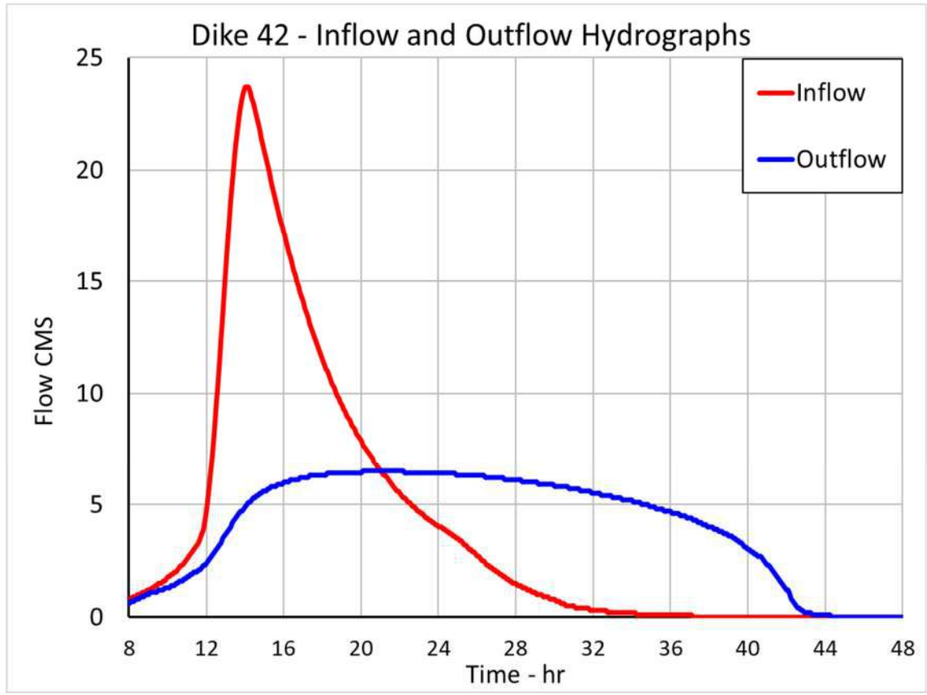

Dike 41 - Area Capacity Curve
Area (km2)
Volume (MCM)
Ground Level (m)
Area (km2)
Volume MCM

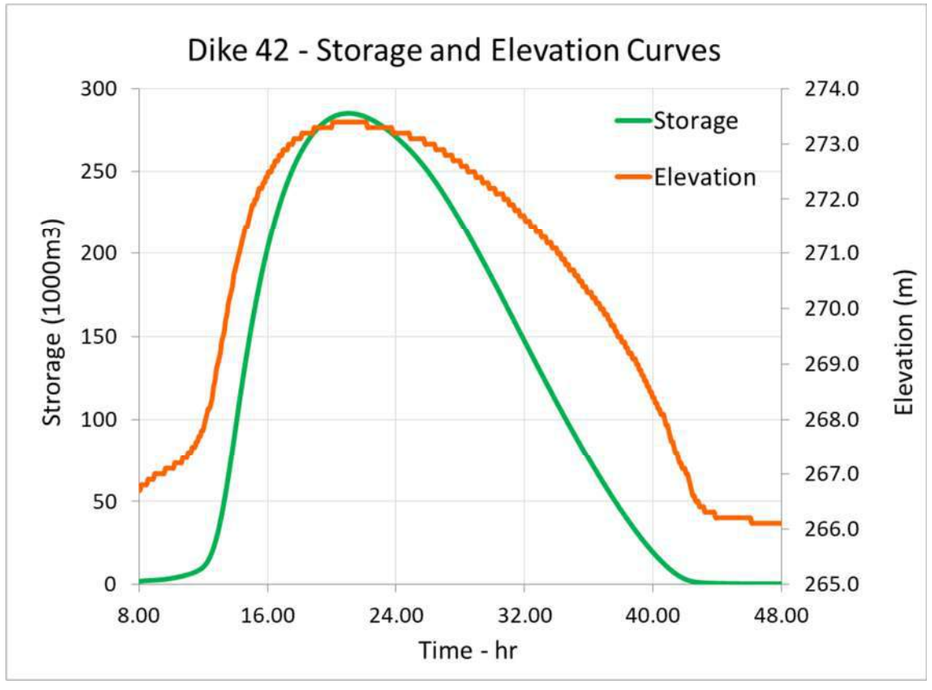

Dike 41 - Storage and Elevation Curves
Storage
Elevation
Strorage (1000m3)
Elevation (m)
Time - hr

6.7 Dike 42

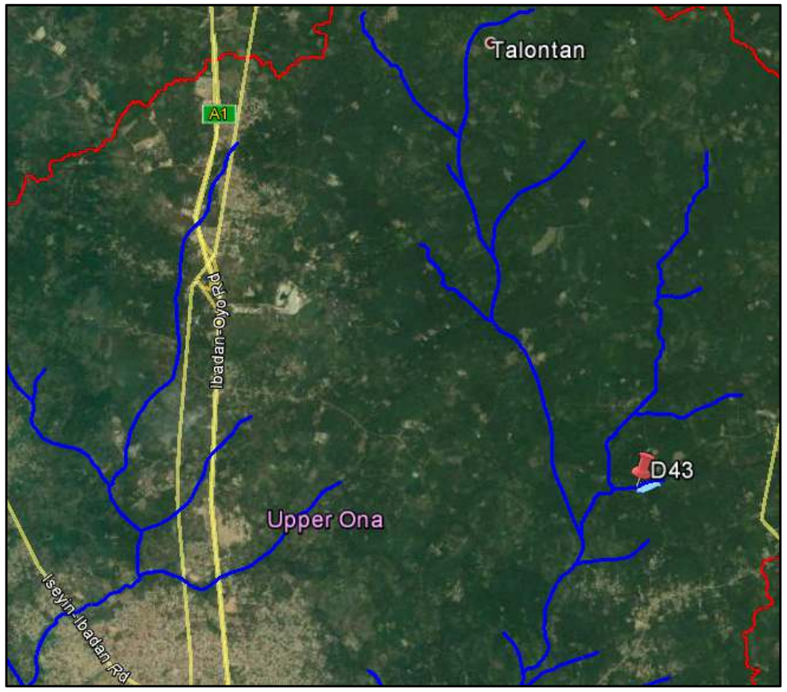

Talontan
A1
Ibadan-Oyo Rd
D42
Upper Ona
Iseyin-Ibadan Rd

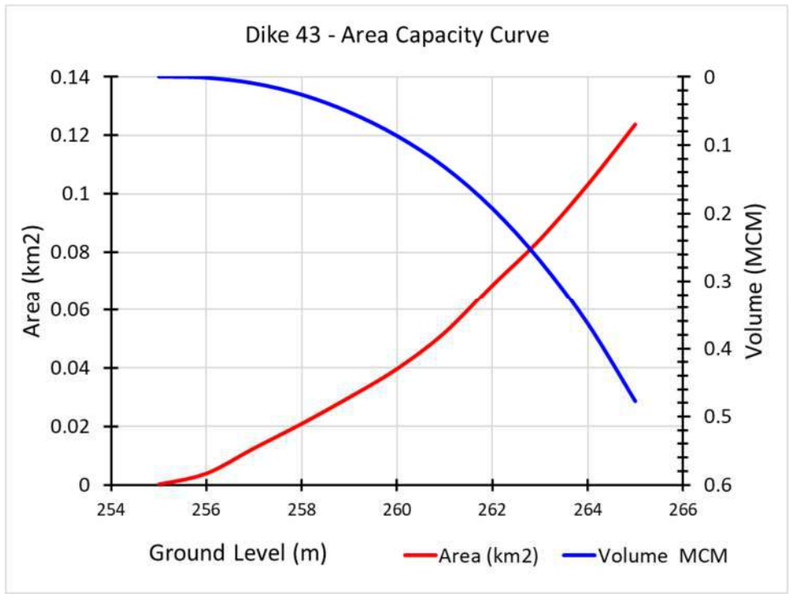

Dike 42 - Area Capacity Curve
Area (km2)
Volume (MCM)
Ground Level (m)
Area (km2)
Volume MCM

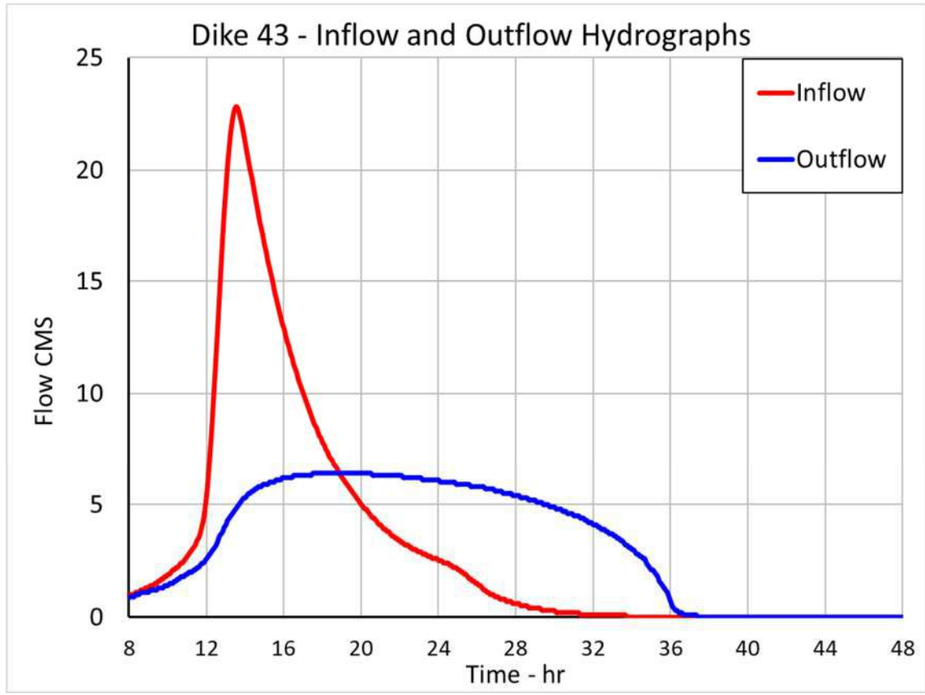

Dike 42 - Inflow and Outflow Hydrographs
Flow CMS
Time - hr
Inflow
Outflow

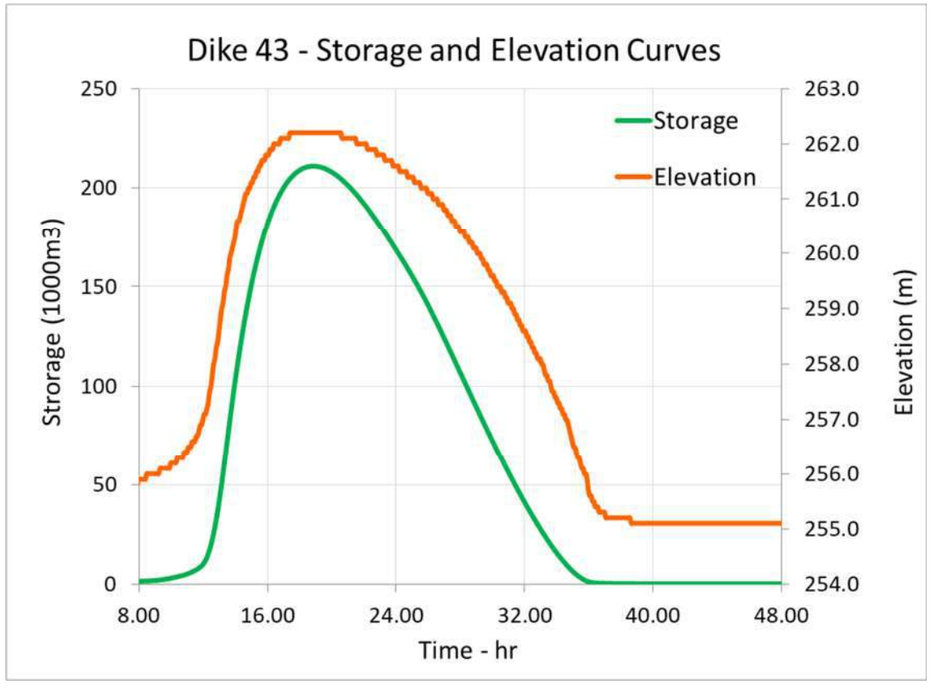

Dike 42 - Storage and Elevation Curves
Strorage (1000m3)
Elevation (m)
Time - hr
Storage
Elevation

6.8 Dike 43

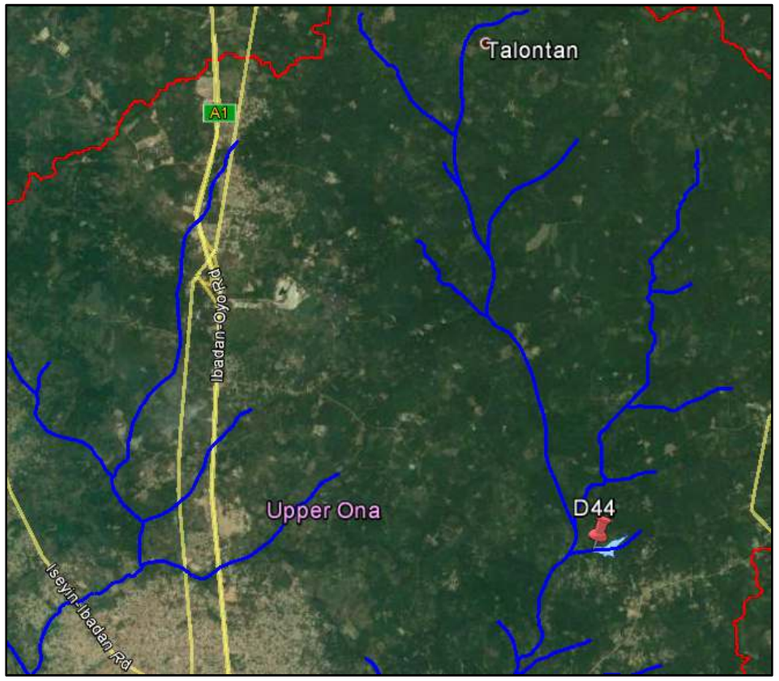

Talontan
A1
Ibadan-Oyo Rd
D43
Upper Ona
Iseyin-Ibadan Rd

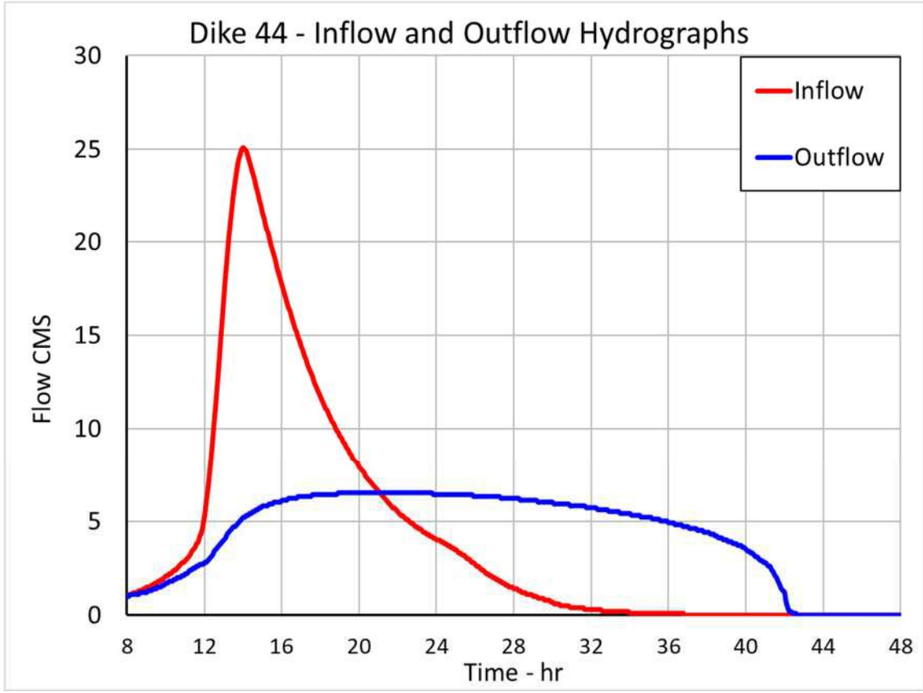

Dike 43 - Area Capacity Curve
Area (km2)
Volume (MCM)
Ground Level (m)
Area (km2)
Volume MCM

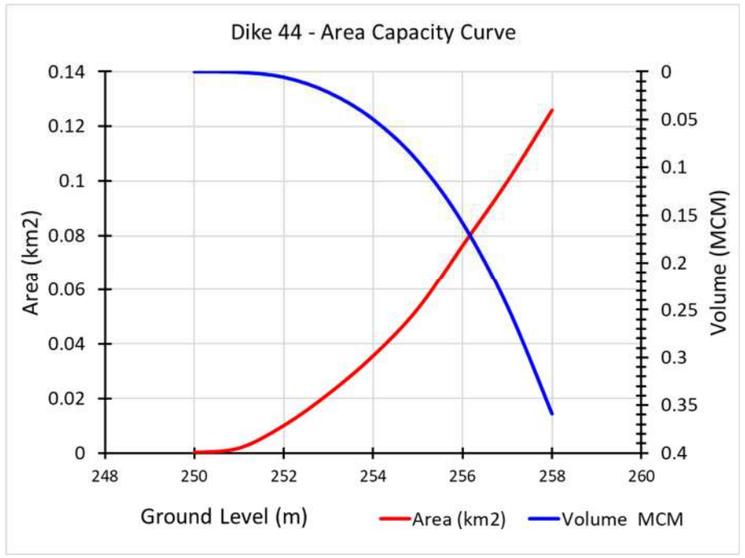

Dike 43 - Inflow and Outflow Hydrographs
Flow CMS
Time - hr
Inflow
Outflow

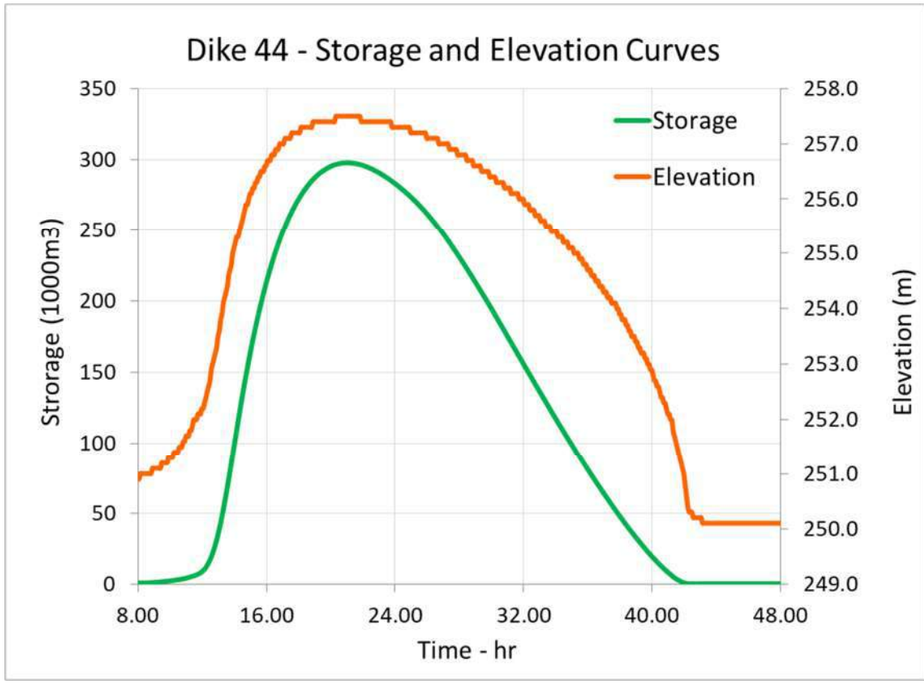

Dike 43 - Storage and Elevation Curves
Strorage (1000m3)
Elevation (m)
Time - hr
Storage
Elevation

6.9 Dike 44


Talontan
A1
Ibadan-Ojoro Rd
Upper Ona
D44
Isevin-Ibadan Rd

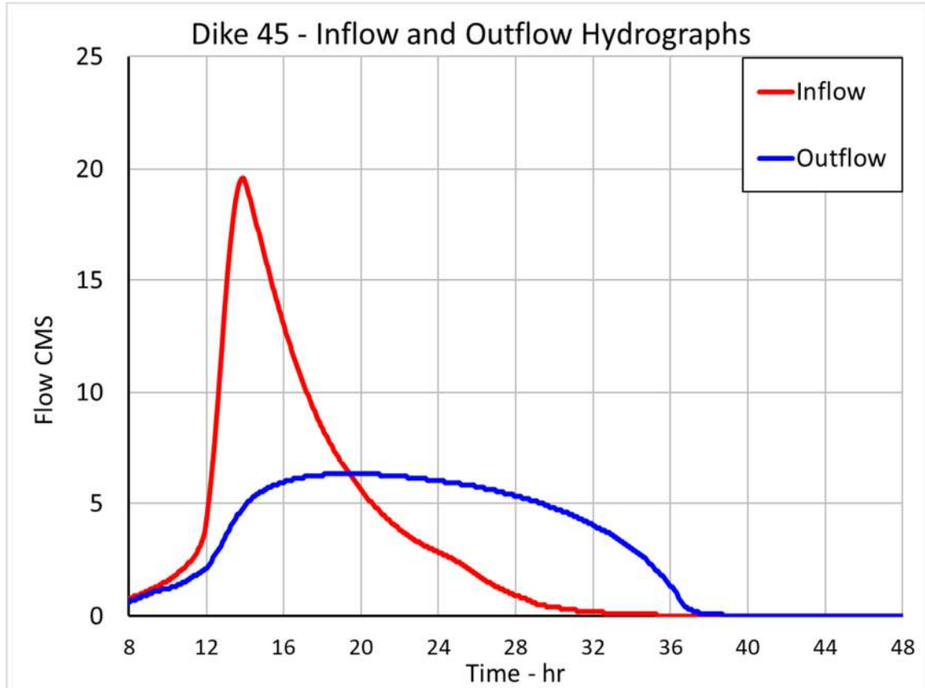

Dike 44 - Inflow and Outflow Hydrographs
Inflow
Outflow
Flow CMS
Time - hr
0
5
10
15
20
25
30
8
12
16
20
24
28
32
36
40
44
48

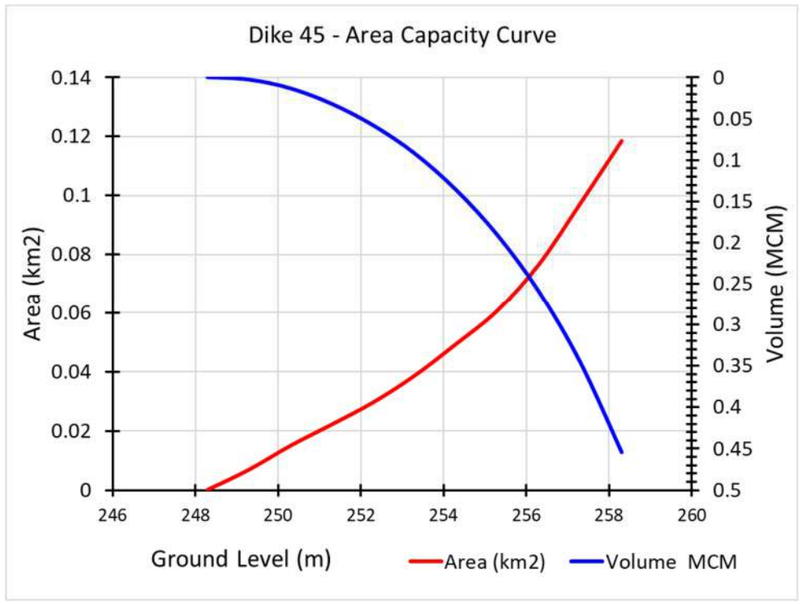

Dike 44 - Area Capacity Curve
Area (km2)
Volume (MCM)
Ground Level (m)
Area (km2)
Volume MCM
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
248
250
252
254
256
258
260

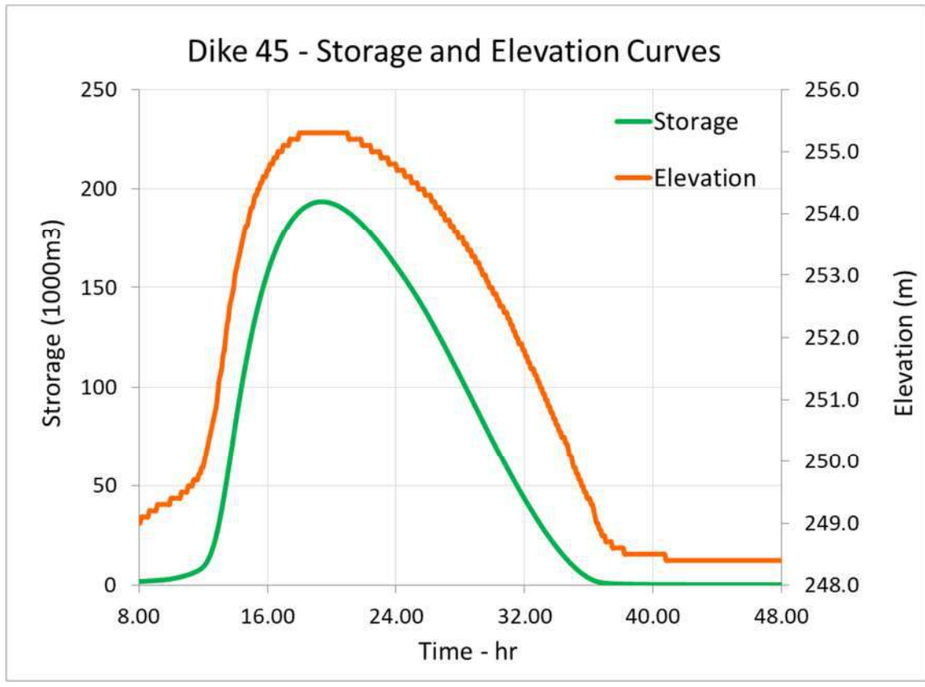

Dike 44 - Storage and Elevation Curves
Storage
Elevation
Strorage (1000m3)
Elevation (m)
Time - hr
0
50
100
150
200
250
300
350
249.0
250.0
251.0
252.0
253.0
254.0
255.0
256.0
257.0
258.0
8.00
16.00
24.00
32.00
40.00
48.00

6.10 Dike 45

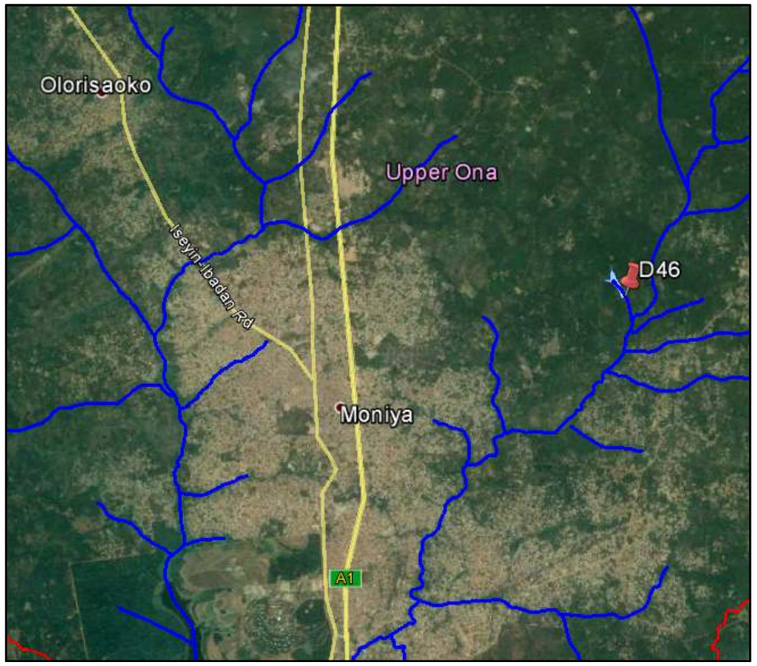
Olorisaoko
Upper Ona
Iseyin-Ibadan Rd
D45
Moniya
A1

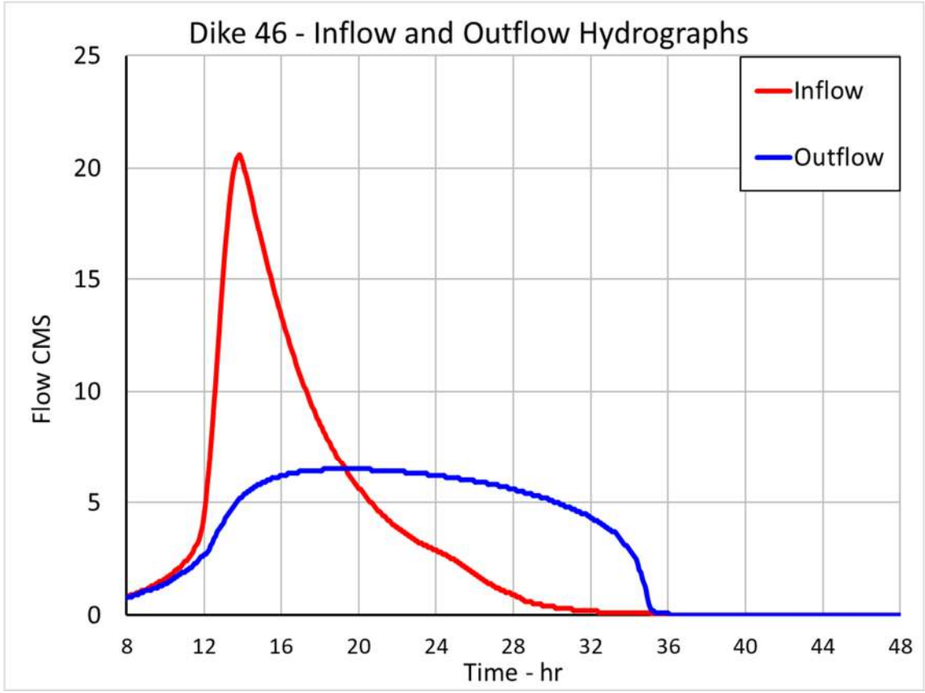

Dike 45 - Inflow and Outflow Hydrographs
Inflow
Outflow
Flow CMS
Time - hr
0
5
10
15
20
25
8
12
16
20
24
28
32
36
40
44
48

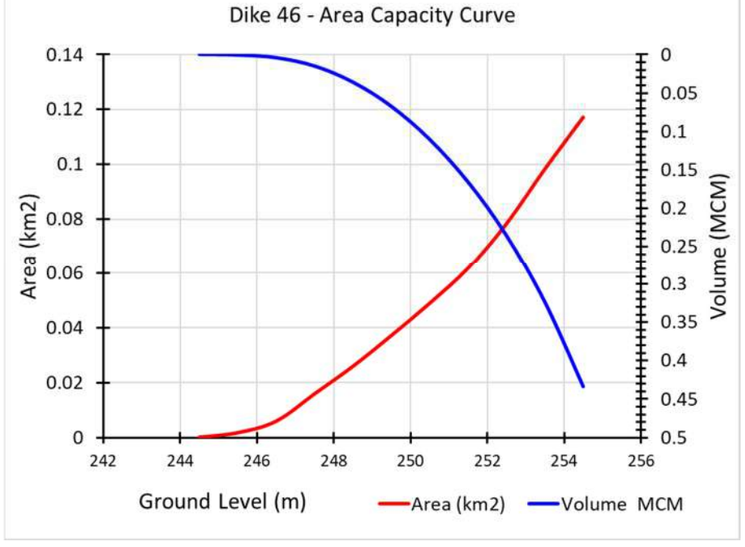

Dike 45 - Area Capacity Curve
Area (km2)
Volume (MCM)
Ground Level (m)
Area (km2)
Volume MCM
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
246
248
250
252
254
256
258
260

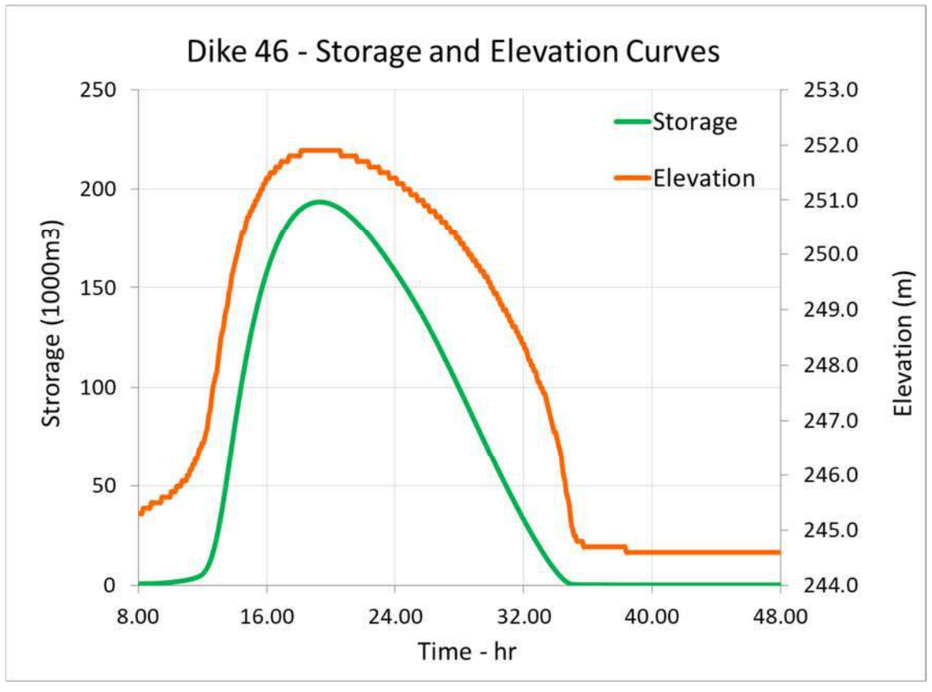

Dike 45 - Storage and Elevation Curves
Storage
Elevation
Strorage (1000m3)
Elevation (m)
Time - hr
0
50
100
150
200
250
248.0
249.0
250.0
251.0
252.0
253.0
254.0
255.0
256.0
8.00
16.00
24.00
32.00
40.00
48.00

6.11 Dike 46

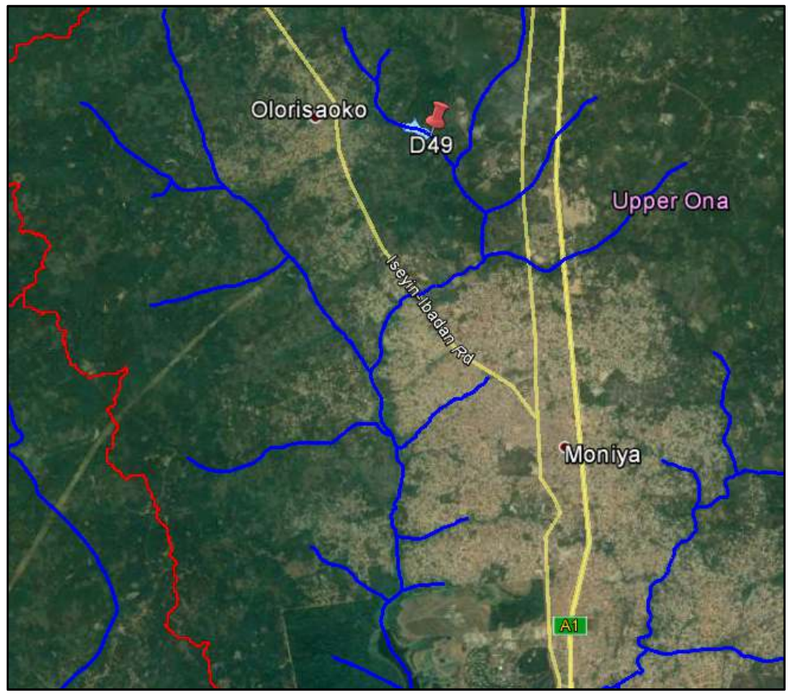

Olorisaoko
Upper Ona
Iseyin-Ibadan Rd
D46
Moniya
A1

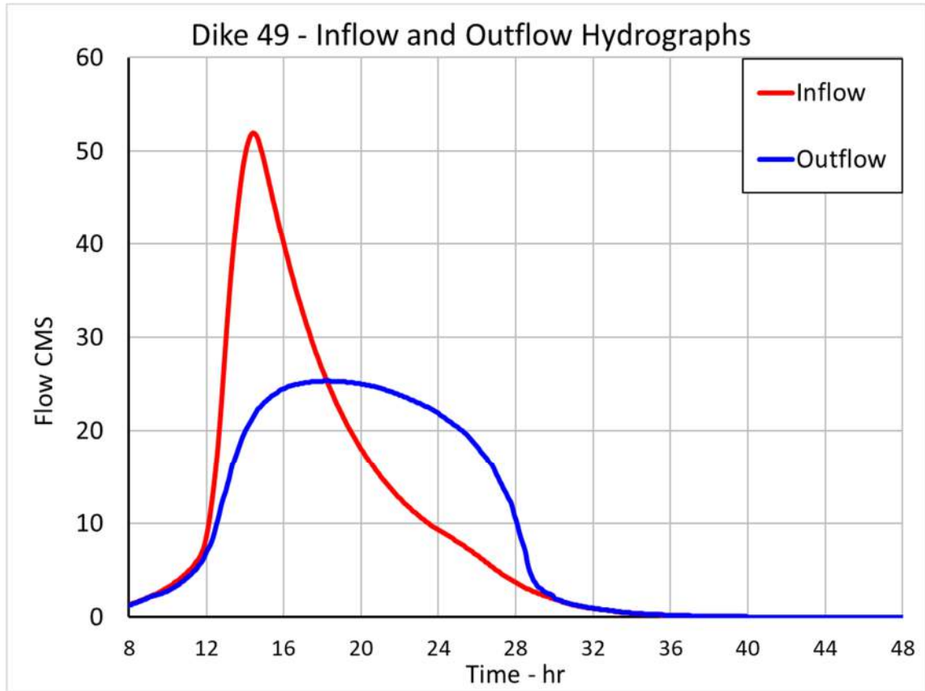

Dike 46 - Inflow and Outflow Hydrographs
Inflow
Outflow
Flow CMS
Time - hr
0
5
10
15
20
25
8
12
16
20
24
28
32
36
40
44
48

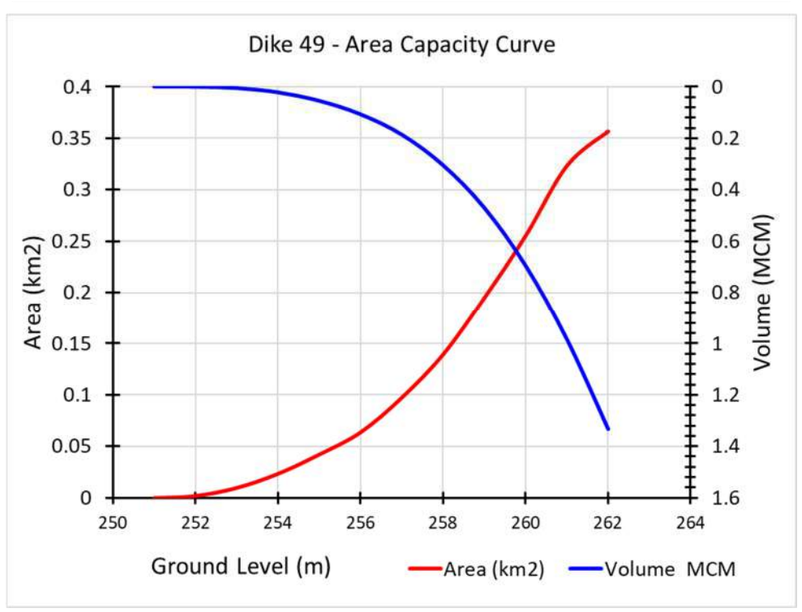

Dike 46 - Area Capacity Curve
Area (km2)
Volume (MCM)
Ground Level (m)
Area (km2)
Volume MCM
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
242
244
246
248
250
252
254
256

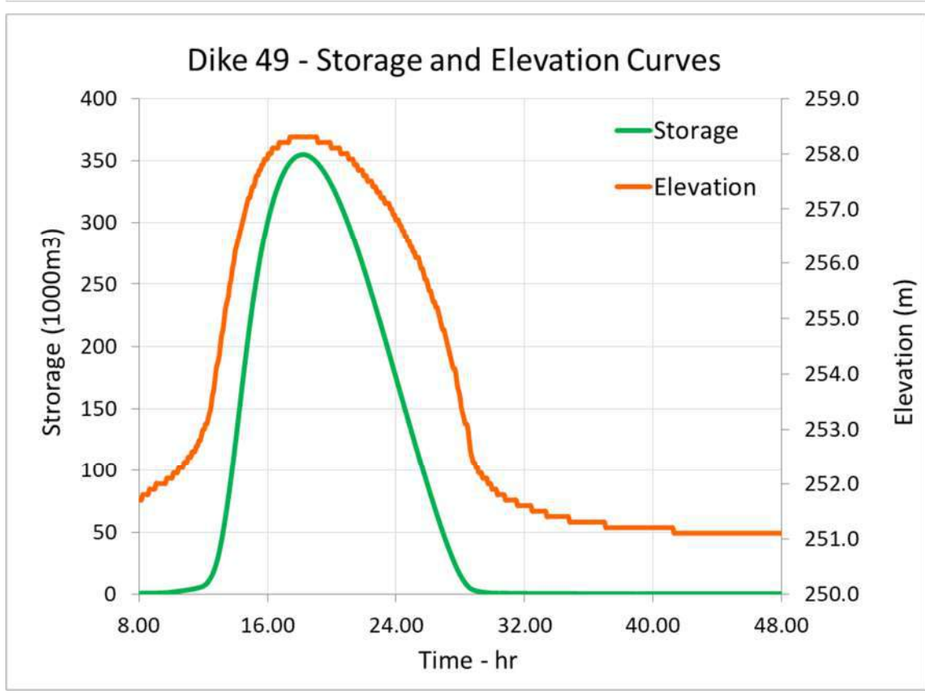

Dike 46 - Storage and Elevation Curves
Storage
Elevation
Strorage (1000m3)
Elevation (m)
Time - hr
0
50
100
150
200
250
244.0
245.0
246.0
247.0
248.0
249.0
250.0
251.0
252.0
253.0
8.00
16.00
24.00
32.00
40.00
48.00

6.12 Dike 49


Olorisaoko
D49
Upper Ona
Iseyin-Ibadan Rd
Moniya
A1

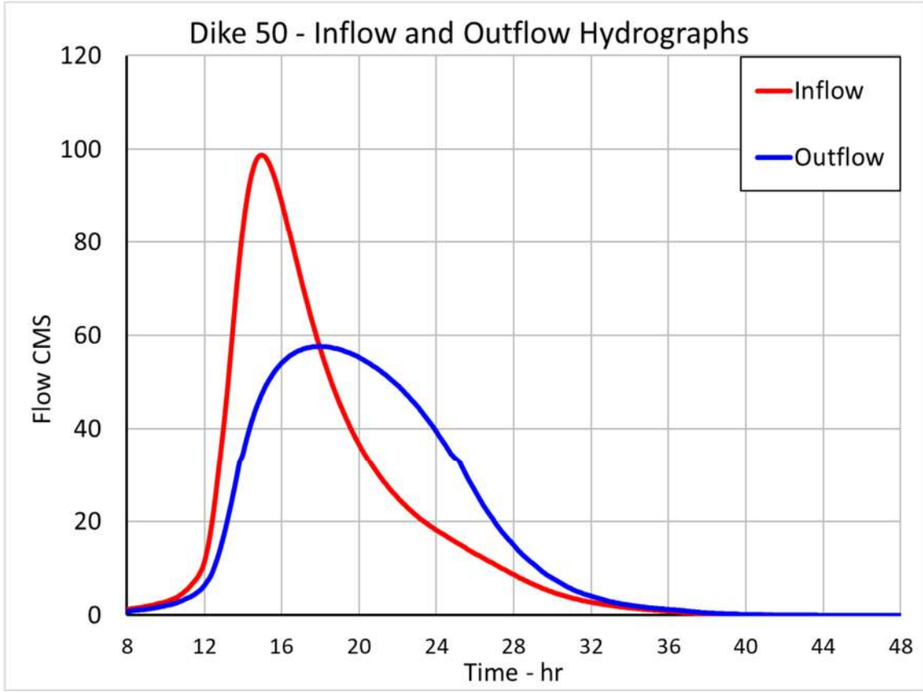

Dike 49 - Inflow and Outflow Hydrographs
Inflow
Outflow
Flow CMS
Time - hr

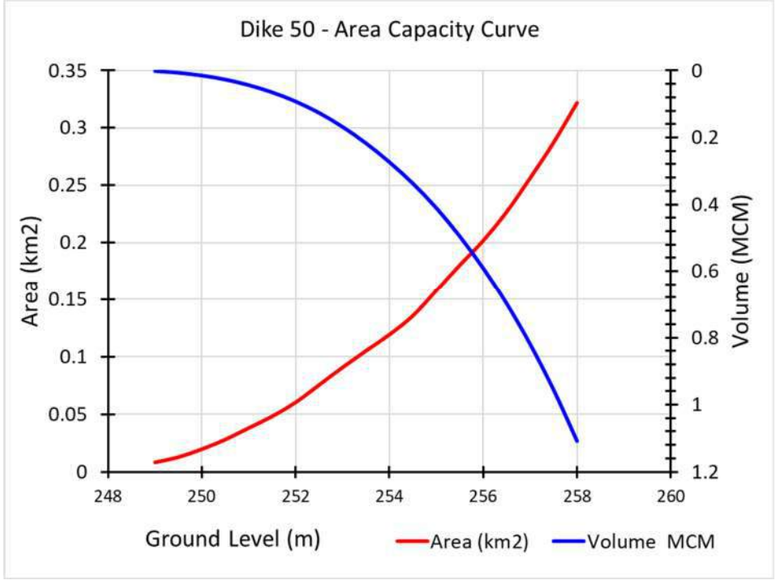

Dike 49 - Area Capacity Curve
Area (km2)
Volume (MCM)
Ground Level (m)
Area (km2)
Volume MCM

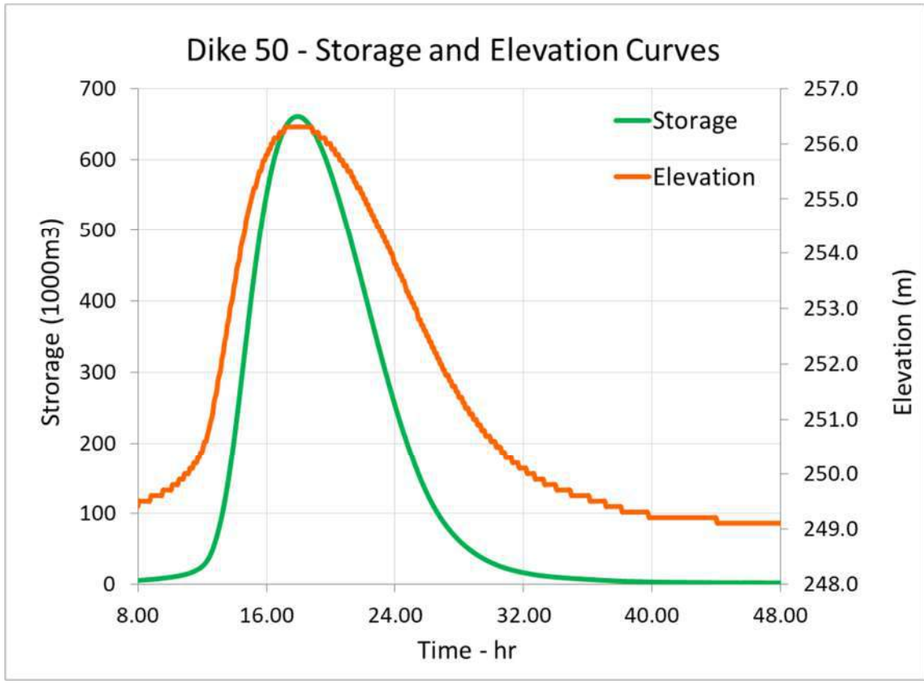

Dike 49 - Storage and Elevation Curves
Storage
Elevation
Strorage (1000m3)
Elevation (m)
Time - hr

6.13 Dike 50

Olorisaoko
D50
Upper Ona
Iseyin-Ibadan Rd
Moniya
A1

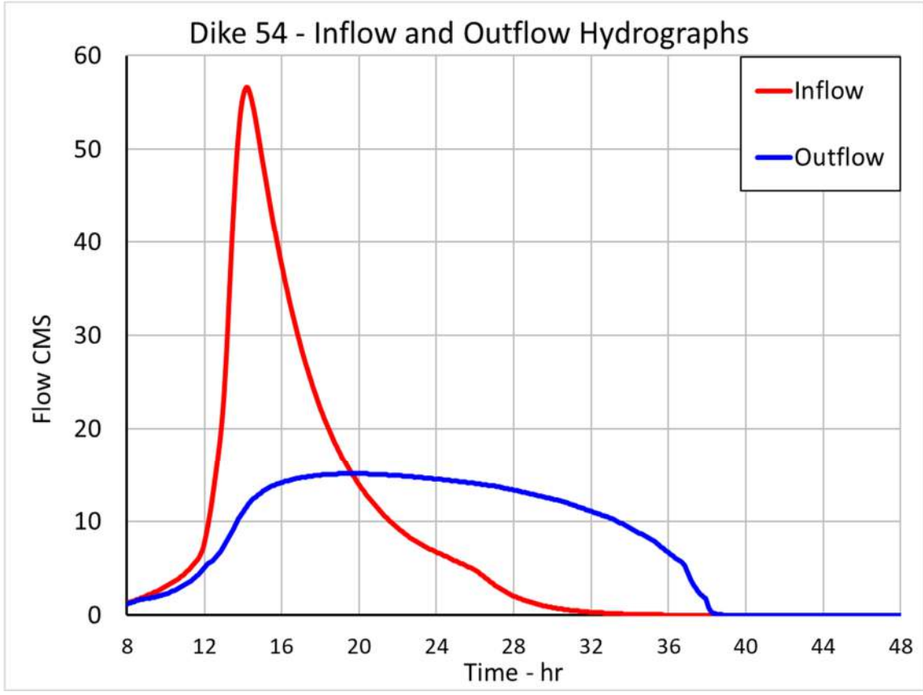

Dike 50 - Inflow and Outflow Hydrographs
Inflow
Outflow
Flow CMS
Time - hr
0
20
40
60
80
100
120
8
12
16
20
24
28
32
36
40
44
48

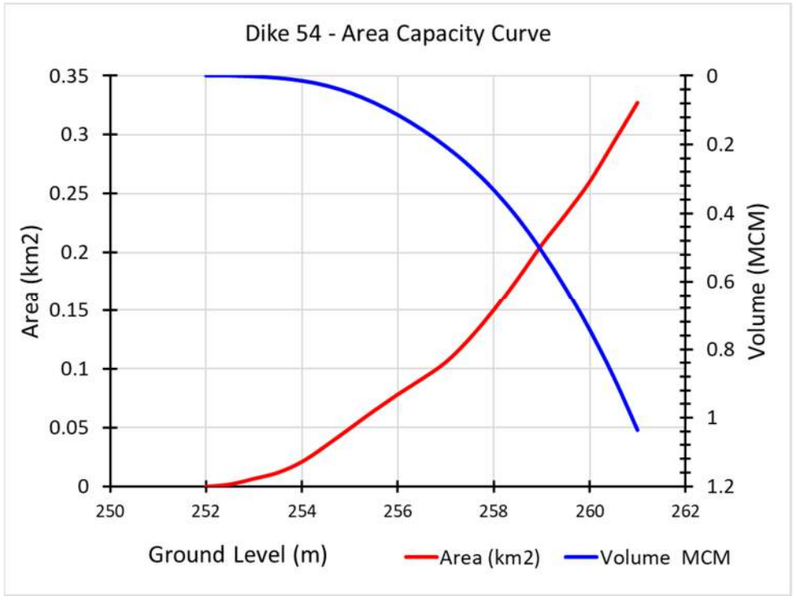

Dike 50 - Area Capacity Curve
Area (km2)
Volume (MCM)
Ground Level (m)
Area (km2)
Volume MCM
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0
0.2
0.4
0.6
0.8
1
1.2
248
250
252
254
256
258
260

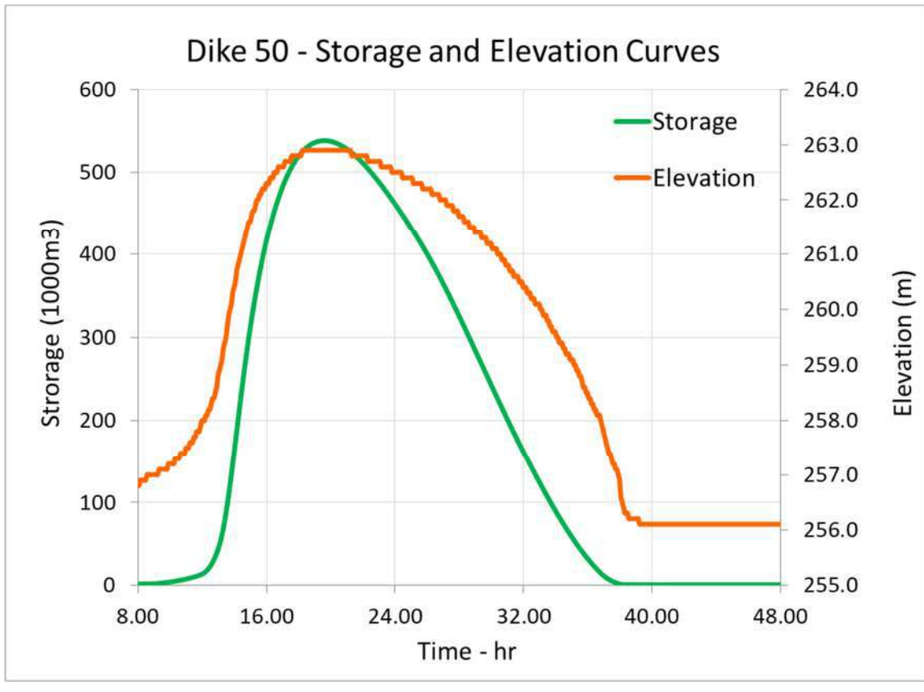

Dike 50 - Storage and Elevation Curves
Storage
Elevation
Strorage (1000m3)
Elevation (m)
Time - hr
0
100
200
300
400
500
600
700
248.0
249.0
250.0
251.0
252.0
253.0
254.0
255.0
256.0
257.0
8.00
16.00
24.00
32.00
40.00
48.00

6.14 Dike 54

D54
Olorisaoko
Upper Ona
Iseyin-Ibadan Rd
Moniya
A1

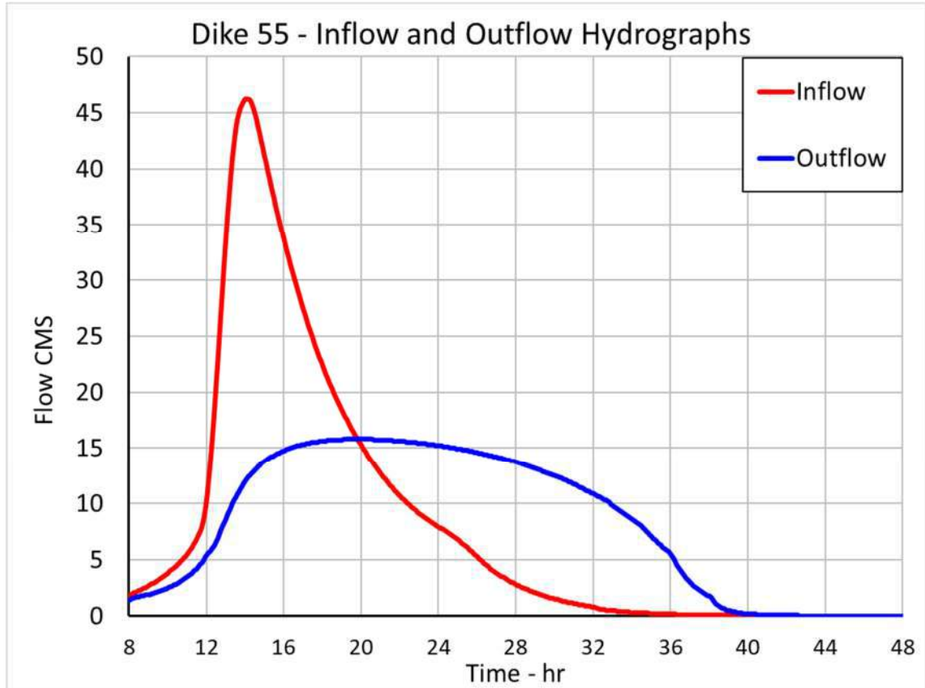

Dike 54 - Inflow and Outflow Hydrographs
Inflow
Outflow
Flow CMS
Time - hr
0
10
20
30
40
50
60
8
12
16
20
24
28
32
36
40
44
48

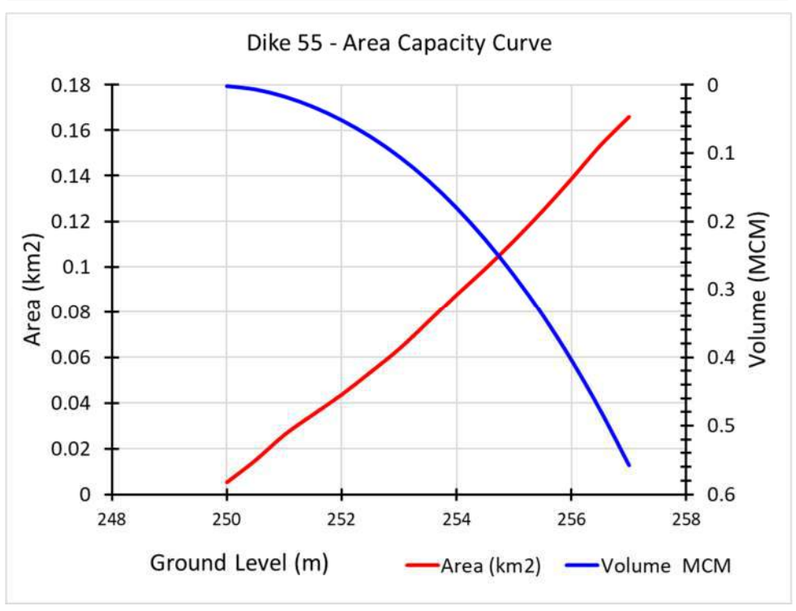

Dike 54 - Area Capacity Curve
Area (km2)
Volume (MCM)
Ground Level (m)
Area (km2)
Volume MCM
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.2
0.4
0.6
0.8
1
1.2
250
252
254
256
258
260
262

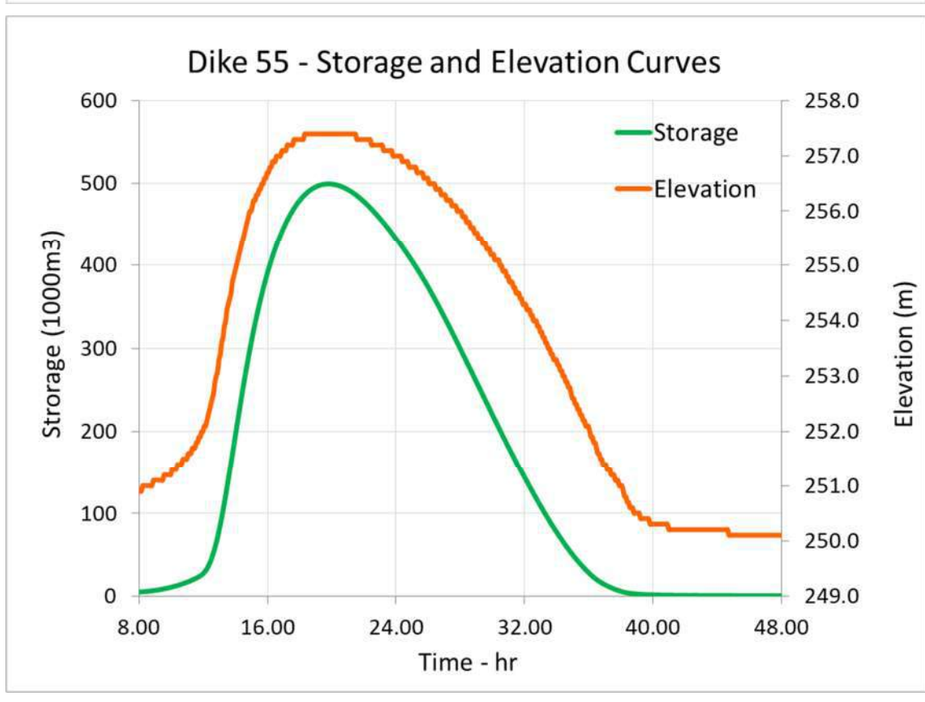

Dike 50 - Storage and Elevation Curves
Storage
Elevation
Strorage (1000m3)
Elevation (m)
Time - hr
0
100
200
300
400
500
600
255.0
256.0
257.0
258.0
259.0
260.0
261.0
262.0
263.0
264.0
8.00
16.00
24.00
32.00
40.00
48.00

6.15 Dike 55

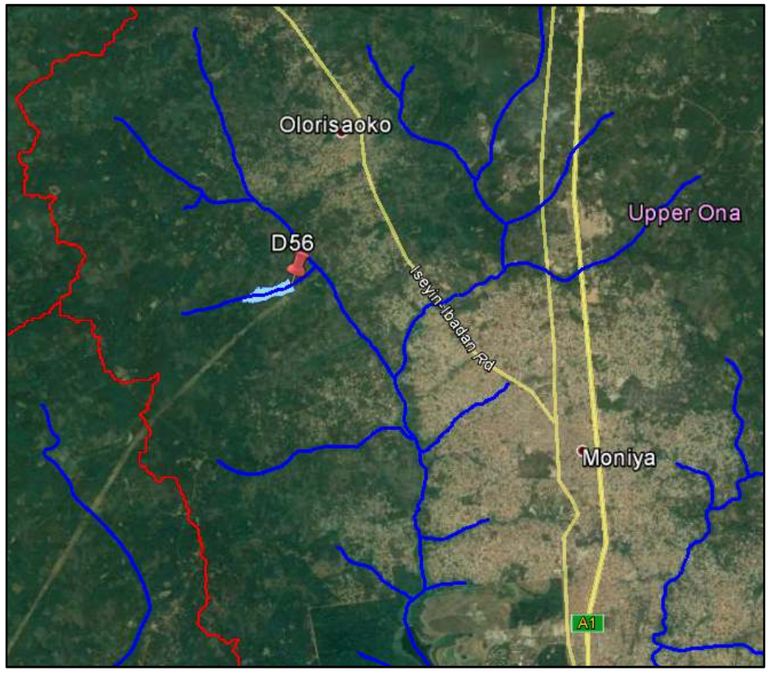
Olorisaoko
D55
Upper Ona
Iseyin-Ibadan Rd
Moniya
A1

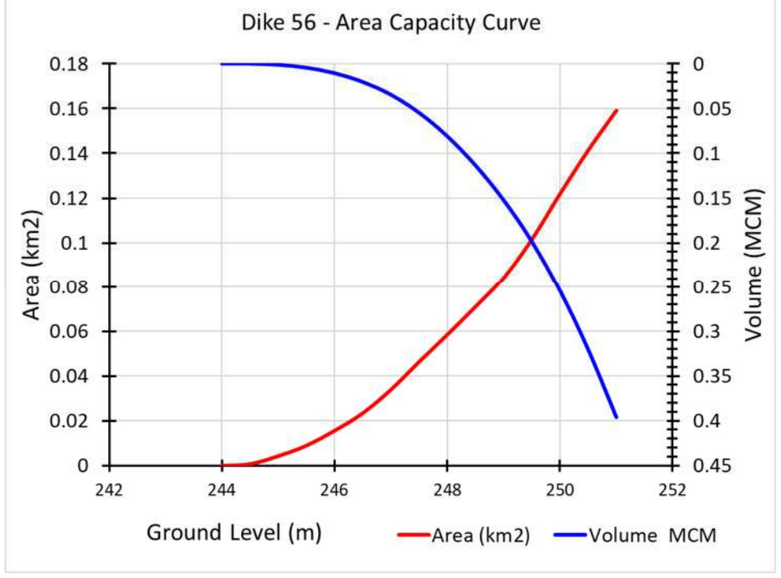

Dike 55 - Inflow and Outflow Hydrographs
Inflow
Outflow
Flow CMS
Time - hr

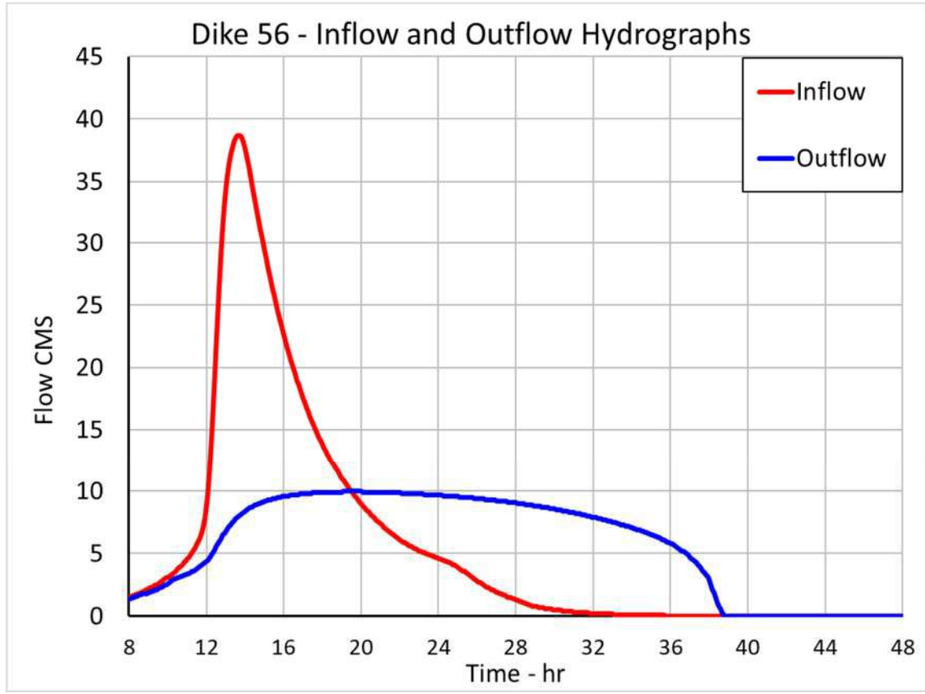

Dike 55 - Area Capacity Curve
Area (km2)
Volume (MCM)
Ground Level (m)
Area (km2)
Volume MCM

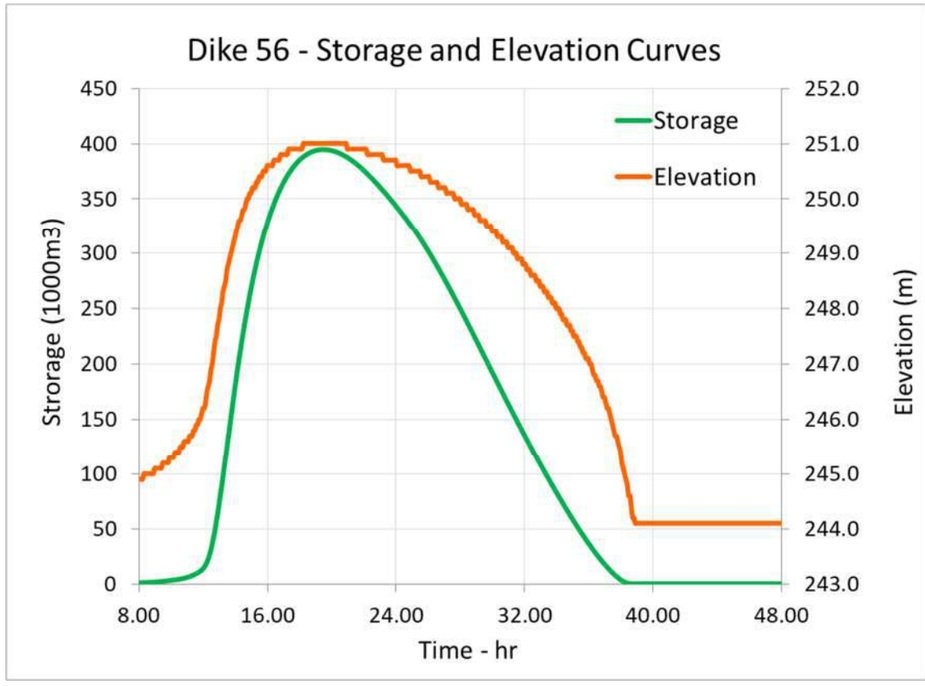

Dike 55 - Storage and Elevation Curves
Storage
Elevation
Strorage (1000m3)
Elevation (m)
Time - hr

6.16 Dike 56


Olorisaoko
Upper Ona
D56
Iseyin-Ibadan Rd
Moniya
A1

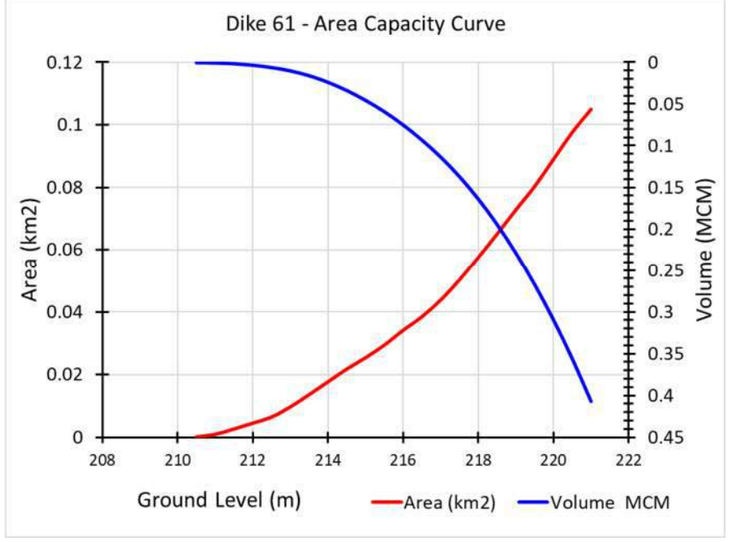

Dike 56 - Area Capacity Curve
Area (km2)
Volume (MCM)
Ground Level (m)
Area (km2)
Volume MCM

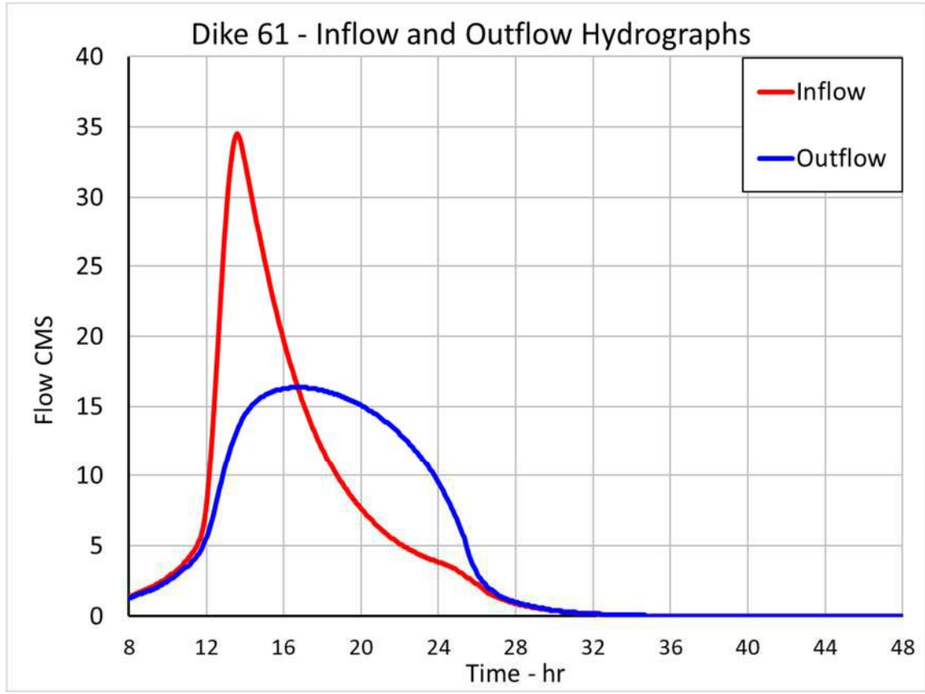

Dike 56 - Inflow and Outflow Hydrographs
Flow CMS
Time - hr
Inflow
Outflow

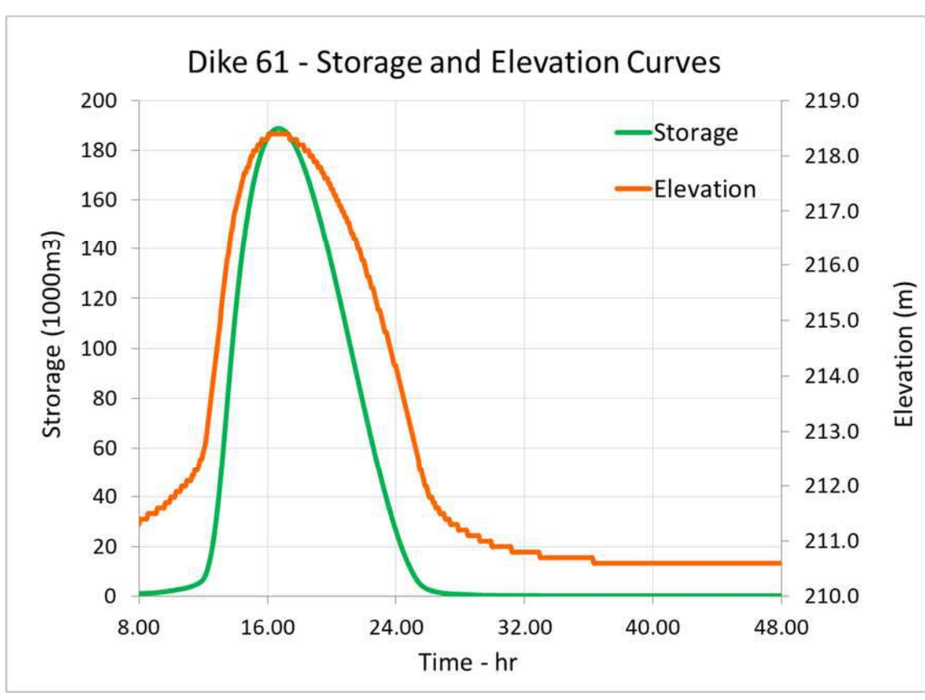

Dike 56 - Storage and Elevation Curves
Strorage (1000m3)
Elevation (m)
Time - hr
Storage
Elevation

6.17 Dike 61

IITA
Inalende
Middle Ona
D61
Eleyele Reservoir
Eleyele

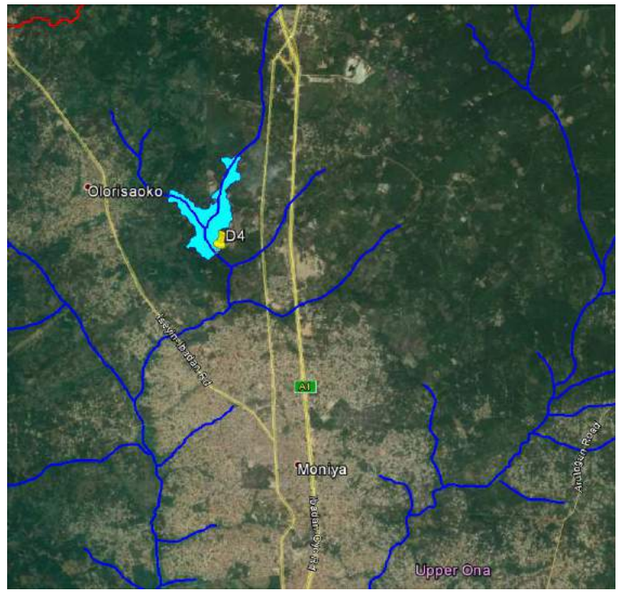

Dike 61 - Area Capacity Curve
Area (km2)
Volume (MCM)
Ground Level (m)
Area (km2)
Volume MCM

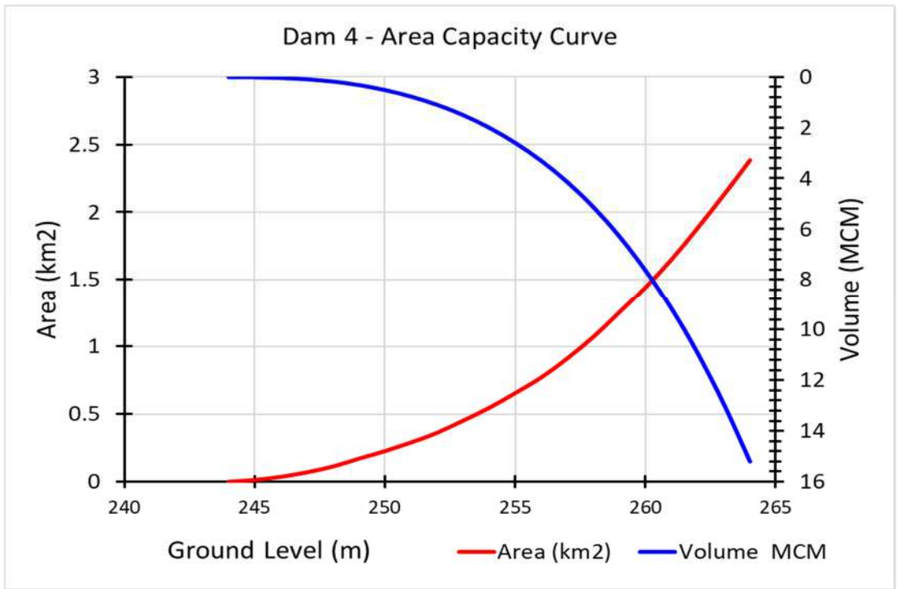

Dike 61 - Inflow and Outflow Hydrographs
Inflow
Outflow
Flow CMS
Time - hr

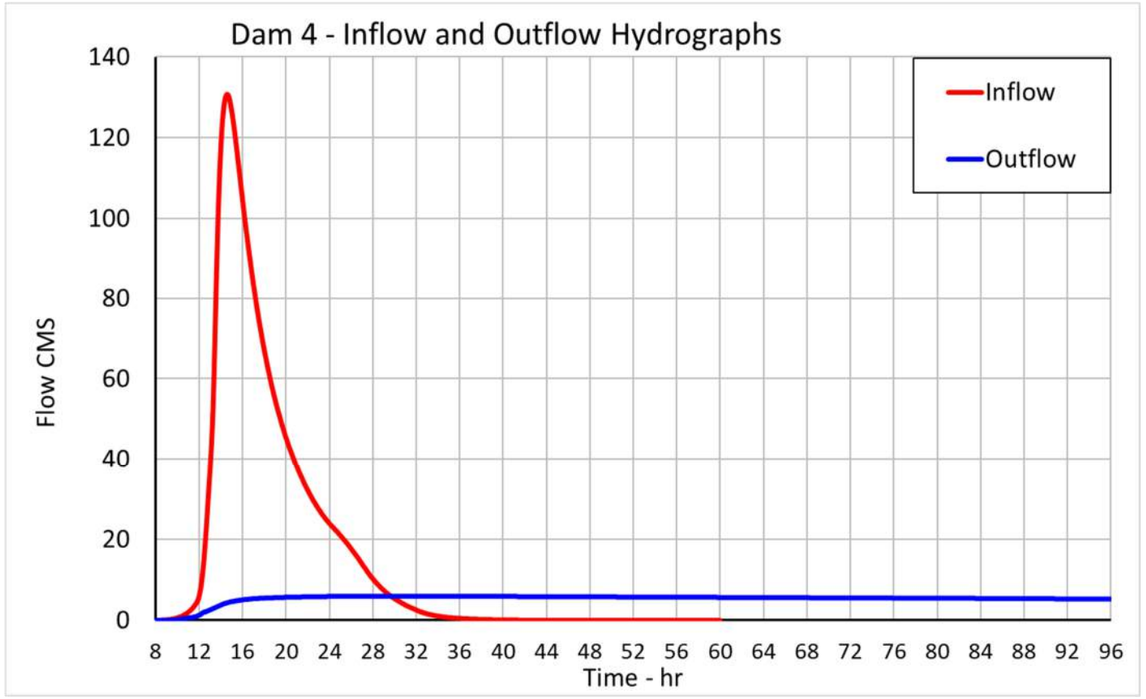

Dike 61 - Storage and Elevation Curves
Storage
Elevation
Strorage (1000m3)
Elevation (m)
Time - hr

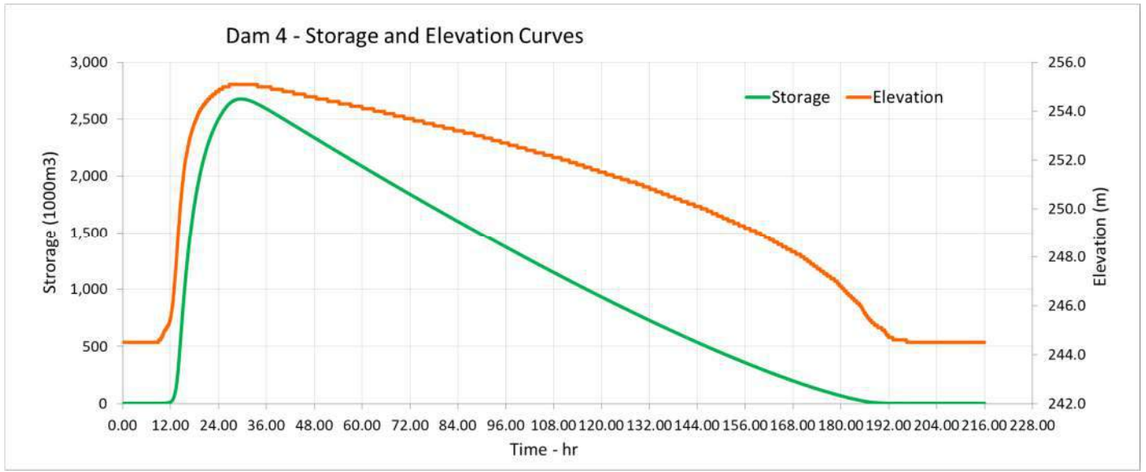
7 Layouts and Graphs of Proposed Multi-Purpose Dams in Ona and Omi Basins

7.1 Dam 4

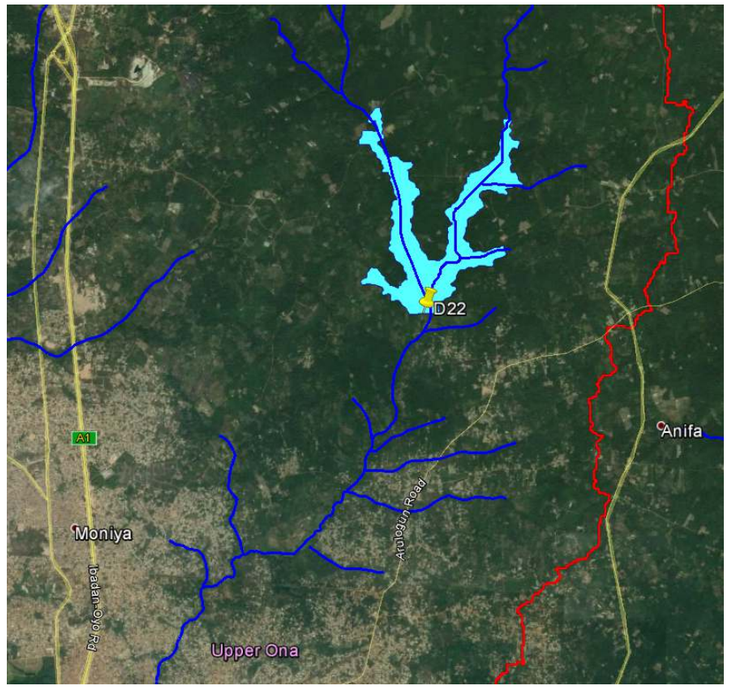


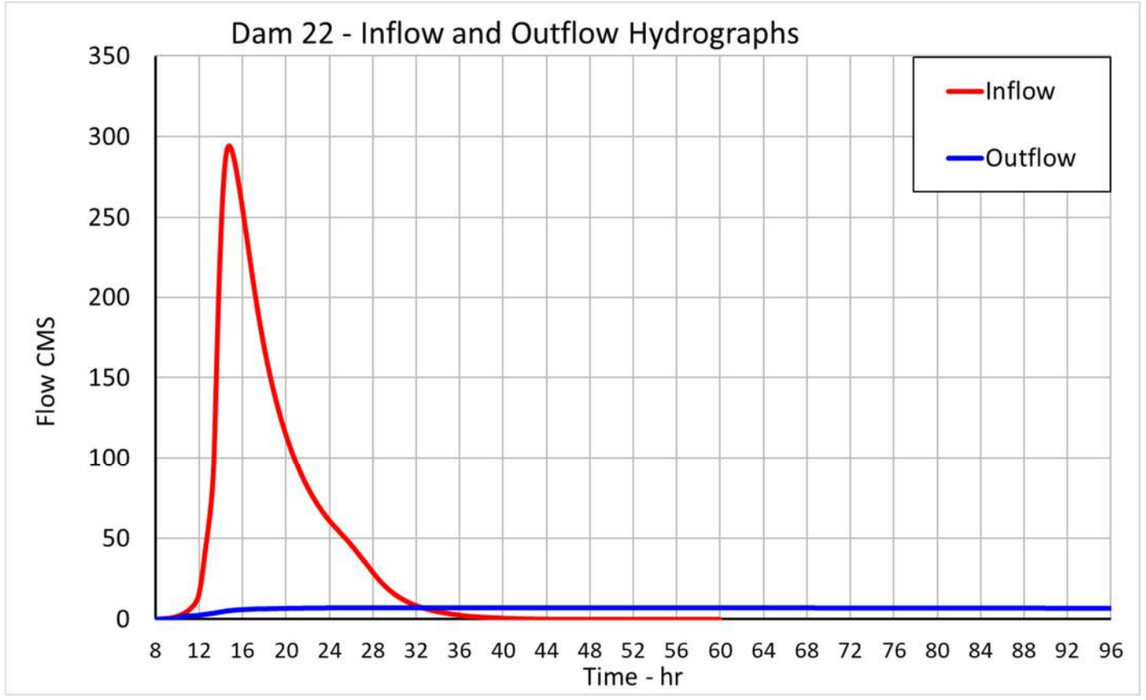


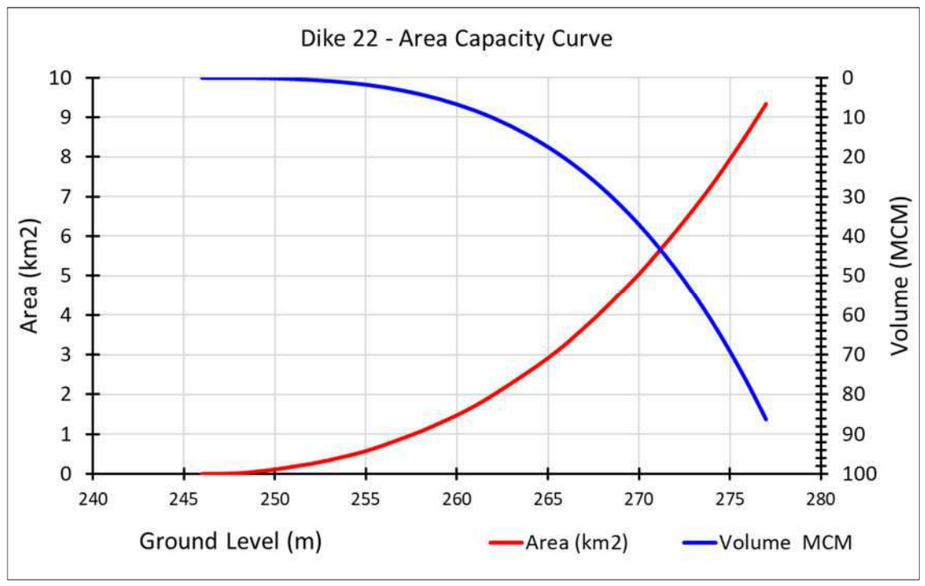


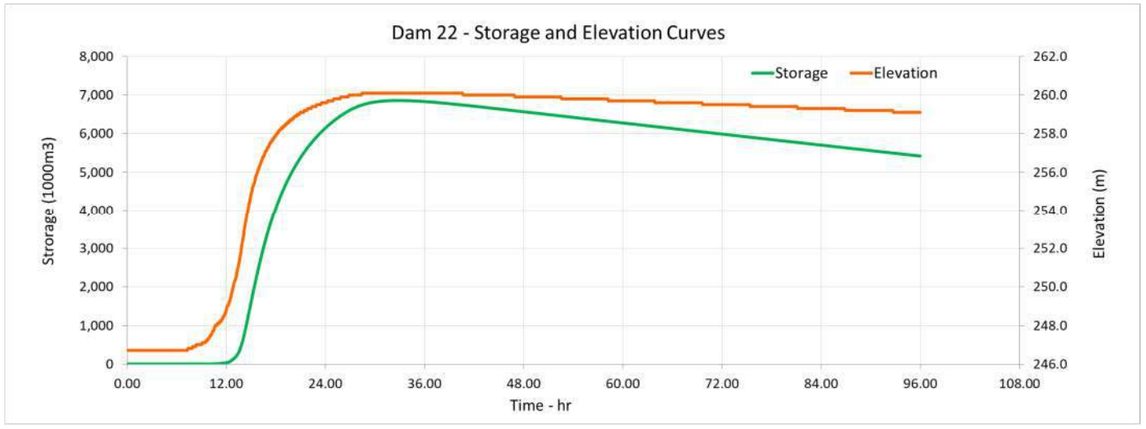


7.2 Dam 22

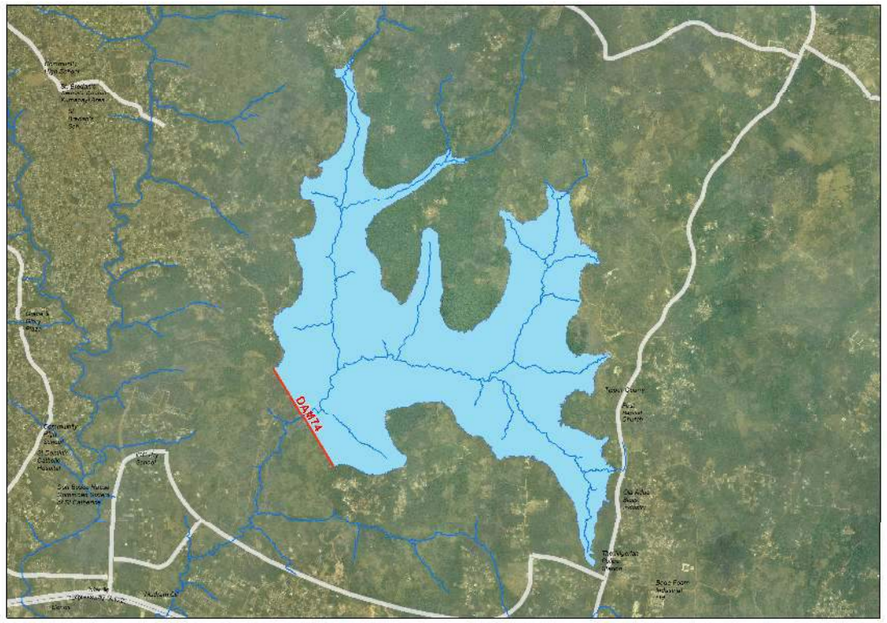

D22
A1
Moniya
Ibadan-Oyo Rd
Upper Ona
Arolegun Road
Anifa

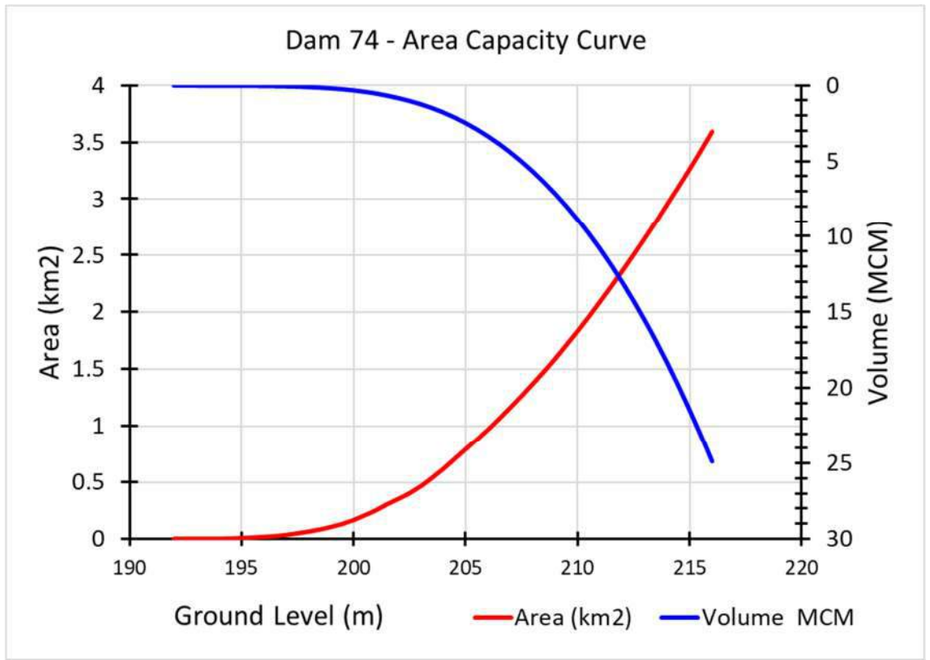

Dam 22 - Inflow and Outflow Hydrographs
Inflow
Outflow
Flow CMS
Time - hr

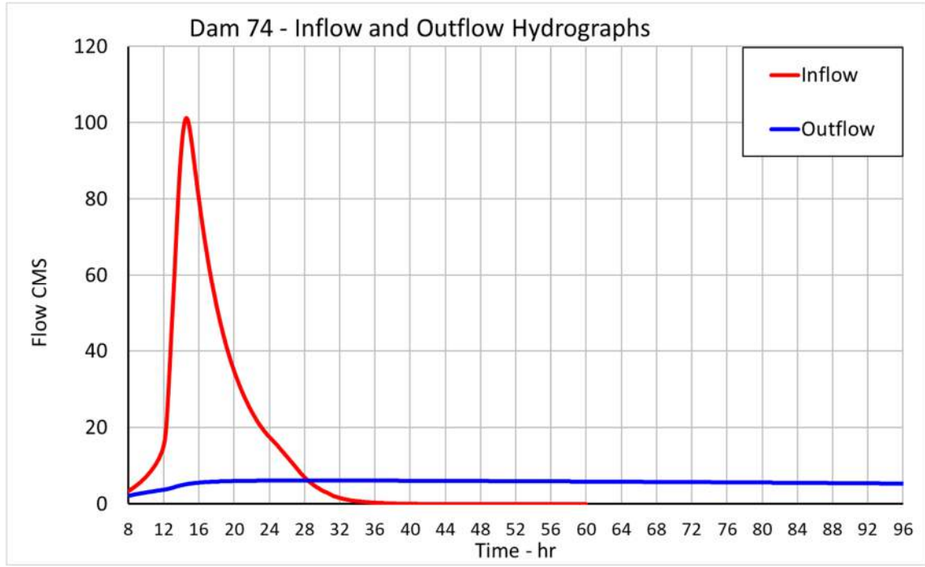

Dike 22 - Area Capacity Curve
Area (km2)
Volume (MCM)
Ground Level (m)
Area (km2)
Volume MCM

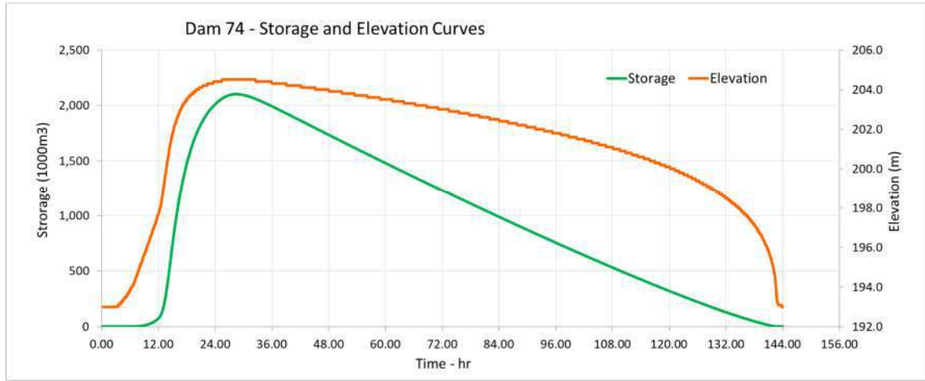

Dam 22 - Storage and Elevation Curves
Storage
Elevation
Strorage (1000m3)
Elevation (m)
Time - hr

7.3 Dam 74

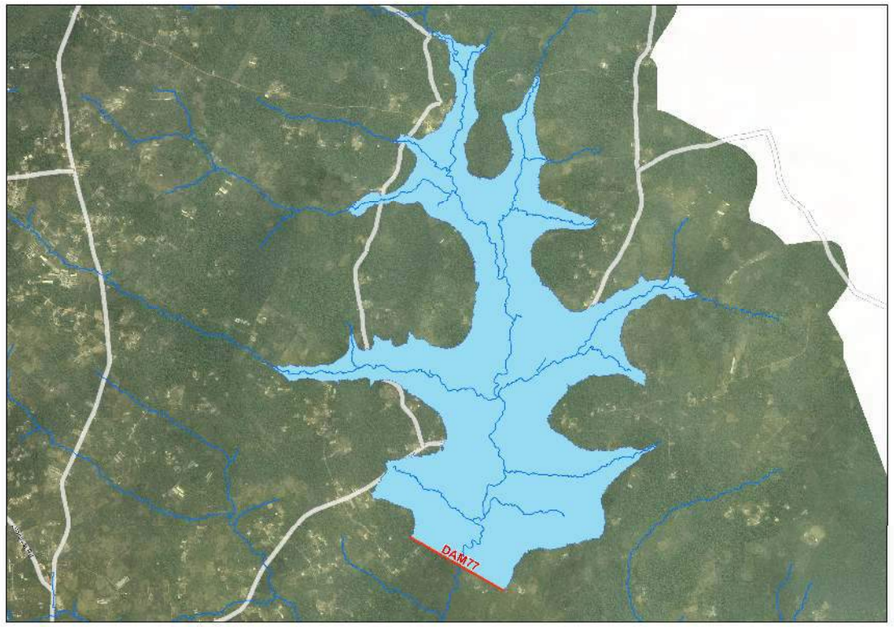

DAM74

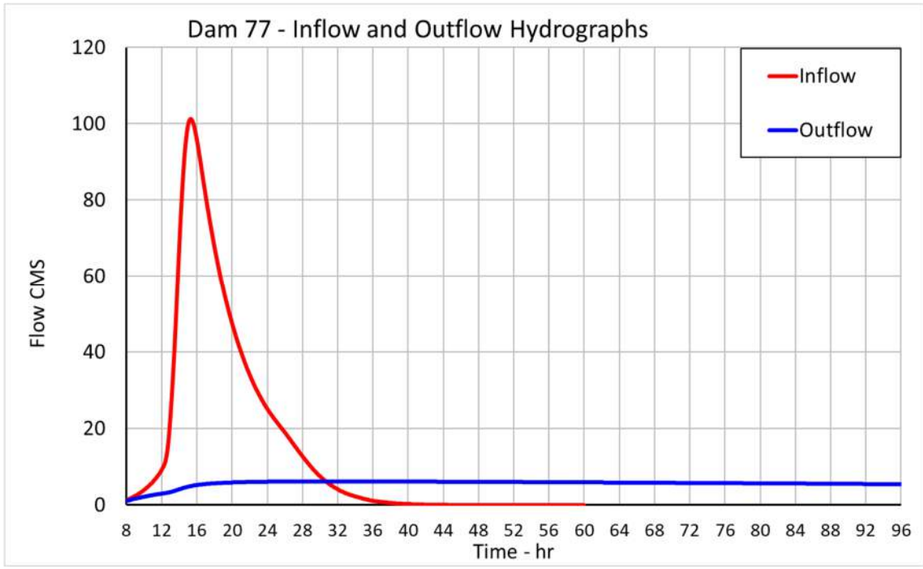

Dam 74 - Area Capacity Curve
Area (km2)
Volume (MCM)
Ground Level (m)
Area (km2)
Volume MCM

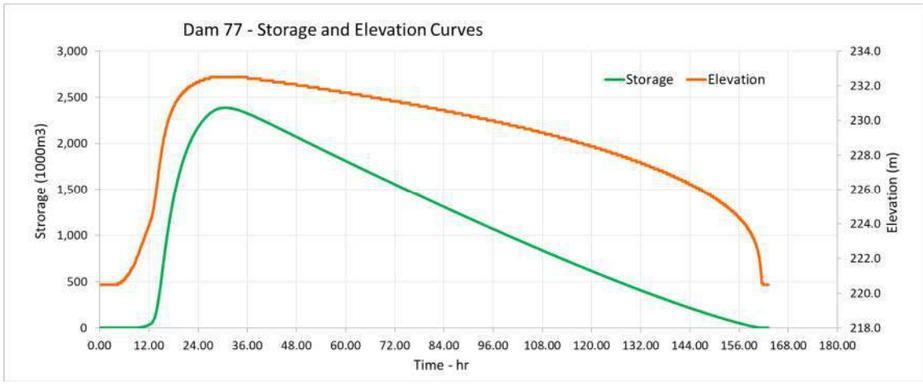

Dam 74 - Inflow and Outflow Hydrographs
Inflow
Outflow
Flow CMS
Time - hr

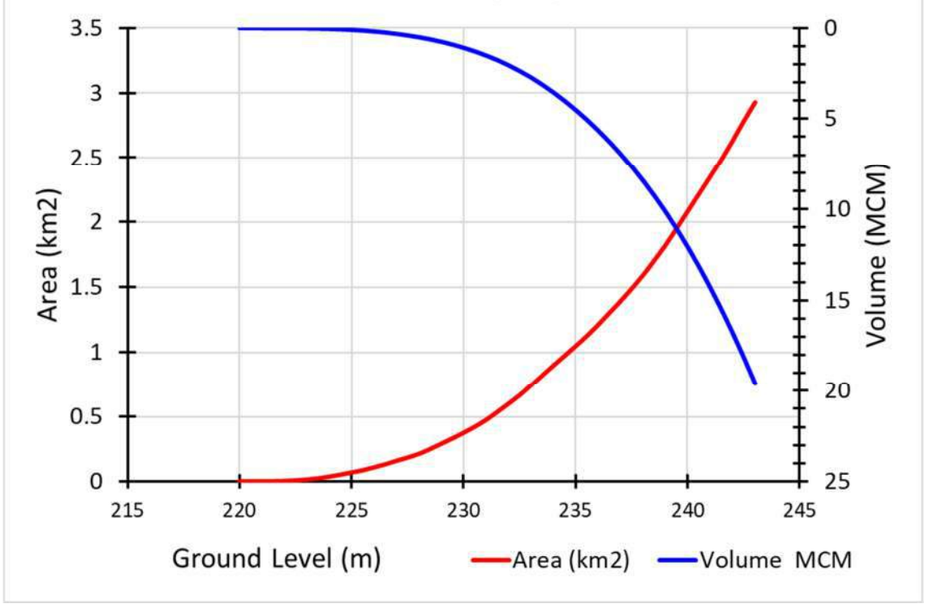

Dam 74 - Storage and Elevation Curves
Storage
Elevation
Strorage (1000m3)
Elevation (m)
Time - hr

7.4 Dam 77


DAM 77


Dam 77 - Inflow and Outflow Hydrographs
Inflow
Outflow
Flow CMS
Time - hr


Dam 77 - Storage and Elevation Curves
Storage
Elevation
Strorage (1000m3)
Elevation (m)
Time - hr


Dam 77 - Area Capacity Curve
Area (km2)
Volume (MCM)
Ground Level (m)
Area (km2)
Volume MCM

Annex

7

Ongoing Priority Works & Damaged Structures

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1 Introduction

In the aftermath of 26th August flood disaster in Ibadan (2011), a study was undertaken by Oyo State Task Force to establish the causes of the flood and identify the short and medium to long-term initiatives required to address this issue. The study recommended 39 sites to be rehabilitated. The report summarized these sites in a table with a serial number, their location and size of their existing structure...etc. Table 1 presents the summary of these structures with their Easting and Northing positions. To relate these locations to the **T**ask Force Report, each location was identified with the same serial number of the task force report and added a suffix **T**. e.g. 4T, 5T, etc. These sites are presented in Figure 1.

Furthermore, the government identified 14 priority sites that requires urgent repair and upgrade to improve their infrastructure ability and reduce risk. The summary of these structures is presented in Table 2 with their Easting and Northing positions. To relate these locations to the **P**riority sites, each location was identified with a serial number and added a suffix **P**. e.g. 8P, 9P, etc. These sites are presented in Figure 22.

This section summarizes the PIU priority works designed by other Consultants. In addition, this section also summarizes the designs of the 3 pool of priority investments by Dar and under the Flood Risk Management and Drainage Masterplan Project.

2 PIU Priority Works

Following the identification of priority works, the PIU tendered several structures to be designed for rehabilitation. Four (4) of these structures were designed Abfort Associates Limited, while thirteen (13) of these structures were designed by Pheman Peniel Consultants Limited.

The PIU tendered also the Design works for Eleyele Dam Rehabilitation, which was awarded to Tractebel Engineering France Consultant (TEF). The following sections briefs the works accomplished by other Consultants.

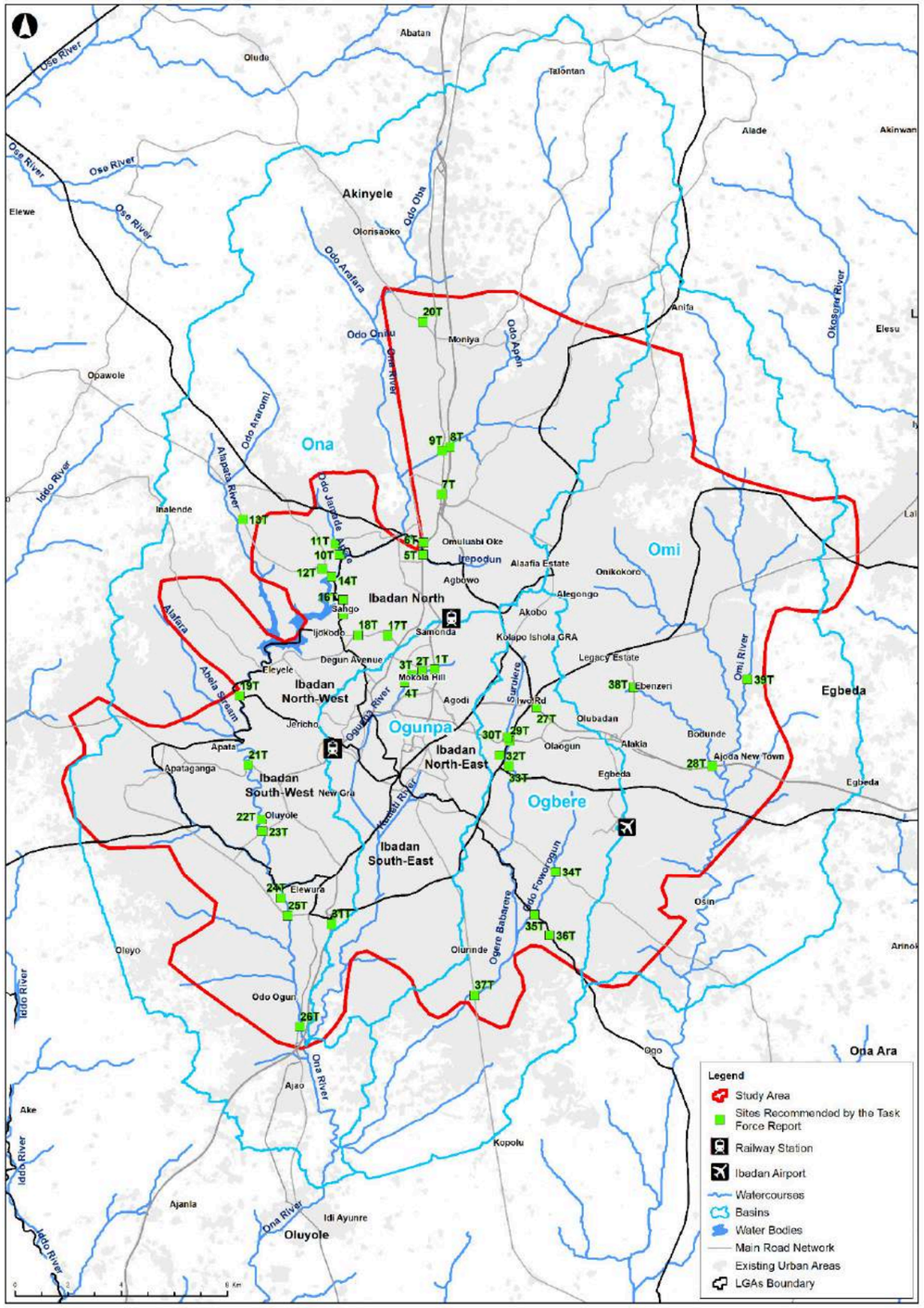

Figure 2: Sites recommended by the Task Force Report (39 Sites)

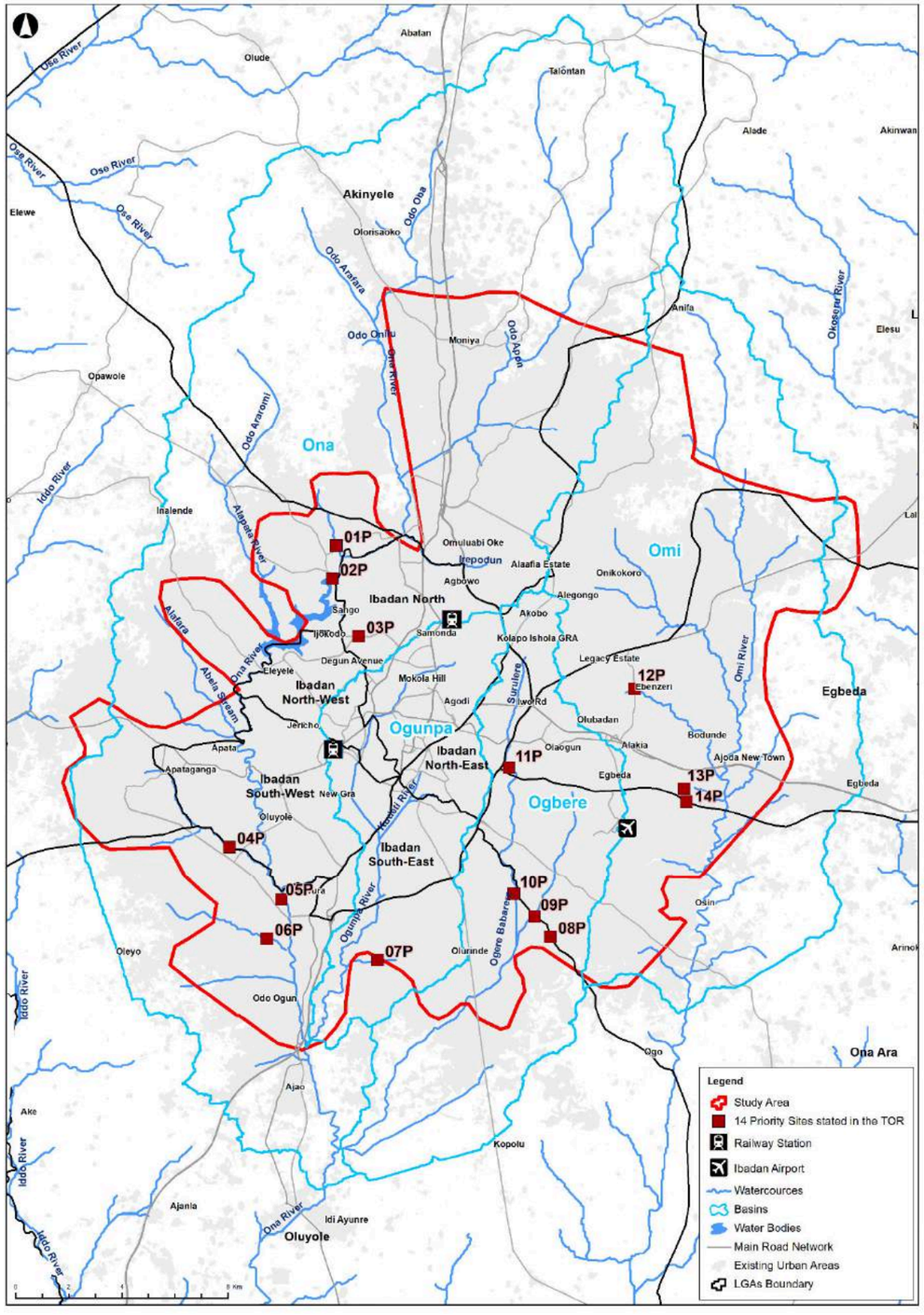

Figure 22: Priority Sites stated in the Terms of Reference (14 Sites)

2.1 Structures designed by Abfort Consultant

The Oyo State Government, in January 2015, appointed Abfort Associates Limited for detailed engineering design of four (4) priority sites in Ibadan, as part of Ibadan Urban Flood Management Project (IUFMP). The Consultant services included comprehensive studies, survey, investigations and design of the following four (4) priority sites:

1. Saasa Culvert, Osajin - Apete Road, Iddo LGA, (Structure no. 625B)
2. Ola Adua River – Old Akufo Road, Iddo LGA, (Structure no. 626)
3. Cele Rainbow - Ojo Ekun, Oluyole LGA, (Structure no. 31)
4. Ogbere Pegba - Egbeda Tuba Road in Oluyole LGA. (Structure no. 68).

The locations of the above structures are presented in Figure 23. Details of their location, their existing and design dimensions are presented in Table 3.

2.2 Structures designed by Pheman Consultant

The Oyo State Government, in September 2016, appointed Pheman Peniel Consultants Ltd for detailed engineering design of thirteen (13) priority sites in Ibadan, as part of Ibadan Urban Flood Management Project (IUFMP). The Consultant services included comprehensive studies, survey, investigations and design of the following thirteen (13) priority sites:

1. Ebenezer Culvert - Alakia Isebo, Omi Basin (Structure no. 1035)
2. Alaro Culvert - 7Up Road, Alaro Basin, (Structure no. 827)
3. Elere River Culvert - Egbeda Tuba Road, Elere, Ogbere Basin, (Structure no. 70)
4. Foworogi Culvert - Egbeda Tuba Road, Foworogi, Ogbere Basin, (Structure no. 904)
5. Maje River - Maje, Idi Mango Road, Ogunpa Basin, (Structure no. 1237)
6. Believers Stream - Odo ona Elewa Road - Oda Ona, Ona Basin, (Structure no. 148B)
7. Ogbere Moradeyo - Ogbere Moradeyo Road, Ogbere Basin, (Structure no. 84)
8. Omiri Culvert – Omiri, Omi Basin, (Structure no. 995)
9. Olorungunwa Culvert - Poat Area, Omi Basin, (Structure no. 14P)
10. Alaro Poly Road - Sango Eleyele Road - Poly Ijokodo, (Structure no. 137)
11. Isokun Ojoo (Before Gofamint), Arulogun Road, Akinyele LGA, (Structure no. 548)
12. Oke Ayotuntun Community Area, Oki, Olodo, Egbeda Ona Ara LGA, (Structure no. 953)
13. Abonde Ogbere, Olunloyo Area, Ona Ara/Oluyole LGA, (Structure no. 7M)

The locations of the above structures are presented in Figure 23. Details of their location, their existing and design dimensions are presented in Table 4.

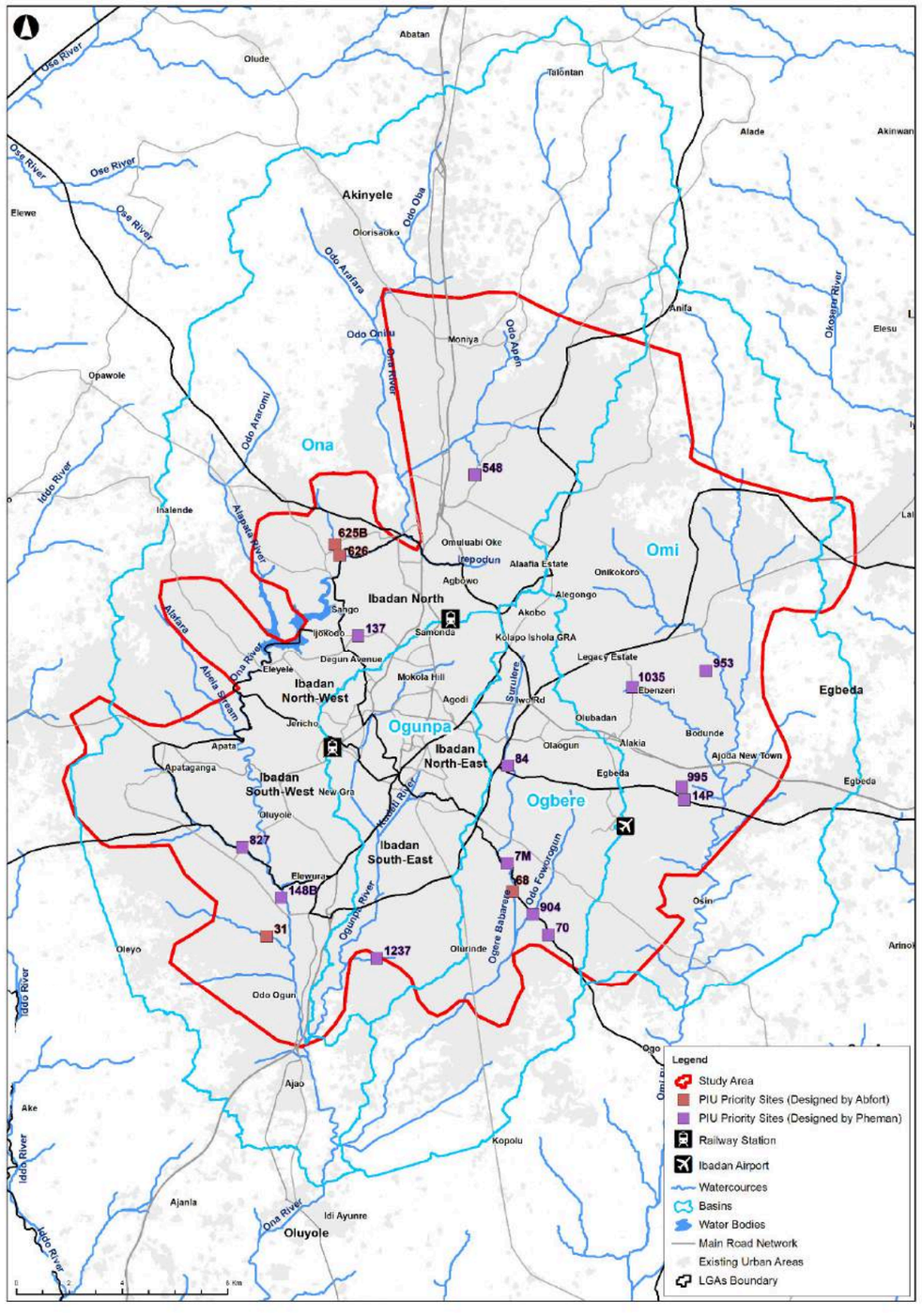

Figure 23: PIU Priority Sites (Designed by Abfort and Pheman)

2.3 Design of Eleyele Dam Rehabilitation by Tractebel Consultant

As part of efforts to prevent further devastating floods in the city of Ibadan and enhance the socio-economic well-being of the citizens, the Oyo State Government intends to carry out emergency rehabilitation works on Eleyele Dam and its appurtenant structures. Such work include spillway weir and channel, embankment, intake tower, scour tunnel, scour channel and reservoir.

The Oyo State Government, appointed Tractebel Engineering France for detailed engineering design Eleyele Dam Rehabilitation as part of Ibadan Urban Flood Management Project (IUFMP). Studies and Detailed Engineering Design of the rehabilitation of Eleyele Dam and Intake have been completed. The contract for the works has been awarded and handing over of site to the Contractor (CGC) for

implementation has been carried out

2.3.1 Eleyele ESIA Report Recommendations

The Environmental and Social Impact Assessment (ESIA) for Eleyele Dam Report summarized the proposed emergency and rehabilitation works including the following:

a. Rehabilitation of the weir wall, where a section of base slab is missing at the toe.
b. Remedial works at the spillway trough and downstream channels repair of the base slab within the trough section and also the spillway channel down to the confluence with the scour channel.
c. Removal of debris and vegetation including trees within the spillway and spillway channels where these are currently impeding the design capacity of the spillway.
d. Repairs of the access road drainage and as a matter of priority reinstatement of the backfill to the retaining walls downstream of the footbridge would be carried out.
e. Full and detailed assessment of the operating and guard valves and the operating mechanisms.
f. Repair of all defects on the embankment.
g. Repair of the Scour tunnel
h. Rehabilitation of intake tower

In addition, the report highlighted the following:

- Design Flood with a return period of 10,000 years was used in the upgrade design.
- The current spillway is designed for a peak inflow of 368 m^3/s. Its capacity is proposed to be increased to contain a peak inflow of 1269 m^3/s by raising reservoir level. This raises head allowable over spillway and provides sufficient freeboard for the design condition. Peak outflow over spillway would move up from 821 m^3/s to 1068 m^3/s.

2.3.2 Eleyele Dam Hydrological Report

The Eleyele dam hydrological report pointed out differences between the annual maximum rainfall data obtained from two sources, the IITA (International Institute of Tropical Agriculture) and NIMET (Nigerian Meteorological Agency).

Based on the observation that the IITA record of the 2011 event was 165.5 mm (as quoted from the report) compared to 86.2 mm from NIMET, and a longer record of IITA data, the Eleyele dam hydrological report preferred to use the IITA data. However, doing so resulted in neglecting other high events in the NIMET data set not reflected in the IITA data.

2.3.3 Eleyele Dam Rehabilitation Project Scope of Works

Moreover, it is noted through the brief handing over of site to the contractor (dated 6th April, 2018) that the scope of works for Eleyele Dam Rehabilitation Project includes the following:

- Rehabilitation of the spillway weir
- Rehabilitation of spillway channel to Ologeneru Bridge (138B)
- Rehabilitation and raising of the existing embankment from its existing height of 183.6m to 185.4m (1.8m heightening).
- Rehabilitation of the intakes tower, scour channel, scour tunnel and reservoir.
- Design flood with a return period of 10,000 years

2.3.4 Information from PIU

More information from the PIU confirmed the heightening of the dam by 1.8m and revealed the following information:

- A concrete parapet wall will be built on the dam with 1m height.
- Elevation drawdown by lowering the existing water level to 180m asl (a drop 2.3m from the existing crest level).
- New spillway with a modified profile with the same crest level 182.3m
- Spillway crest length is 101.5m
- Maximum Water Level is 185.4 (3.1m above spillway crest level)

It is worth to note that the above elevation values do not match any of the well-known coordinate systems (Minna or WGS84). It is presumed that these elevations are local survey ones. Dar shall use the elevation differences in estimating the available head over the spillway.

2.3.5 Rating Curve

Based on the proposed heightening of Eleyele Dam (1.8m) and the modification of the crest length from 106 to 101.5, the rating curve over the spillway is modified, refer to Figure 04.

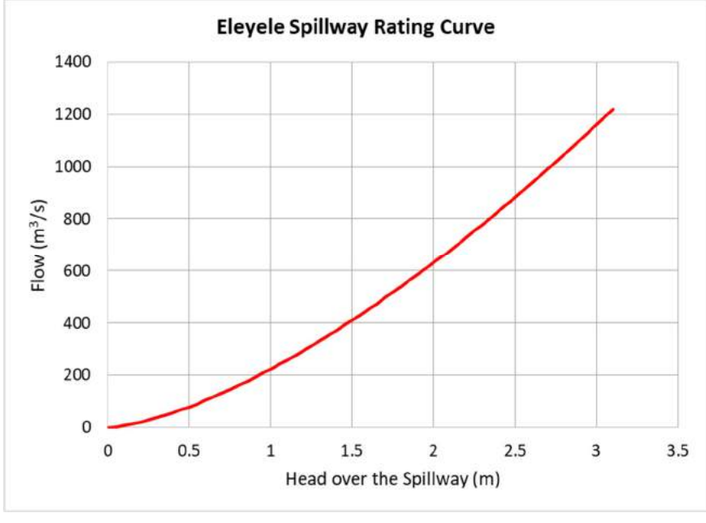

Figure 04: Future Eleyele Spillway Rating Curve (based on rehabilitation)

3 Design of the Three Pool of Priority Investments

As per the Terms of Reference, the Flood Risk Management and Drainage Masterplan Project designed by Dar it was required to identify and to prepare three pools of priority works (works volume between 30-40 million USD for each pool). Those no-regret infrastructure works are designed to mitigate flood risk on the short term. This is followed-up by the preparation of their detailed design, and tender documents to allow the kick-off of implementation of those infrastructure works.

Based on the above, Dar prepared 3 pools of work which are sub-divided into 4 lots; these lots cover the channelization of major rivers such as Ona River and major tributaries such as Upper Ogunpa, Kudeti, Ogbere and Orogun. The channelization includes the rehabilitation of the crossing structures lying along these channels. The 3 pool of works include the rehabilitation of some separate crossing structures that required urgent upgrade to their infrastructure ability. In addition, the 3 pools include measures to reduce flood risk along lower Ona River.

This section comprises the 4 lots of the priority investments. Figure 3 presents the channels and structures (Bridges/Culverts) that are designed under the three pool of works. Tables at the end of the annex presents the details of their location, their existing and proposed dimensions.

3.1 First Pool of Works - Lot1 & Lot 2

The potential works for the selection of the first pool of works were initiated in June 2017 with the submission of the First pool of Works Report (N17036-0100D-RPT-ENV-02-Rev0). Several progress were further issued and a site visit was conducted in July 2017. The scope of works was agreed based on a WebEx Meeting conducted in August 2017.

Lot 1 includes the following works:

i. Upper Ogunpa – System 1 (also known as Agodi River in other Dar reports) and its associative structures (627, 42, 41, 40).
ii. Yemetu – System 3 (also known as Kudeti River in other Dar reports)
iii. Olojuoro – System 4 and its associative structures (275 and 273)
iv. Kudeti – System 5
v. Upper Ogbere – System 12 (also known as Ogbere North in other Dar reports) and its associative structures (G4, G5, 87, 86, 305 and 74)
vi. Orogun - System 70 and its associative structures (565, 678, 677, 634, 633 and 122B)

Lot 2 includes the following works:

i. Middle Ogbere – System 13 (also known as Ogbere South in other Dar reports) and its associative structure no. 73
ii. Separate structures located on natural streams including the following structures: 23, 76, 125A, 132, 195, 27T and 6T

It is worth to note that the scope of work included also the design of Lower Ona River channelization or System 83 (known as Ona1 in other Dar reports). However, due to the unavailability of LiDAR survey at that time, it was agreed to postpone the design to the second pool of services (Lot3).

3.2 Second Pool of Works - Lot3

Based on a WebEx meeting conducted in April, 2018, the scope of work for the second pool (Lot3) covers the channelization of Lower Ona River (System 83), the bridges along Ona and the proposed dikes.

Lot 3 includes the following works:

i. Lower Ona North – System 83 (also known as Ona1 in other Dar reports) and its associative structures (139B, 146B, 147B and 816).
ii. Dikes for attenuation – this includes 17 dikes in upper and middle Ona basins to reduce the flow in lower Ona River and the sizes of associative structures; this includes the following dikes: D24, D25, D37, D38, D39, D41, D42, D43, D44, D45, D46, D49, D50, D54, D55, D56, D61.

3.3 Third Pool of Works - Lot4

The potential works for the selection of the third pool were initiated in November 2018 with the submission of a multi-criteria analysis report. The works were discussed during the WB's mission to Ibadan in the same month. Based on a WebEx meeting conducted in December, 2018, the scope of work (Lot 4) includes the following works:

i. Lower Ona East – System 88 (also known as Ona2 in other Dar reports) and its associative structure (149B).
ii. Bridge no. 150B located along Lower Ona South – System 91

Table 5 presents the summary of all above mentioned structures with their Easting and Northing positions.

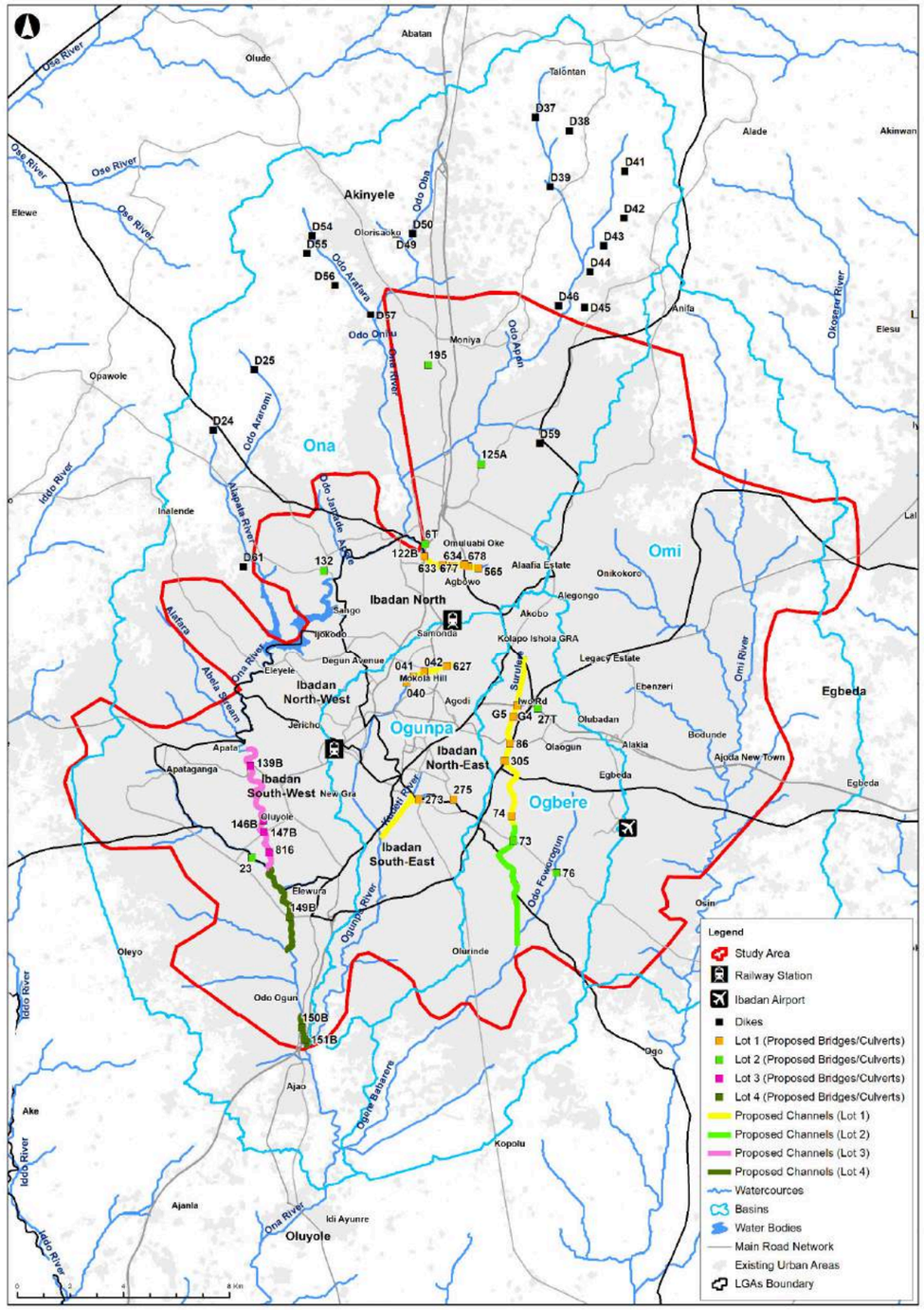

Figure 35: Proposed Channels and Structures - Three Pool of Priority Investments

4 Damaged Structures

During the design stages of this project, the PIU compiled 4 lists of damaged structures and sent them to Dar to consider these sites in the pool of priority works. The listed sites are compiled from requests forwarded by Ministry of Environment and Water Resources as well as various communities and identified by PIU during their visits to Flood Prone and Flood affected areas.

These 4 lists were received as follows:

- The 1st List includes 57 structures received on 26th September, 2017.
- The 2nd List includes 18 structures received on 26th January, 2018
- The 3rd List includes 7 structures received on 21st March, 2018
- The 4th List includes 12 structures received on 21st June, 2018
- The 5th List includes 7 identified structures received on the 30th October, 2018.

The PIU lists includes a lot of damaged structure varieties according to different types such as bridges, culverts, footpaths and requested channels. These structures lie on various catchment areas beginning from 2 hectares (0.02 km2) to 447 km2.

Furthermore, the indicated list includes different kinds of damages that were observed in site visits including scouring, erosion, potential instability, partial and complete damaged structures. Some structures were found relocated from their position or completed destroyed with no sign of the structure itself. Other locations included cut off roads, water accumulation, overtopped culverts, bypassed culverts, eroded roads, buildings blocking the drainage main route and gullies.

To initiate the site visit, it was necessary to code each requested structure or channel with a unique identity code. Each structure is identified with a number according to its sequence in the list, a suffix "D" for **D**amaged structures. The 5 lists of damaged structures (a total of 94 damaged structures) are tabulated in Table 6. The table shows the location of each structure, their code naming and their existing and proposed dimensions. It is worth to note that the list included several repeated structures that have similar locations with the other lists.

The damaged structures are distributed in the 11 LGAs of Ibadan and 5 main basins namely Ona, Ogunpa, Ogbere, Omi and Iddo, refer to Figure 6. Table 6 lists all these damaged structures.

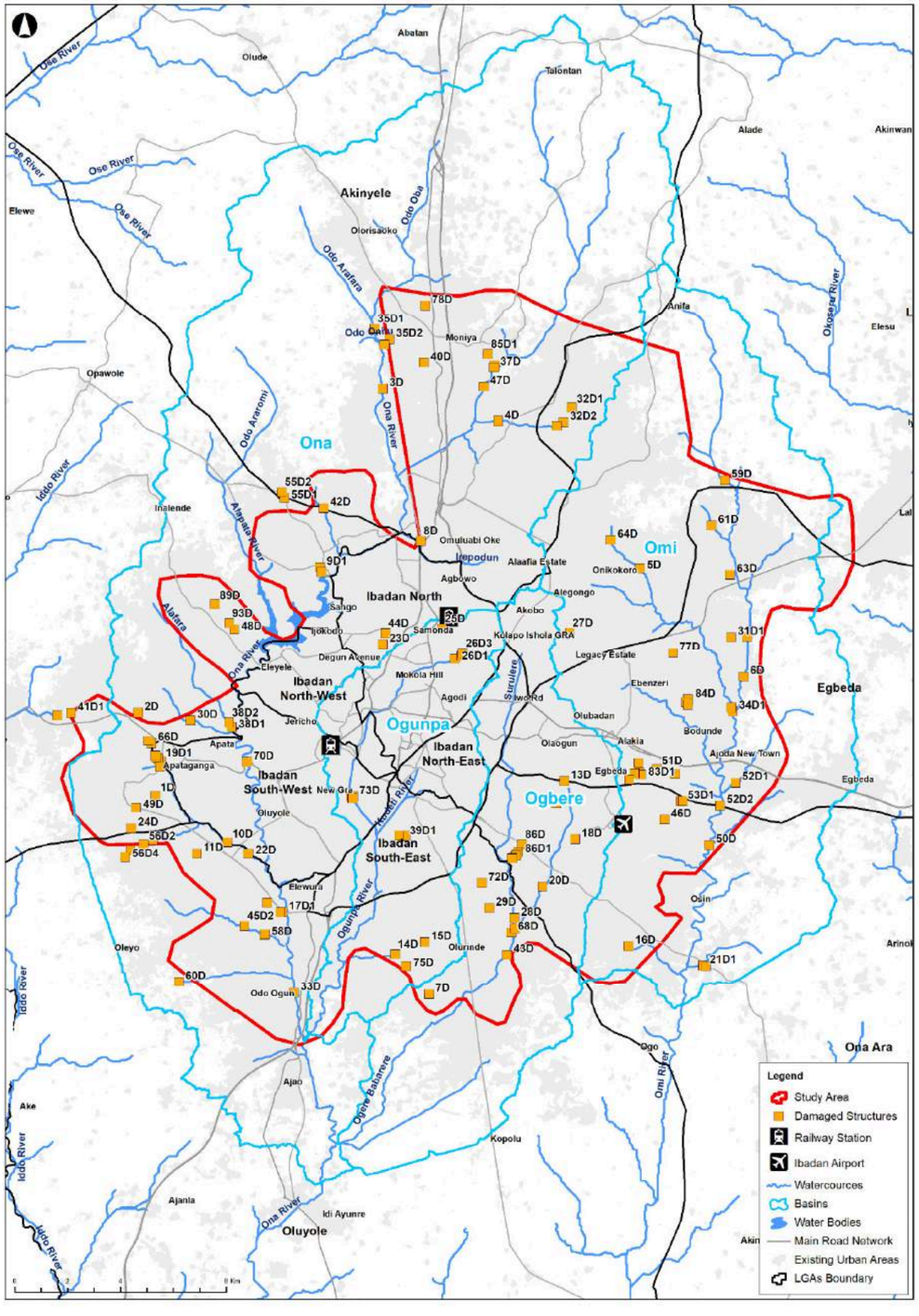

Figure 46: Damaged Structures

Table 1 - Sites recommended by the Task Force Report (39 Sites)

Task Force ID	Structure No.	Subbasin	Structure No.	Alternative ID	Existing Crossing Structure Dimensions	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Stream Slope (%)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necessity for a New structure	Proposed Crossing Structure Dimensions	Designed by	Status
1T	44	Og1 Upper Ogunpa	44	1T	Br (2 Span 12.2)	600556	819787	Good	7.9	Highway		82.5	110.0	0.44	518.5	Adequate	Adequate	No			
2T	42	Og1 Upper Ogunpa	42	2T	2 BC (1.98 x 2.3)	600088	819678	Good	8.7	Tertiary Road		95.0	126.7	0.44	23.2	Inadequate	Adequate	Yes	2 Cv (6 x 2.5)	Dar	Lot1 (Going for Bid)
3T	41	Og1 Upper Ogunpa	41	3T	2 BC (1.8 x 1.97)	599690	819535	Fair	9.0	Tertiary Road		95.0	126.7	0.44	16.6	Inadequate	Inadequate	Yes	2 Cv (6 x 2.5)	Dar	Lot1 (Going for Bid)
4T	40	Og1 Upper Ogunpa	40	4T	1 BC (2.5 x 1.89)	599430	819287	Fair	10.6	Tertiary Road	Damaged culvert	95.0	126.7	0.44	12.1	Inadequate	Inadequate	Yes	4 Cv (6 x 2.5)	Dar	Lot1 (Going for Bid)
5T	122B	ON9 Orogun	122B	5T	2 BC (2.7 x 2.68)	600092	824064	Erosion	15.9			164.0	218.7						5 Cv (6 x 2)	Dar	Lot1 (Going for Bid)
6T	632	On9 Orogun	632	8D	2 CC (Dia 1.2)	600125	824528	Fair	0.9	Main	During heavy rain it prevents motorist from plying the road				3.3	Inadequate	Inadequate	Yes	1 Cv (4 x 1.5)	Dar	Masterplan
7T	499	On10 Middle Ona North	499		2 BC (2.5 x 2.45)	600824	826356	Good	0.6	Highway					28.6	Adequate	Adequate	No			
8T	126A	ON8 Upper Ona South	126A	8T	Br (2 Span 24)	601101	828095	Good	107.6	Tertiary Road		387.2	516.2	0.26	998.9	Adequate	Adequate	No			
9T	127	ON8 Upper Ona South	127	9T	1 BC (6.4 x 3.01)	600833	827949	Fair	107.8	Highway		387.2	516.2	0.26	59.0	Inadequate	Inadequate	Yes	Br (55 x 20)	Dar	Masterplan
10T	626	ON10 Middle Ona North	626	1T	3 BC (3 x 2)	596985	824082	Good	9.5	Tertiary Road	FLOODED OCASSIONALLY	85.0	113.4	0.69	62.6	Inadequate	Adequate	Yes	Add 3 Cv (3 x 2)	Abfort	Addition by Dar
11T	625B	ON10 Middle Ona North	625B	11T	2 BC (3 x 2)	596804	824486	Good	9.5	Tertiary Road	Newly constructed bridge by state government.	85.0	113.4	0.69	41.7	Inadequate	Adequate	Yes	Add 4 Cv (3 x 2)	Abfort	Addition by Dar
12T	132	ON10 Middle Ona North	132	9D1	1 BC (2.2 x 1.39)	596314	823519	Erosion	1.8	Main Road		17.5	23.3	0.75	8.8	Inadequate	Inadequate	Yes	1 Cv (4 x 2)	Dar	Lot2 (Going for Bid)
13T	461	ON11 Alapata South	461	13T	1 BC (1.8 x 1.21)	593306	825399	Poor	1.3	Main Road		13.7	18.3	1.09	6.8	Inadequate	Inadequate	Yes	1 Cv (3 x 1.5)	Dar	Masterplan
14T	133	ON10 Middle Ona North	133	14T	Br (3 Span 19.77)	596659	823241	Good	248.0	Main Road		508.6	678.1	0.20	680.6	Adequate	Adequate	No			New
15T	136	On10 Middle Ona North	136		1 BC (15.3 x 2.55)	597088	821805	Poor	5.1	Main		55.8			133.4	Adequate	Inadequate	Yes	1 Cv (7 x 2.5)	Dar	Masterplan
16T	135	ON10 Middle Ona North	135	16T	1 BC (2.97 x 1.66)	597102	822359	Good	4.2	Main Road		35.3	47.1	0.80	17.0	Inadequate	Adequate	Yes	Add 1 Cv (4 x 2)	Others	Addition by Dar
17T	659	ON10 Middle Ona North	659	44D	1 BC (2.45 x 2.48)	598794	821034	Good	1.2	Main Road		12.8	17.1	0.72	21.9	Adequate	Adequate	No			
18T	137	ON10 Middle Ona North	137	18T	1 BC (2.45 x 2.45)	597663	821038	Fair	3.8	Main Road		32.0	42.7	0.72	21.6	Inadequate	Inadequate	Yes	Br (10m)	Pheman	Going For Bid
19T	145B	On13 Middle Ona South	145B		2 BC (11.27 x 9.44)	593203	818749	Erosion		Secondary					1289.8	Adequate	Inadequate	Yes	1 Cv (1 x 1)	Dar	Masterplan
20T	184	ON6 Upper Ona West	184	2T	1 BC (2.6 x 1.8)	600062	832874	Good	2.0	Main Road		18.8	25.1	0.85	16.6	Inadequate	Adequate	Yes	1 Cv (3 x 2)	Dar	Masterplan
21T	139B	ON14 Lower Ona North	139B	70D																	
22T	146B	ON14 Lower Ona North	146B	22T	Br (3 Span 13.35)	594035	814096	Good	366.8	Secondary Road		551.6	735.4	0.21	342.8	Inadequate	Adequate	Yes	Add 4 Cv (7 x 5.1)	Dar	Lot3 (Going for Bid)
23T	147B	ON14 Lower Ona North	147B	23T	3 BC (3.08 x 3.16)	594056	813654	Fair	367.3	Main Road		563.6	751.5	0.21	67.0	Inadequate	Inadequate	Yes	Br (48 x 13)	Dar	Lot3 (Going for Bid)
24T	148B	ON17 Lower Ona East	148B	24T	2 BC (8.95 x 2.87)	594751	811112	Fair	408.7	Tertiary Road		564.7	752.9	0.21	147.3	Inadequate	Inadequate	Yes	Br (15m)	Pheman	Going For Bid
25T	149B	ON17 Lower Ona East	149B	25T	Br (2 Span 10.2)	595014	810452	Good	411.8	Main Road		574.3	765.7	0.21	192.5	Inadequate	Adequate	Yes	Br (72m)	Dar	Lot4
26T	150B	ON18 Lower Ona South	150B	26T	Br (2 Span 13)	595479	806271	Fair	452.2	Highway	FLOODED ALWAYS	603.4	804.5	0.11		Inadequate	Inadequate	Yes	Br (86m)	Dar	Lot4
27T	803	Ob2 Upper Ogbere	803		2 CC (Dia 0.9)	604381	818291	Good	0.7	Expressway	THE INLECT IS FILLED WITH SEDIMENTS				1.5	Inadequate	Adequate	Yes	1 Cv (3.5 x 1.5)	Dar (Lot2)	Going For Bid
28T	92	OM6 Middle Omi West	92	28T	1 BC (2.4 x 1.85)	610995	816102	Good	17.8	Expressway		113.1	150.8	0.56	12.7	Inadequate	Adequate	Yes	2 Cv (6 x 2.5)	Dar	Masterplan
29T	86	Ob2 Upper Ogbere	304B	86	Br (3.6m)	603318	816985	Good	12.3	Expressway		94.5	126.0	0.44	35.7	Inadequate	Adequate	Yes	2 Cv (6 x 2.5)	Dar	Lot1 (Going for Bid)
30T	87	Ob2 Upper Ogbere	87	3T	1 BC (4 x 3)	603291	817189	Good	12.2	Highway		94.5	126.0	0.44	42.3	Inadequate	Adequate	Yes	Add 2 Cv (4 x 2.5)	Dar	Lot1 (Going for Bid)
31T	1502	On17 Lower Ona East	1502		2 BC (3.07 x 3)	596688	810126	Good	0.2	Tertiary	The channell does not get flooded whenever it rain heavily.				49.3	Adequate	Adequate	No			
32T	85	Ob2 Upper Ogbere	85		2 BC (2.17 x 1.57)	602991	816510	Erosion	0.8	Tertiary					13.0	Adequate	Inadequate	Yes	1 Cv (3.5 x 1.5)	Dar	Masterplan
33T	84	Ob2 Upper Ogbere	84	33T	2 BC (2.88 x 2.17)	603327	816097	Dilapidated	14.0	Secondary Road	The box culvert break down from the inlet	118.4	157.8	0.44	35.4	Inadequate	Inadequate	Yes	Br (15m)	Pheman	Going For Bid
34T	76	Ob4 Foworogbun	76	34T	2 BC (3.15 x 3.93)	605091	812124	Fair	16.8	Main Road		181.9	242.5	0.50	94.1	Inadequate	Inadequate	Yes	6 Cv (6 x 2.5)	Dar	Lot2 (Going for Bid)
35T	904	Ob4 Foworogbun	904	35T	2 BC (1.87 x 1.34)	604278	810482	Good	20.7		FLOODED ALWAYS	181.5	242.0	0.33		Inadequate	Adequate	Yes	Br (15m)	Pheman	Going For Bid
36T	70	Ob4 Foworogbun	70	36T	1 BC (1.65 x 0.65)	604851	809778	Fair	1.9	Secondary Road	The box culvert break down	17.8	23.7	0.80	2.1	Inadequate	Inadequate	Yes	1 Cv (3 x 3.5)	Pheman	Going For Bid
37T	65B	Ob5 Lower Ogbere North	65B	37T	Br (3 Span 14.5)	602045	807453	Good	66.9	Main Road	Erosion cutoff some part of the bridge.	463.0	617.4	0.35	1538.3	Adequate	Adequate	No		N/A	New
38T	1035	OM6 Middle Omi West	1035	38T					9.2	Main Road		87.6	116.8	0.39	5.7	Inadequate	Inadequate	Yes	Br (15 x 37)	Pheman	Going For Bid
39T	111	OM4 Upper Omi East	111	6D	2 BC (1.86 x 1.88)	612331	819378	Erosion	80.3	Tertiary Road		315.9	421.2	0.22	11.5	Inadequate	Inadequate	Yes	Br (30 x 10)	Dar	Masterplan

Table 2 - Priority Sites stated in the Terms of Reference (14 Sites)

TOR Priority Sites ID	Structure No.	Subbasin	Structure No.	Alternative ID	Existing Crossing Structure Dimensions	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Stream Slope (%)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necessity for a New structure	Proposed Crossing Structure Dimensions	Designed by	Status
1P	625B	ON10 Middle Ona North	625B	11T	2 BC (3 x 2)	596804	824486	Good	9.5	Tertiary Road	Newly constructed bridge by state government.	85.0	113.4	0.69	41.7	Inadequate	Adequate	Yes	Add 4 Cv (3 x 2)	Abfort	Addition by Dar
2P	133	ON10 Middle Ona North	133	14T	Br (3 Span 19.77)	596659	823241	Good	248.0	Main Road		508.6	678.1	0.20	680.6	Adequate	Adequate	No			New
3P	137	ON10 Middle Ona North	137	18T	1 BC (2.45 x 2.45)	597663	821038	Fair	3.8	Main Road		32.0	42.7	0.72	21.6	Inadequate	Inadequate	Yes	Br (10m)	Pheman	Going For Bid
4P	22	ON15 Alaro	22	10D	3 BC (2.75 x 2.69)	592789	813119	Fair	24.9	Tertiary Road		181.6	242.2	0.47	69.0	Inadequate	Inadequate	Yes	3 Cv (6 x 2.75)	Dar	Masterplan
5P	148B	ON17 Lower Ona East	148B	24T	2 BC (8.95 x 2.87)	594751	811112	Fair	408.7	Tertiary Road		564.7	752.9	0.21	147.3	Inadequate	Inadequate	Yes	Br (15m)	Pheman	Going For Bid
6P	31	ON16 Agara Kasumu	31	58D	3 BC (3 x 2)	594212	809654	Good	14.5	Secondary Road		108.3	144.5	0.60	58.2	Inadequate	Adequate	Yes	Add 2 Cv (5 x 2)	Abfort	Addition by Dar
7P	1237	Og4 Lower Ogunpa	1237	7P	4 CC (1.26 dia)	598369	808827	Fair	6.1		Get flooded when it rains heavily	63.7	84.9			Inadequate	Inadequate	Yes	3 Cv (3 x 3.5)	Pheman	Going For Bid
8P	70	Ob4 Foworogbun	70	36T	1 BC (1.65 x 0.65)	604851	809778	Fair	1.9	Secondary Road	The box culvert break down	17.8	23.7	0.80	2.1	Inadequate	Inadequate	Yes	1 Cv (3 x 3.5)	Pheman	Going For Bid
9P	904	Ob4 Foworogbun	904	35T	2 BC (1.87 x 1.34)	604278	810482	Good	20.7		FLOODED ALWAYS	181.5	242.0	0.33		Inadequate	Adequate	Yes	Br (15m)	Pheman	Going For Bid
10P	68	Ob3 Middle Ogbere	68	1P	Br (2 Span 14.05)	603517	811337	Good	25.7	Tertiary Road		297.2	396.3	0.63	770.9	Adequate	Adequate	No		Abfort	New
11P	84	Ob2 Upper Ogbere	84	33T	2 BC (2.88 x 2.17)	603327	816097	Dilapidated	14.0	Secondary Road	The box culvert break down from the inlet	118.4	157.8	0.44	35.4	Inadequate	Inadequate	Yes	Br (15m)	Pheman	Going For Bid
12P	1035	OM6 Middle Omi West	1035	38T					9.2	Main Road		87.6	116.8	0.39	5.7	Inadequate	Inadequate	Yes	Br (15 x 37)	Pheman	Going For Bid
13P	995	OM6 Middle Omi West	995	13P	2 CC (1.2 dia) + BC (2.35 x 2.11)	609907	815310	Good	4.4	Secondary Road		36.9	49.2	1.35	29.8	Inadequate	Adequate	Yes	3 Cv (3 x 3.5)	Pheman	Going For Bid
14P	14P	Om7 Middle Omi South	14P		2 CC (Dia 0.9)	610002	814809	Poor	0.2	Secondary		2.3	3.0		1.5	Inadequate	Inadequate	Yes	1 Cv (3 x 3.5)	Pheman	Going For Bid

Table 3 - PIU Priority Sites (Designed by Abfort)

PIU Priority Sites Abfort	Structure No.	Subbasin	Structure No.	Alternative ID	Existing Crossing Structure Dimensions	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Stream Slope (%)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necessity for a New structure	Proposed Crossing Structure Dimensions	Designed by	Status
1	31	ON16 Agara Kasumu	31	58D	3 BC (3 x 2)	594212	809654	Good	14.5	Secondary Road		108.3	144.5	0.60	58.2	Inadequate	Adequate	Yes	Add 2 Cv (5 x 2)	Abfort	Addition by Dar
2	625B	ON10 Middle Ona North	625B	11T	2 BC (3 x 2)	596804	824486	Good	9.5	Tertiary Road	Newly constructed bridge by state government.	85.0	113.4	0.69	41.7	Inadequate	Adequate	Yes	Add 4 Cv (3 x 2)	Abfort	Addition by Dar
3	626	ON10 Middle Ona North	626	1T	3 BC (3 x 2)	596985	824082	Good	9.5	Tertiary Road	FLOODED OCASSIONALLY	85.0	113.4	0.69	62.6	Inadequate	Adequate	Yes	Add 3 Cv (3 x 2)	Abfort	Addition by Dar
4	68	Ob3 Middle Ogbere	68	1P	Br (2 Span 14.05)	603517	811337	Good	25.7	Tertiary Road		297.2	396.3	0.63	770.9	Adequate	Adequate	No		Abfort	New

Table 4 - PIU Priority Sites (Designed by Pheman)

PIU Priority Sites Pheman	Structure No.	Subbasin	Structure No.	Alternative ID	Existing Crossing Structure Dimensions	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Stream Slope (%)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necessity for a New structure	Proposed Crossing Structure Dimensions	Designed by	Status
1	1035	OM6 Middle Omi West	1035	38T					9.2	Main Road		87.6	116.8	0.39	5.7	Inadequate	Inadequate	Yes	Br (15 x 37)	Pheman	Going For Bid
2	827	ON15 Alaro	827		5 BC (1.75 x 1.7)	593288	813018	Good	25.7			181.6	242.2	0.47	34.1	Inadequate	Adequate	Yes	Br (15m)	Pheman	Going For Bid
3	70	Ob4 Foworogbun	70	36T	1 BC (1.65 x 0.65)	604851	809778	Fair	1.9	Secondary Road	The box culvert break down	17.8	23.7	0.80	2.1	Inadequate	Inadequate	Yes	1 Cv (3 x 3.5)	Pheman	Going For Bid
4	904	Ob4 Foworogbun	904	35T	2 BC (1.87 x 1.34)	604278	810482	Good	20.7		FLOODED ALWAYS	181.5	242.0	0.33		Inadequate	Adequate	Yes	Br (15m)	Pheman	Going For Bid
5	1237	Og4 Lower Ogunpa	1237	7P	4 CC (1.26 dia)	598369	808827	Fair	6.1		Get flooded when it rains heavily	63.7	84.9			Inadequate	Inadequate	Yes	3 Cv (3 x 3.5)	Pheman	Going For Bid
6	148B	ON17 Lower Ona East	148B	24T	2 BC (8.95 x 2.87)	594751	811112	Fair	408.7	Tertiary Road		564.7	752.9	0.21	147.3	Inadequate	Inadequate	Yes	Br (15m)	Pheman	Going For Bid
7	84	Ob2 Upper Ogbere	84	33T	2 BC (2.88 x 2.17)	603327	816097	Dilapidated	14.0	Secondary Road	The box culvert break down from the inlet	118.4	157.8	0.44	35.4	Inadequate	Inadequate	Yes	Br (15m)	Pheman	Going For Bid
8	995	OM6 Middle Omi West	995	13P	2 CC (1.2 dia) + BC (2.35 x 2.11)	609907	815310	Good	4.4	Secondary Road		36.9	49.2	1.35	29.8	Inadequate	Adequate	Yes	3 Cv (3 x 3.5)	Pheman	Going For Bid
9	14P	Om7 Middle Omi South	14P		2 CC (Dia 0.9)	610002	814809	Poor	0.2	Secondary		2.3	3.0		1.5	Inadequate	Inadequate	Yes	1 Cv (3 x 3.5)	Pheman	Going For Bid
10	137	ON10 Middle Ona North	137	18T	1 BC (2.45 x 2.45)	597663	821038	Fair	3.8	Main Road		32.0	42.7	0.72	21.6	Inadequate	Inadequate	Yes	Br (10m)	Pheman	Going For Bid
11	548	On8 Upper Ona South	548		1 CC (Dia 1.2)	602090	827098	Poor	0.6	Main	For Attention	8.3	11.1		1.6	Inadequate	Inadequate	Yes	1 Cv (3 x 1.5)	Pheman	Going For Bid
12	953	Om3 Upper Omi West	953		1 BC (7.75 x 3.4)	610827	819697	Poor	0.3	Secondary	Urgent attantion	4.8	6.4		94.9	Adequate	Inadequate	Yes	1 Cv (3 x 3.5)	Pheman	Going For Bid
13	7M	Ob3 Middle Ogbere	7M									275.0	366.7	0.63		Inadequate	Inadequate	Yes	Br (15m)	Pheman	Going For Bid

Table 5 - Pool of Priority Investments (Lot1, Lot2, Lot3 and Lot4)

Pool of Works	Structure No.	Subbasin	Structure No.	Alternative ID	Existing Crossing Structure Dimensions	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Stream Slope (%)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necessity for a New structure	Proposed Crossing Structure Dimensions	Designed by	Status
1	787	Ob2 Upper Ogbere	787	G4	3 BC (4.1 x 3)	603620	818422	Good	8.8	Highway	CONSTRUCTION IS ON GOING	83.3	111.1	0.44	130.9	Adequate	Adequate	No	Add 1 Cv (3 x 2)	Dar	Lot1 (Going for Bid)
2	788	Ob2 Upper Ogbere	788	G5	2 BC (2.98 x 1.8)	603448	817986	Good	10.7	Tertiary Road	FLOODED ALWAYS NEED URGENT ATTENTION	83.3	111.1	0.44	28.5	Inadequate	Adequate	Yes	2 Cv (6 x 2.5)	Dar	Lot1 (Going for Bid)
3	87	Ob2 Upper Ogbere	87	3T	1 BC (4 x 3)	603291	817189	Good	12.2	Highway		94.5	126.0	0.44	42.3	Inadequate	Adequate	Yes	Add 2 Cv (4 x 2.5)	Dar	Lot1 (Going for Bid)
4	304B	Ob2 Upper Ogbere	304B	86	Br (3.6m)	603318	816985	Good	12.3	Expressway		94.5	126.0	0.44	35.7	Inadequate	Adequate	Yes	2 Cv (6 x 2.5)	Dar	Lot1 (Going for Bid)
5	305	Ob2 Upper Ogbere	305		1 BC (1.8 x 1.5)	603140	816454	Good	1.0	Expressway					4.8	Inadequate	Adequate	Yes	1 Cv (4 x 1.5)	Dar	Lot1 (Going for Bid)
6	425	Ob2 Upper Ogbere	425	74	3 BC (3.9 x 3.55)	603385	814267	Good	18.3	Tertiary Road		154.3	205.8	0.44	154.5	Inadequate	Adequate	Yes	Add 1 Cv (4 x 3)	Dar	Lot1 (Going for Bid)
7	73	Ob3 Middle Ogbere	73		1 BC (8 x 3.39)	603453	813338	Erosion	21.3	Main Road		245.0	326.7	0.63	141.8	Inadequate	Inadequate	Yes	4 Cv (6 x 3)	Dar	Lot2 (Going for Bid)
8	76	Ob4 Foworogbun	76	34T	2 BC (3.15 x 3.93)	605091	812124	Fair	16.8	Main Road		181.9	242.5	0.50	94.1	Inadequate	Inadequate	Yes	6 Cv (6 x 2.5)	Dar	Lot2 (Going for Bid)
9	627	Og1 Upper Ogunpa	627		2 BC (3 x 2.73)	600956	819922	Good	5.8	Tertiary Road		76.9	102.5	0.44	50.9	Inadequate	Adequate	Yes	2 Cv (4 x 2.5)	Dar	Lot1 (Going for Bid)
10	42	Og1 Upper Ogunpa	42	2T	2 BC (1.98 x 2.3)	600088	819678	Good	8.7	Tertiary Road		95.0	126.7	0.44	23.2	Inadequate	Adequate	Yes	2 Cv (6 x 2.5)	Dar	Lot1 (Going for Bid)
11	41	Og1 Upper Ogunpa	41	3T	2 BC (1.8 x 1.97)	599690	819535	Fair	9.0	Tertiary Road		95.0	126.7	0.44	16.6	Inadequate	Inadequate	Yes	2 Cv (6 x 2.5)	Dar	Lot1 (Going for Bid)
12	40	Og1 Upper Ogunpa	40	4T	1 BC (2.5 x 1.89)	599430	819287	Fair	10.6	Tertiary Road	Damaged culvert	95.0	126.7	0.44	12.1	Inadequate	Inadequate	Yes	4 Cv (6 x 2.5)	Dar	Lot1 (Going for Bid)
13	275	Og3 Kudeti	275		2 BC (3 x 2.87)	601199	814885	Fair	4.6	Main Road		57.1	76.1	0.86	76.2	Adequate	Inadequate	Yes	1 Cv (7 x 2.5)	Dar	Lot1 (Going for Bid)
14	273	Og3 Kudeti	273		3 BC (2.9 x 3.05)	599892	814895	Fair	5.7	Main Road		67.5	90.0	0.93	123.6	Adequate	Inadequate	Yes	1 Cv (8 x 2.5)	Dar	Lot1 (Going for Bid)
15	578	ON8 Upper Ona South	578	125A	2 CC (0.9 dia)	602242	827517	Poor	5.3		Always over tops culvert when it rains heavy.	52.1	69.4	0.84	2.5	Inadequate	Inadequate	Yes	2 Cv (6 x 2)	Dar	Lot2 (Going for Bid)
16	565	ON9 Orogun	565		1 BC (1.8 x 1.9)	602126	823622	Good	7.6			48.8	65.0						2 Cv (4 x 2)	Dar	Lot1 (Going for Bid)
17	678	ON9 Orogun	678		1 BC (2.3 x 1.83)	601746	823690	Good	8.7			48.8	65.0						2 Cv (6 x 2)	Dar	Lot1 (Going for Bid)
18	677	ON9 Orogun	677		1 BC (3.6 x 2.85)	601611	823754	Good	8.8			59.9	79.9						2 Cv (6 x 2)	Dar	Lot1 (Going for Bid)
19	634	ON9 Orogun	634			601182	823698	Fair	11.7		Flooded ocassionally	82.5	110.0						3 Cv (5 x 2)	Dar	Lot1 (Going for Bid)
20	633	ON9 Orogun	633		2 BC (2.58 x 2.2)	600784	823752	Fair	12.0		Flooded ocassionally	82.5	110.0						3 Cv (6 x 2)	Dar	Lot1 (Going for Bid)
21	122B	ON9 Orogun	122B	5T	2 BC (2.7 x 2.68)	600092	824064	Erosion	15.9			164.0	218.7						5 Cv (6 x 2)	Dar	Lot1 (Going for Bid)
22	132	ON10 Middle Ona North	132	9D1	1 BC (2.2 x 1.39)	596314	823519	Erosion	1.8	Main Road		17.5	23.3	0.75	8.8	Inadequate	Inadequate	Yes	1 Cv (4 x 2)	Dar	Lot2 (Going for Bid)
23	139B	ON14 Lower Ona North	139B	70D	2 BC (10.9 x 5)	593529	816144	Fair	357.0	Highway		551.6	735.4	0.21	424.0	Inadequate	Inadequate	Yes	Br (63 x 11)	Dar	Lot3 (Going for Bid)
24	146B	ON14 Lower Ona North	146B	22T	Br (3 Span 13.35)	594035	814096	Good	366.8	Secondary Road		551.6	735.4	0.21	342.8	Inadequate	Adequate	Yes	Add 4 Cv (7 x 5.1)	Dar	Lot3 (Going for Bid)
25	147B	ON14 Lower Ona North	147B	23T	3 BC (3.08 x 3.16)	594056	813654	Fair	367.3	Main Road		563.6	751.5	0.21	67.0	Inadequate	Inadequate	Yes	Br (48 x 13)	Dar	Lot3 (Going for Bid)
26	816	ON14 Lower Ona North	816	N1	Br (13.4m)	594258	812882	Fair	372.3			563.6	751.5	0.21	172.4	Inadequate	Inadequate	Yes	Br (61 x 10)	Dar	Lot3 (Going for Bid)
27	23	ON15 Alaro	23	22D	1 BC (1.95 x 8.2)	593589	812694	Fair	26.0			199.4	265.9	0.47	54.9	Inadequate	Inadequate	Yes	8 Cv (6 x 2)	Dar	Lot2 (Going for Bid)
28	149B	ON17 Lower Ona East	149B	25T	Br (2 Span 10.2)	595014	810452	Good	411.8	Main Road		574.3	765.7	0.21	192.5	Inadequate	Adequate	Yes	Br (72m)	Dar	Lot4
29	150B	ON18 Lower Ona South	150B	26T	Br (2 Span 13)	595479	806271	Fair	452.2	Highway	FLOODED ALWAYS	603.4	804.5	0.11		Inadequate	Inadequate	Yes	Br (86m)	Dar	Lot4
30	195	On6 Upper Ona West	195	40D	1 CC (Dia 0.85)	600248	831265	Depilated	0.4	Tertiary	Break Down Culvert				0.6	Inadequate	Inadequate	Yes	1 Cv (2.5 x 1.5)		Lot2 (Going for Bid)
31	27T	Ob2 Upper Ogbere	803		2 CC (Dia 0.9)	604381	818291	Good	0.7	Expressway	THE INLECT IS FILLED WITH SEDIMENTS				1.5	Inadequate	Adequate	Yes	1 Cv (3.5 x 1.5)	Dar	Lot2 (Going for Bid)
32	6T	On9 Orogun	632	8D	2 CC (Dia 1.2)	600125	824528	Fair	0.9	Main	During heavy rain it prevents motorist from plying the road				3.3	Inadequate	Inadequate	Yes	1 Cv (4 x 1.5)		Lot2 (Going for Bid)

Table 6 - Damaged Structures

PIU List No.	Damaged ID	Similar locations	Subbasin	Structure No.	Alternative ID	Existing Crossing Structure Dimensions	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2018	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Stream Slope (%)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necessity for a New structure	Proposed Crossing Structure Dimensions	Designed by	Status
1	1D	12 (1st List) 36 (1st List)	ON15 Alaro	13	1D	2 BC (2.43 x 1.95)	590062	814869	Good	1.9			18.1	24.1	1.16	39.8	Adequate	Adequate	No			New
1	2D		On12 Middle Ona West	1110	2D	2 BC (1.05 x 1.08)	589411	818010	Poor	0.7	Tertiary	Usually flooded the area	8.8	11.7		3.0	Inadequate	Inadequate	Yes	1 Cv (3.5 x 1.5)	Dar	Masterplan
1	3D		ON6 Upper Ona West	187	3D	3 BC (2 x 1.3)	598674	830266	Good	81.5	Tertiary Road	Block with sand	402.9	537.2	0.15	9.6	Inadequate	Adequate	Yes	Br (70 x 10)	Dar	Masterplan
1	4D	10 (3rd List)	ON8 Upper Ona South	124A	4D	1 BC (2.18 x 1.29)	603052	829038	Fair	13.3	Tertiary Road		101.2	134.9	0.58	6.9	Inadequate	Inadequate	Yes	2 Cv (6 x 2.5)	Dar	Masterplan
1	5D		OM3 Upper Omi West	100	5D	1 BC (1.97 x 1.44)	608406	823503	Erosion	8.7	Secondary Road	erosion around the culvert	61.4	81.8	0.60	7.2	Inadequate	Inadequate	Yes	2 Cv (4.5 x 2)	Dar	Masterplan
1	6D	57 (1st List)	OM4 Upper Omi East	111	6D	2 BC (1.86 x 1.88)	612331	819378	Erosion	80.3	Tertiary Road		315.9	421.2	0.22	11.5	Inadequate	Inadequate	Yes	Br (30 x 10)	Dar	Masterplan
1	7D		Ob5 Lower Ogbere North	1251	7D		600441	807372	Fair	0.2	Tertiary	Get flooded when it rains heavily.	2.3	3.0		1.3	Inadequate	Inadequate	Yes	1 Cv (2 x 1)	Dar	Masterplan
1	8D		On9 Orogun	632	8D	2 CC (Dia 1.2)	600125	824528	Fair	0.9	Main	During heavy rain it prevents motorist from plying the road				3.3	Inadequate	Inadequate	Yes	1 Cv (4 x 1.5)	Dar	Masterplan
1	9D1		ON10 Middle Ona North	132	9D1	1 BC (2.2 x 1.39)	596314	823519	Erosion	1.8	Main Road		17.5	23.3	0.75	8.8	Inadequate	Inadequate	Yes	1 Cv (4 x 2)	Dar	Lot2 (Going for Bid)
1	9D2		ON10 Middle Ona North	599	9D2	1 CC (2.8 dia) + BC (2.53 x 1.82)	596373	823353	Fair	2.0	Tertiary Road		18.5	24.7	0.75	55.3	Adequate	Inadequate	Yes	1 Cv (3.5 x 2)	Dar	Masterplan
1	10D		ON15 Alaro	22	10D	3 BC (2.75 x 2.69)	592789	813119	Fair	24.9	Tertiary Road		181.6	242.2	0.47	69.0	Inadequate	Inadequate	Yes	3 Cv (6 x 2.75)	Dar	Masterplan
1	11D		On15 Alaro	824	11D	2 BC (1.6 x 1.5)	591636	812686	Good	1.0	Tertiary					8.2	Inadequate	Adequate	Yes	1 Cv (4 x 1.5)	Dar	Masterplan
1	13D		Ob4 Foworogbun	81	13D	2 BC (1.77 x 1.87)	605534	815454	Erosion	4.4	Main Road		37.0	49.3	0.46	15.6	Inadequate	Inadequate	Yes	2 Cv (4 x 2)	Dar	Masterplan
1	14D	9 (3rd List)	Og4 Lower Ogunpa	1224	14D	2 CC (1.2 dia)	599134	808898	Poor	3.4	Tertiary Road	Get flooded when it rains heavily. About 7hrs before movement can commence	29.3	39.1	1.10	6.2	Inadequate	Inadequate	Yes	1 Cv (4.5 x 2)	Dar	Masterplan
1	15D	10 (2nd List)	Og4 Lower Ogunpa	71	15D	2 CC (0.9 dia) + BC (2.13 x 1.9)	600249	809301	Dilapidated	1.3	Tertiary Road		13.5	18.0	1.10	34.4	Adequate	Inadequate	Yes	1 Cv (2.5 x 2)	Dar	Masterplan
1	16D		Om8 Lower Omi	69	16D	1 BC (2.45 x 1.33)	607985	809181	Poor	4.6	Tertiary		51.0			6.0	Inadequate	Inadequate	Yes	2 Cv (5 x 2)	Dar	Masterplan
1	17D2		ON17 Lower Ona East	29	17D2	1 BC (1.85 x 0.9)	594799	810477	Fair	1.4	Tertiary Road		14.5	19.3	0.77	3.9	Inadequate	Inadequate	Yes	1 Cv (4 x 1.5)	Dar	Masterplan
1	17D1		ON17 Lower Ona East	1585	17D1		594876	810487	Fair	1.5	Tertiary Road		14.7	19.6	0.77	5.9	Inadequate	Inadequate	Yes	1 Cv (4 x 1.5)	Dar	Masterplan
1	18D		Ob4 Foworogbun	78	18D		605959	813243	Dilapidated	2.0	Tertiary Road	Footstep	18.4	24.5	0.90	15.7	Inadequate	Inadequate	Yes	1 Cv (4.5 x 1.5)	Dar	Masterplan
1	19D5		ON15 Alaro	19D5			590061	816393	No Structure	1.3	No Road	Houses are encroaching on the flood plain but there is no crossing road	13.7	18.3								
1	19D4		ON15 Alaro	19D4			590097	816328	No Structure	1.4	No Road	Houses are encroaching on the flood plain but there is no crossing road	14.0	18.7								
1	19D2		ON15 Alaro	19D2			590187	816245	No Structure	1.4	No Road	Houses are encroaching on the flood plain but there is no crossing road	14.2	18.9								
1	19D3		ON15 Alaro	19D3			590174	816290	No Structure	1.4	No Road	Houses are encroaching on the flood plain but there is no crossing road	14.2	18.9								
1	19D1		ON15 Alaro	1087	19D1	1 BC (1.6 x 1.65)	590267	816172	Inadequate	1.4	Secondary Road	Erosion downstream	14.6	19.4	1.00	8.5	Inadequate	Inadequate	Yes	1 Cv (2.5 x 2)	Dar	Masterplan
1	19D6		ON15 Alaro	1064	19D6	1 BC (1.6 x 1.58)	590239	815966	Fair	6.0	Main Road		60.1	80.2	0.60	6.2	Inadequate	Inadequate	Yes	1 Cv (6 x 2.5)	Dar	Masterplan
1	20D		Ob4 Foworogbun	20D			604721	811449	No Structure	18.1	No Road	There is no structure	165.8	221.1	0.50		Inadequate	Inadequate	Yes	3 Cv (6 x 2.5)	Dar	Masterplan
1	21D2		Om8 Lower Omi	21D2			610901	808432		10.3	Tertiary	There is no structure	93.4	73.0			Inadequate	Inadequate	Yes	3 Cv (6 x 2)	Dar	Masterplan
1	21D1		Om8 Lower Omi	1448	21D1		610789	808467	Good	10.4	Tertiary	Always heavily flooded	94.3	73.0		26.4	Inadequate	Adequate	Yes	3 Cv (6 x 2)	Dar	Masterplan
1	22D		ON15 Alaro	23	22D	1 BC (1.95 x 8.2)	593589	812694	Fair	26.0			199.4	265.9	0.47	54.9	Inadequate	Inadequate	Yes	8 Cv (6 x 2)	Dar	Lot2 (Going for Bid)
1	23D		On10 Middle Ona North	23D		1 CC (Dia 0.8)	598674	820615		0.1	Tertiary	Gullies eroding the steep pathway between the houses causing difficulty in accessibility and instability to houses. Needs a local drainage system / There is a difference between excel sheet dimensions and the pictures./ Pictures show that there is no cul				0.6	Inadequate	Inadequate	Yes	1 Cv (1.5 x 1)	Dar	Masterplan
1	24D		ON15 Alaro	1290	24D	1 CC (0.8 dia)	589151	813650	Poor - Erosion	2.1	Local Road	Culvert need expansion,swamy and also get flooded when it rains	19.3	25.7	1.00	1.0	Inadequate	Inadequate	Yes	1 Cv (4 x 1.5)	Dar	Masterplan
1	25D		Og1 Upper Ogunpa	25D		2 BC (1.8 x 1.2)	600921	821208		0.4	Tertiary	Clogged Culvert, erosion downstream, used for diversion of a small drainage stream				7.0	Adequate	Inadequate	Yes	1 Cv (2.5 x 1.5)	Dar	Masterplan
1	26D2		Og1 Upper Ogunpa	26D2		2 BC (0.5 x 0.5)	601648	820151		0.1	Tertiary	Undersized culverts, downstream erosion, used for diversion of a small drainage stream				0.4	Inadequate	Inadequate	Yes	1 Cv (1.5 x 1)	Dar	Masterplan
1	26D1		Og1 Upper Ogunpa	675	26D1	2 CC (0.5 dia)	601382	820045	Poor	1.4	Tertiary Road	The Channel is too small, therefore it always flooded	13.9	18.5	0.78	0.5	Inadequate	Inadequate	Yes	1 Cv (3.5 x 1.5)	Dar	Masterplan
1	26D3	5 (2nd List)	Og1 Upper Ogunpa	46	26D3	2 BC (2 x 0.87)	601714	820275	Erosion	2.5	Tertiary Road		22.6	30.1	0.91	8.8	Inadequate	Inadequate	Yes	1 Cv (3.5 x 2)	Dar	Masterplan
1	27D		Om6 Middle Omi West	27D		1 BC (2 x 1.5)	605747	821048		0.3	Tertiary	The drainage channel route is not defined. The culvert is located in between a parcel of land, as a result the fence on the parcel of land was damaged during the heavy rainfall in June, 2017.				5.5	Adequate	Inadequate	Yes	1 Cv (3 x 1)	Dar	Masterplan
1	28D		Ob3 Middle Ogbere	28D			603659	810263	Inadequate	29.7	No Road	There is no structure and no crossing road near the confluence of Ogbere with Foworogbun	322.0	429.3	0.63		Inadequate	Inadequate	Yes	Br (55 x 10)	Dar	Masterplan
1	29D		Ob3 Middle Ogbere	915	29D	1 BC (3 x 1.82)	602700	810639	Good	0.9	Tertiary	FLOODED OCCASSIONALLY				12.0	Inadequate	Adequate	Yes	1 Cv (4 x 1.5)	Dar	Masterplan
1	30D	4 (4th List) 11 (4th List)	ON12 Middle Ona West	6	30D	2 BC (2.8 x 2.14)	591398	817720	Good	10.4	Tertiary Road		70.6	94.2	0.56	37.7	Inadequate	Adequate	Yes	2 Cv (6 x 2)	Dar	Masterplan
1	31D1		Om4 Upper Omi East	1380	31D1	2 CC (Dia 0.73)	611853	820884	Fair	0.4	Tertiary	HEAVILY FLOODED WITH RAINFALL,INLET COVERED WITH DEBIS.				0.9	Inadequate	Inadequate	Yes	1 Cv (2.5 x 1.5)	Dar	Masterplan
1	31D2		OM4 Upper Omi East	1378	31D2		612474	820914	Poor	1.2		FLOODED WITH HEAVY RAINFALL,SURROUNDED WITH VEGETATIONS.	12.5	16.6	0.71	18.9	Adequate	Inadequate	Yes	1 Cv (3.5 x 1.5)	Dar	Masterplan
1	32D1	1 (3rd List)	ON8 Upper Ona South	209	32D1	2 BC (0.73 x 0.95)	605822	829568	Good	1.2	Tertiary Road		12.4	16.5	0.87	2.6	Inadequate	Adequate	Yes	1 Cv (4 x 1.5)	Dar	Masterplan
1	32D2	2 (3rd List)	ON8 Upper Ona South	560	32D2	1 CC (0.5 dia)	605498	829021	Good	3.6	Tertiary Road	the area is usually flooded	30.4	40.5	0.87	0.3	Inadequate	Adequate	Yes	1 Cv (5 x 2)	Dar	Masterplan
1	32D3	3 (3rd List)	ON8 Upper Ona South	561	32D3	1 BC (1 x 1.26)	605265	828858	Fair	3.9	Secondary Road	the area is usually flooded	32.9	43.8	0.87	2.9	Inadequate	Inadequate	Yes	1 Cv (5 x 2)	Dar	Masterplan

Damaged Structures

PIU List No.	Damaged ID	Similar locations	Subbasin	Structure No.	Alternative ID	Existing Crossing Structure Dimensions	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2018	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Stream Slope (%)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necessity for a New structure	Proposed Crossing Structure Dimensions	Designed by	Status
1	33D	8 (3rd List)	ON18 Lower Ona South	1216	33D		595318	807403	Poor	447.3	Tertiary Road	NOT MEASURABLE FLOODED ALWAYS	599.8	799.8	0.11		Inadequate	Inadequate	Yes	Br (70 x 10)	Dar	Masterplan
1	34D2		OM3 Upper Omi West	34D2			611866	818210	No Structure	33.9	No Road	No structure, no crossing roads across Omi river	176.6	235.4	0.46		Inadequate	Inadequate	Yes	Br (30 x 10)	Dar	Masterplan
1	34D1		OM4 Upper Omi East	34D1			611909	818061	No Structure	116.1	No Road	No structure, no crossing roads across Omi river	393.0	524.0	0.25		Inadequate	Inadequate	Yes	Br (45 x 10)	Dar	Masterplan
1	35D1		ON6 Upper Ona West	167	35D1	1 BC (6.2 x 1.6)	598383	832534	Fair	66.8	Secondary Road		376.3	501.7	0.25	21.5	Inadequate	Inadequate	Yes	Br (55 x 10)	Dar	Masterplan
1	35D2		ON6 Upper Ona West	164	35D2		598940	832136	Dilapidated	3.4	Tertiary Road		29.0	38.6	0.85	61.1	Adequate	Inadequate	Yes	1 Cv (4.5 x 2)	Dar	Masterplan
1	35D3		ON6 Upper Ona West	35D3			598733	831929	No Structure	3.5	No Road	There is no structure	29.9	39.9	0.85		Inadequate	Inadequate	Yes	1 Cv (4.5 x 2)	Dar	Masterplan
1	37D	14 (2nd List) 2 (4th List)	ON7 Upper Ona East	203			602891	831048	Erosion	78.8	Tertiary Road		331.6	442.2	0.32	5.7	Inadequate	Inadequate	Yes	Br (45 x 10)	Dar	Masterplan
1	38D2		ON12 Middle Ona West	744	38D2	2 BC (1.43 x 0.9)	592858	817639	Poor	12.6	Tertiary Road		149.9	199.9	0.67	5.2	Inadequate	Inadequate	Yes	2 Cv (6 x 2.5)	Dar	Masterplan
1	38D1		ON12 Middle Ona West	2	38D1	2 CC (0.8 dia)	592957	817479	Good	12.7	Tertiary Road		149.9	199.9	0.67	1.6	Inadequate	Adequate	Yes	2 Cv (6 x 2.5)	Dar	Masterplan
1	39D2		Og3 Kudeti	391	39D2	1 BC (1.4 x 0.93)	599540	813367	Good	0.8	Secondary					1.8	Inadequate	Adequate	Yes	1 Cv (3.5 x 1.5)	Dar	Masterplan
1	39D1		Og3 Kudeti	39D1			599436	813331	No Structure	1.1	No Road	There is no structure	11.8	15.7								
1	39D3		Og3 Kudeti	39D3			599301	813384	No Structure	1.1	No Road	There is no structure	12.3	16.4								
1	40D		On6 Upper Ona West	195	40D	1 CC (Dia 0.85)	600248	831265	Depilated	0.4	Tertiary	Break Down Culvert				0.6	Inadequate	Inadequate	Yes	1 Cv (2.5 x 1.5)	Dar	Masterplan
1	41D1		Iddo Basin	41D1		2 CC (Dia 0.75)	586876	818001	Good	1.9	Tertiary	Patially blocked Culvert by Sediments	23.6			0.9	Inadequate	Adequate	Yes	1 Cv (4 x 2)	Dar	Masterplan
1	41D2		Iddo Basin	41D2			586360	817903	Poor	4.8	Tertiary	There is no structure	53.2				Inadequate	Inadequate	Yes	2 Cv (5 x 2)	Dar	Masterplan
1	42D		ON10 Middle Ona North	474	42D		596424	825749	Poor	6.8	Tertiary Road		85.0	113.4	0.69	27.9	Inadequate	Inadequate	Yes	2 Cv (6 x 2)	Dar	Masterplan
1	43D		Ob5 Lower Ogbere North	43D			603372	808874	No Structure	57.4	No Road	There is no structure to cross Ogbere River, south of the Confluence with Foworogbun, communities lack connection	365.9	487.8	0.38		Inadequate	Inadequate	Yes	Br (55 x 10)	Dar	Masterplan
1	44D		ON10 Middle Ona North	659	44D	1 BC (2.45 x 2.48)	598794	821034	Good	1.2	Main Road		12.8	17.1	0.72	21.9	Adequate	Adequate	No			
1	45D1		On17 Lower Ona East	851	45D1	1 CC (Dia 0.9) + 1 BC (2.05 x 1.85)	594301	810838	Fair	0.9	Tertiary	The culvet is at the point of collapse and required urgent attention				8.3	Inadequate	Inadequate	Yes	1 Cv (4 x 1.5)	Dar	Masterplan
1	45D2		ON16 Agara Kasumu	30	45D2	2 BC (3.78 x 2.15)	593434	809962	Fair	13.5	Tertiary Road		108.3	144.5	0.60	57.5	Inadequate	Inadequate	Yes	2 Cv (6 x 2.5)	Dar	Masterplan
1	46D	12 (4th List)	Om7 Middle Omi South	1129	46D	1 CC (Dia 0.85)	609336	813983	Fair	0.4	Secondary					0.6	Inadequate	Inadequate	Yes	1 Cv (2.5 x 1.5)	Dar	Masterplan
1	47D		ON7 Upper Ona East	47D			602492	830351	No Structure	82.6	No Road	There is no structure, communities lack connection in upper Ona	335.4	447.2	0.32		Inadequate	Inadequate	Yes	Br (45 x 10)	Dar	Masterplan
1	48D		On13 Middle Ona South	48D		1 BC (0.5 x 0.75)	593058	821194		0.1	Tertiary	Scour and Gullies, water bypasses the culvert				0.3	Inadequate	Inadequate	Yes	1 Cv (1.5 x 1)	Dar	Masterplan
1	49D		On15 Alaro	49D			589332	814426		0.1	Main	The main road is eroded, many signs of scour, erosion and accumualtion of water over the road					Inadequate	Inadequate	Yes	1 Cv (1.5 x 1)	Dar	Masterplan
1	50D		OM7 Middle Omi South	1141	50D	Br (3 Span 5.6)	611036	813009	Good	174.4	Secondary Road		444.8	593.0	0.19	90.8	Inadequate	Adequate	Yes	Br (60 x 10)	Dar	Masterplan
1	51D		OM6 Middle Omi West	1006	51D	2 BC (1.95 x 1.15)	609057	815881	Good	1.8	Tertiary Road		17.0	22.6	1.25	14.9	Inadequate	Adequate	Yes	1 Cv (2.5 x 2)	Dar	Masterplan
1	52D1		OM5 Middle Omi East	1416		1 BC (2.4 x 1.22)	612187	815465	Fair	17.0	Tertiary Road	Always over topping the culvert when it rains.	106.6	142.1	0.52	6.8	Inadequate	Inadequate	Yes	2 Cv (7 x 2.5)	Dar	Masterplan
1	52D2		OM7 Middle Omi South	1173	52D2		611443	814433	Poor	161.5	Tertiary Road	No access to measure it	432.7	576.9	0.19		Inadequate	Inadequate	Yes	Br (60 x 10)	Dar	Masterplan
1	53D1		Om7 Middle Omi South	53D1			609961	814671		0.2	Tertiary	Olorungunwa community postponed from 1st pool of works, Gullies eroding the steep pathway between the houses causing difficulty in accessibility and instability to houses. Needs a local drainage system					Inadequate	Inadequate	Yes	1 Cv (2.5 x 1)	Dar	Masterplan
1	53D2		Om7 Middle Omi South	53D2			610041	814677		0.2	Secondary	Olorungunwa community postponed from 1st pool of works, Gullies eroding the steep pathway between the houses causing difficulty in accessibility and instability to houses. Needs a local drainage system					Inadequate	Inadequate	Yes	1 Cv (2.5 x 1)	Dar	Masterplan
1	54D1		Ob4 Foworogbun	54D1			605235	814598		0.3	Tertiary	Gullies eroding the pathway between houses, primative footstep to pass the stream					Inadequate	Inadequate	Yes	1 Cv (3 x 1)	Dar	Masterplan
1	55D1		On10 Middle Ona North	55D1			594943	826156		0.1	Main	The road is eroded, many signs of scour, erosion in the road					Inadequate	Inadequate	Yes	1 Cv (1.5 x 1)	Dar	Masterplan
1	55D2		On10 Middle Ona North	55D2			594858	826372		0.4	Tertiary	Low point in the road, no structure, accumualtion of water over the road					Inadequate	Inadequate	Yes	1 Cv (2.5 x 1.5)	Dar	Masterplan
1	56D4		On15 Alaro	56D4			588921	812571		0.2	Tertiary	Low point in the road, no structure, accumualtion of water over the road					Inadequate	Inadequate	Yes	1 Cv (2 x 1)	Dar	Masterplan
1	56D3		ON15 Alaro	1294	56D3	1 BC (2 x 1.4)	589119	812812	Good	1.7	Local Road		16.8	22.4	1.00	9.1	Inadequate	Adequate	Yes	1 Cv (4 x 1.5)	Dar	Masterplan
1	56D2		ON15 Alaro	1297	56D2	1 CC (0.68 dia)	589618	813042	Fair	2.3	Secondary Road	Get flooded when it rains heavily.	21.2	28.3	1.00	0.7	Inadequate	Inadequate	Yes	1 Cv (4.5 x 1.5)	Dar	Masterplan
1	56D1		ON15 Alaro	1299	56D1		589990	813220	Poor - Erosion	5.3	Secondary Road	Get flooded when it rains heavily.	44.9	59.9	0.73		Inadequate	Inadequate	Yes	2 Cv (3.5 x 2)	Dar	Masterplan

Damaged Structures

PIU List No.	Damaged ID	Similar locations	Subbasin	Structure No.	Alternative ID	Existing Crossing Structure Dimensions	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2018	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Stream Slope (%)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necessity for a New structure	Proposed Crossing Structure Dimensions	Designed by	Status
2	58D	5 (4th List)	ON16 Agara Kasumu	31	58D	3 BC (3 x 2)	594212	809654	Good	14.5	Secondary Road		108.3	144.5	0.60	58.2	Inadequate	Adequate	Yes	Add 2 Cv (5 x 2)	Abfort	Addition by Dar
2	59D		OM2 Omi Headwaters South	1369	59D	2 BC (1.35 x 1.8)	611610	826770	Poor	32.9	Tertiary Road	Rain water always over topping the culvert and prevents people from passing. The culvert is old and very weak. For Attention	178.1	237.4	0.42	9.7	Inadequate	Inadequate	Yes	3 Cv (6.5 x 2.5)	Dar	Masterplan
2	60D		ON19 Lower Ona West	1333	60D		590935	807812	Fair	4.3	Tertiary Road	Gets flooded when it rains heavily	36.2	48.2	0.87		Inadequate	Inadequate	Yes	1 Cv (5.5 x 2)	Dar	Masterplan
2	61D		OM2 Omi Headwaters South	1348	61D	1 BC (1.8 x 1)	611115	825109	Dilapidated	7.7	Secondary Road	Culvert broken,flooded when it rains heavy,calls for attention!	55.9	74.6	0.68	4.1	Inadequate	Inadequate	Yes	2 Cv (5 x 2)	Dar	Masterplan
2	63D		OM2 Omi Headwaters South	1373	63D	1 BC (1.8 x 1.1)	611814	823239	Fair	2.1		CULVERT CLUSTARD WITH VEGETATION AT INLET,FLOODED WITH HEAVY RAINFALL.	19.1	25.5	1.06	5.8	Inadequate	Inadequate	Yes	1 Cv (3 x 2)	Dar	Masterplan
2	64D		OM3 Upper Omi West	101	64D	1 CC (0.8 dia)	607270	824546	Fair	6.5	Tertiary Road		49.1	65.5	0.60	0.8	Inadequate	Inadequate	Yes	2 Cv (4.5 x 2)	Dar	Masterplan
2	65D		Iddo Basin	65D			582566	815424	Poor	100.7	Tertiary	Primative Wooden Footpath acrros the Iddo Main River. Both pedestrian and vehicles will have to stop-over for hours during heavy rain.	500.9				Inadequate	Inadequate	Yes	Br (Span=85m)	Dar	Masterplan
2	66D1		On15 Alaro	1084	66D1	2 CC (Dia 0.75)	589808	816946	Fair	0.9	Tertiary					0.9	Inadequate	Inadequate	Yes	1 Cv (3.5 x 1.5)	Dar	Masterplan
2	66D		On15 Alaro	1085	66D	2 CC (Dia 0.75)	589914	816867	Poor	1.0	Tertiary					0.9	Inadequate	Inadequate	Yes	1 Cv (4 x 1.5)	Dar	Masterplan
2	68D		Ob5 Lower Ogbere North	916	74D		603446	809732	Poor	53.8	Tertiary Road	FLOODED OCCASSIONALLY	365.9	487.8	0.38	194.7	Inadequate	Inadequate	Yes	Br (55 x 10)	Dar	Masterplan
2	69D		Om6 Middle Omi West	1011	69D		608306	816092		0.1	Tertiary	Pond					Inadequate	Inadequate	Yes	1 Cv (1.5 x 1)	Dar	Masterplan
2	70D		ON14 Lower Ona North	139B	70D	2 BC (10.9 x 5)	593529	816144	Fair	357.0	Highway		551.6	735.4	0.21	424.0	Inadequate	Inadequate	Yes	Br (63 x 11)	Dar	Lot3 (Going for Bid)
2	71D1		ON7 Upper Ona East	202	71D1		602928	831163	Fair	2.3	Tertiary Road		20.8	27.7	1.33	14.9	Inadequate	Inadequate	Yes	1 Cv (3 x 2)	Dar	Masterplan
2	72D		Ob3 Middle Ogbere	909	72D		602432	811575	Poor	1.3	Tertiary Road	FLOODED ALWAYS	13.7	18.2	1.08	222.2	Adequate	Inadequate	Yes	1 Cv (2.5 x 2)	Dar	Masterplan
2	73D	6 (3rd List)	Og2 Middle Ogunpa	73D			597543	814852		0.0	Tertiary	The area is always flooded, houses are blocking the main route for draining the runoff to Ogunpa River.					Inadequate	Inadequate	Yes	1 Cv (1 x 1)	Dar	Masterplan
2	73D1	7 (3rd List)	Og2 Middle Ogunpa	73D1		1 CC (Dia 0.6)	597487	814820		0.0	Tertiary	The area is always flooded, houses are blocking the main route for draining the runoff to Ogunpa River.				0.3	Inadequate	Inadequate	Yes	1 Cv (1 x 1)	Dar	Masterplan
2	74D		Ob5 Lower Ogbere North	916	74D		603446	809732	Poor	53.8	Tertiary Road	FLOODED OCCASSIONALLY	365.9	487.8	0.38	194.7	Inadequate	Inadequate	Yes	Br (55 x 10)	Dar	Masterplan
2	75D		Og4 Lower Ogunpa	1231	75D	3 CC (0.716 dia)	599553	808449	Fair	1.6	Tertiary Road	Get flooded when it rains heavily	15.4	20.5	1.16	2.4	Inadequate	Inadequate	Yes	1 Cv (3.5 x 1.5)	Dar	Masterplan
3	77D		Om3 Upper Omi West	947	77D		609652	820288	Poor	0.6	Tertiary					6.8	Inadequate	Inadequate	Yes	1 Cv (3 x 1.5)	Dar	Masterplan
3	78D		On6 Upper Ona West	78D			600283	833417		0.0	Tertiary	There is no crossing structure./ Scour / The driange channel passing between houses.					Inadequate	Inadequate	Yes	1 Cv (1 x 1)	Dar	Masterplan
3	83D		Om6 Middle Omi West	1009	83D	1 BC (2.1 x 1.52)	608383	815759	Good	0.9	Tertiary					5.9	Inadequate	Adequate	Yes	1 Cv (4 x 1.5)	Dar	Masterplan
3	83D1		Om6 Middle Omi West	83D1		1 CC (Dia 0.85)	608449	815669		0.1	Tertiary	Damaged structure, overtopping occurs				0.6	Inadequate	Inadequate	Yes	1 Cv (1.5 x 1)	Dar	Masterplan
3	83D2		Om6 Middle Omi West	1012	83D2	1 BC (2.1 x 1.2)	608210	815723	Fair	0.9	Tertiary	Culvert under construction				4.3	Inadequate	Inadequate	Yes	1 Cv (4 x 1.5)	Dar	Masterplan
3	83D3		Om6 Middle Omi West	83D3		1 CC (Dia 1)	607995	815486		0.2	Tertiary	Damaged pipe culvert.				1.0	Inadequate	Inadequate	Yes	1 Cv (2.5 x 1)	Dar	Masterplan
4	84D		Om6 Middle Omi West	84D			610247	818502		0.1	Tertiary	Gully Erosion Problem / Damaged Channel box section					Inadequate	Inadequate	Yes	1 Cv (1.5 x 1)	Dar	Masterplan
4	84D1		Om6 Middle Omi West	84D1			610223	818525		0.1	Tertiary	The area is facing serious gully erosion problem. Damaged Channel box section					Inadequate	Inadequate	Yes	1 Cv (1.5 x 1)	Dar	Masterplan
4	84D2		Om6 Middle Omi West	84D2			610163	818410		0.1	Tertiary	The area is facing serious gully erosion problem. Damaged Channel box section					Inadequate	Inadequate	Yes	1 Cv (1.5 x 1)	Dar	Masterplan
4	84D3		Om6 Middle Omi West	84D3		1 CC (Dia 0.8)	610218	818316		0.3	Tertiary	The area is facing serious gully erosion problem and require urgent attention				0.6	Inadequate	Inadequate	Yes	1 Cv (3 x 1)	Dar	Masterplan
4	85D1		ON7 Upper Ona East	85D1			602663	831576	No Structure	2.0	No Road	It is an abandoned road,Require culvert to be motor able,It is a link road for communities.	18.7	24.9	1.33		Inadequate	Inadequate	Yes	1 Cv (2.5 x 2)	Dar	Masterplan
4	86D		Ob3 Middle Ogbere	86D		1 CC (Dia 0.6)	603957	813041		0.1	Main	The culvert is inadequate therefore the sorounding is usually flooded.				0.3	Inadequate	Inadequate	Yes	1 Cv (1.5 x 1)	Dar	Masterplan
4	86D1		Ob3 Middle Ogbere	86D1		1 BC (1 x 0.8)	603796	812750		0.3	Tertiary	Erosion and damaged channel box section / The culvert appears in a fair condition.				0.9	Inadequate	Inadequate	Yes	1 Cv (3 x 1)	Dar	Masterplan
4	86D2		Ob3 Middle Ogbere	86D2		1 BC (1.7 x 0.8)	603762	812686		0.3	Tertiary	The culvert appears in a fair condition. The request from the community is channelisation of this stream				1.8	Inadequate	Inadequate	Yes	1 Cv (3 x 1)	Dar	Masterplan
4	86D3		Ob3 Middle Ogbere	86D3			603706	812610		0.3	Tertiary	The request from the community is channelisation of this stream					Inadequate	Inadequate	Yes	1 Cv (3 x 1)	Dar	Masterplan
4	86D4		Ob3 Middle Ogbere	86D4		1 BC (0.75 x 1)	603595	812535		0.6	Tertiary	New Box Culvert / Erosion in downstream channel				0.9	Inadequate	Inadequate	Yes	1 Cv (3 x 1.5)	Dar	Masterplan
4	86D5		Ob3 Middle Ogbere	408	86D5	1 BC (1 x 1.1)	603566	812512	Poor	0.5	Tertiary	For Attention				1.4	Inadequate	Inadequate	Yes	1 Cv (3 x 1.5)	Dar	Masterplan
4	89D		On11 Alapata South	605	89D	1 BC (1.2 x 2)	592324	822167	Good	0.8	Secondary					4.0	Inadequate	Adequate	Yes	1 Cv (3.5 x 1.5)	Dar	Masterplan
4	90D		OM6 Middle Omi West	997	90D	1 BC (2.3 x 1.75)	609756	815718	Good	3.6	Tertiary Road		30.5	40.6	1.35	17.2	Inadequate	Adequate	Yes	1 Cv (4 x 2)	Dar	Masterplan
4	91D																					
4	92D																					
4	93D		On13 Middle Ona South	614		2 CC (Dia 0.75)	592885	821420	Fair	0.3	Tertiary	Flooded during heavy rain				0.9	Inadequate	Inadequate	Yes	1 Cv (2 x 1.5)	Dar	Masterplan

Annex

8

Assessment of Crossing Structures lying on Proposed Channels

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1. Introduction

There are around 1615 crossing locations in Ibadan comprising of 46 Bridges, 1067 Culverts and 181 boardwalks and footpaths. The rest of these crossing locations (321) have yet still no structures. It is important to ensure that the sizes of these structures are sufficient to convey the flow through them without causing any constrictions or bottle necks.

As the number of Structures are very large, the Consultant divided them to:

- Division 1: Structures located on proposed channels
- Division II: Structures located on natural streams

In this respect, this annex (Annex 8) presents the assessment of all identified crossing locations lying on proposed channels of the 1st Division. Annex 11 presents the 2nd Division of crossing locations lying on natural streams. Further Annexes (Annex 9, 10 and 12) presents the design of these structures and channels along with their cost estimate.

This annex comprises of the following:

- Assessment Methodology
- Sample of Calculation for one of the structures
- Compiled table including assessment of all structures and channels. The table is preceded by an introduction to define the terms of the table columns.

2. Assessment Methodology

The assessment of the different crossing structures investigated four main points:

- Location and Configuration
- Structure Integrity
- Hydraulic adequacy.

To understand the application of the above points on each crossing location, the Consultant chose a pilot structure as an example. The pilot structure chosen is Jenriyin Adeyipo Culvert with an Id. Structure no. 100. Sample of the Calculations for this structure is presented below.

2.1 Location and Configuration

The location of each structure is identified by using different types of methods such as:

1- Address of the structure obtained from the site visit investigations
2- The Easting and Northing position of the Structure based on a WGS1984 - UTM Zone 31N Coordinate System.
3- Identity of the structure; this is identified in different methods:

a. Structure number; this is a coding number system given to each structure ranging from 1 to 1583. This includes all the crossing locations that were visited during the site visit investigations conducted between August 2016 and November 2017.
b. The Batch number; this is a group of around 40 to 50 structures that lie near each other and were visited altogether during the same period of site investigations.
c. Alternative Id; this is another identity given to the structure which was either identified lately or prior to the structure coding system, such as damaged structures. The Consultant received the damaged structures from the PIU and named them with alternative identities, then these structures were visited. It was later noticed that these structures were previously visited and had already identities based on the coding number system, yet the Consultant opted to leave both identities for references.
d. The PIU list and number of the structure within this list (for damaged structures identified by the PIU).

2.2 Configuration

The configuration of each structure is defined as follows:

1. The type of existing crossing structure such as culvert, bridge, footpath, boardwalk or left as a natural stream with no structure.
2. The existing crossing structure dimensions
3. The vertical distance between the road level and the culvert invert level
4. The contributing rainfall catchment area of each structure in km^2.
5. The crossroad classification such as expressway, highway, main road, secondary road or tertiary road.

2.3 Structure Integrity

The structure integrity of each structure was assessed using the following criteria:

1. Condition of the structure; this was based on the site visit investigations conducted between August 2016 and November 2017 along with the associated site visit pictures.
2. Structural Adequacy; this is the conclusion of the structural assessment defining the adequacy of this structure from the structural point of view. These are based on the visual assessment on the conditions of this structure during the site investigations and site visit pictures. The conclusion is stated as Adequate or Non-Adequate.

2.4 Hydraulic Adequacy

The hydraulic Adequacy is based on the following:

1- The estimated flow passing through the structure; the flow is extracted from the rainfall-runoff model (HEC-HMS) model for both a 25-, and a 100-year return period.
2- The stream's slope; this shows the longitudinal slope of the channel's profile. The slope has no units and is presented in percentage of the drop of the channel's bed with respective to its length. The topographic slope of the stream is extracted from the LiDAR Digital Elevation Model.
3- The Manning's roughness coefficient; this represents friction factor of the structure. This value is taken as n = 0.017 for existing concrete culverts.
4- The hydraulic capacity of the existing structure based on Manning's formula and using one of the commercial software programs such as Flowmaster by Bentley.
5- Remarks based on the survey conducted in 2017 such as previous history for a flooded location or a structure that needs urgent attention.
6- Hydraulic Adequacy; this is the conclusion of the hydraulic assessment defining the adequacy of this structure from the hydraulic point of view. This is based on:
    a. A comparison between the estimated flow passing through the structure and its hydraulic capacity.
    b. The remarks based on the survey conducted in 2017.

    The conclusion is stated as Adequate or Non-Adequate.

2.5 Final Assessment

The final assessment of a structure is concluded based on the structural and hydraulic adequacy of that structure. If one of these criteria is revealed as inadequate, then the structure is considered as a damaged structure and thus there is a necessity to rehabilitate this structure. In the contrary, if both criteria are proved adequate, then the structure is considered as undamaged and there is no necessity to rehabilitate that structure.

3. Sample of Calculation for one of the Structures

The locations and configuration details of the chosen structure no. 100 is presented below

- Structure no. 100
- Jenriyin Adeyipo Culvert
- Batch No: Batch 0
- Easting: 608,406
- Northing: 823,503
- Structure: Culvert
- Size: 1 Box Culvert (1.97 x 1.44)
- Vertical Distance between the Road Level and the Culvert Invert Level is 1.61m
- Catchment Area: 8.7km^2

Plate 1: Location No. 100

The single carriage way has been badly damaged due to erosion around the culvert and along the carriage way. The carriage way is a secondary road category, this structure was visited during the initial survey to all flood prone areas in Ibadan indicated as "Batch 0". This structure is also one of the damaged structures in the PIU 1st list no. 5 with an alternative Id for damaged structures denoted as "5D". The catchment area of this crossing structure is 8.7 km^2 (> 1km^2) and thus considered as one of the crossing locations lying in the first division. Table 1 presents a tabularized form of the presented data above and similar data to other structures lying on system 32. Structure no. 100 indicated above is outlined in red. The table is sorted out from upstream to downstream and according to the catchment area of each structure. Table 1 presents the following fields:

- Channel Id (System no.)
  e.g. Structure 100 lies on system 32
- Subbasin name and Id,
  e.g. Structure 100 lies in Upper Omi West Basin with Id no. OM3
- Crossing number (Structure no.)
  e.g. this is structure no. 100
- Batch ID
  e.g. Structure no. 100 was visited during the initial survey to all flood prone areas in Ibadan during August 2016 and indicated as "Batch 0".
- Alternative ID (if any)
  e.g. Structure no. 100 has an alternative Id denoted as "5D".
- The PIU list and number of the structure within this list (for damaged structures identified by the PIU).
  e.g. Structure no. 100 is one of the damaged structures in the PIU 1st list no. 5

- The Address (Location)
  e.g. Structure no. 100 lies Jenriyin Adeyipo
- The Existing Crossing Structure Type
  e.g. Structure no. 100 is a culvert
- The Existing Crossing Structure Dimensions
  e.g. Structure no. 100 is 1 BC (1.97 x 1.44) which means 1 Box Culvert with a width of 1.97m and a height of 1.44m
- The Vertical Distance between the Road Level and the Culvert Invert Level.
  e.g. for Structure no. 100; this distance is 1.61m which means that the road is constructed directly on the culvert's soffit slab with no earth cover in between.
- The Easting and Northing in WGS 1984 coordinate system – UTM Zone 31N
  e.g. for Structure no. 100; the Easting position is 608,406m while the Northing position is 823,503m
- The Condition of the structure
  e.g. for Structure no. 100; there is erosion around the culvert
- The contributing rainfall Catchment Area of each structure.
  e.g. Structure no. 100 has a contributing rainfall catchment area of 8.7km^2
- The Cross-Road Classification
  e.g. Structure no. 100 lies on a secondary road.

Structure no. 100 is assessed based on the hydraulic design criteria presented in Annex 14. The flow is extracted from the rainfall-runoff model (HEC-HMS) model for both a 25-, and a 100-year return period. The following data is extracted from the rainfall-runoff model:

- The 25-year flow for structure no. 100 is 79 m^3/s, while
- The 100-year flow for structure no. 100 is 105.4 m^3/s.

The topographic slope of the tributary is extracted from the LiDAR Digital Elevation Model. The slope of the tributary along the reach passing through Structure no. 100 is 0.6%.

To assess the capacity of Structure no. 100, the dimensions of the structure is inserted in the commercial software hydraulic model (FlowMaster). The existing dimensions of the structure is 1 Box Culvert (1.97 x 1.44) and topographic slope of the tributary (0.6%).

The analysis reveal that the capacity of this structure can accommodate a flow of 7.2 m^3/s which is far below the 25-year flow (61.4 m3/s). The culvert is considered hydraulically inadequate to convey the flow. Figure 1 presents the analysis of the structure no. 100 using (FlowMaster by Bentley).

The remarks based on survey conducted in 2017 reveals that this Culvert has a fair condition with erosion around the culvert. The culvert is also considered as structurally inadequate.

Based on the above it is necessarily to rehabilitate this structure such that it may convey the design flow. This data is also added to the GIS geodatabase.

Table 2 presents some of the fields of Table 1 in addition to the following fields:

- Existing Crossing Structure Dimensions
  e.g. Structure no. 100 is 1 BC (1.97 x 1.44) which means 1 Box Culvert with a width of 1.97m and a height of 1.44m
- The 25-year flow
  e.g. for structure no. 100, the 25-year flow is 79 m^3/s
- The 100-year flow
  e.g. for structure no. 100, the 100-year flow is 105.4 m^3/s
- Stream Slope (%)
  e.g. for structure no. 100, the stream slope is 0.6%
- Manning roughness coefficient
  e.g. for structure no. 100, the manning's roughness coefficient is taken as n = 0.017 for existing concrete culverts.
- Existing Flow Capacity.
  e.g. for structure no. 100, the existing flow capacity is 7.2 m^3/s based on the Flowmaster calculations.
- Hydraulic Adequacy
  e.g. Structure no. 100 is hydraulically inadequate because the capacity of this structure can accommodate a flow of 7.2 m^3/s which is far below the 25-year flow (61.4 m3/s).
- Structural Adequacy
  e.g. Structure no. 100 is structurally inadequate because there is erosion around the culvert
- Necessity for a New structure
  e.g. for structure no. 100, it is necessary to rehabilitate this structure.

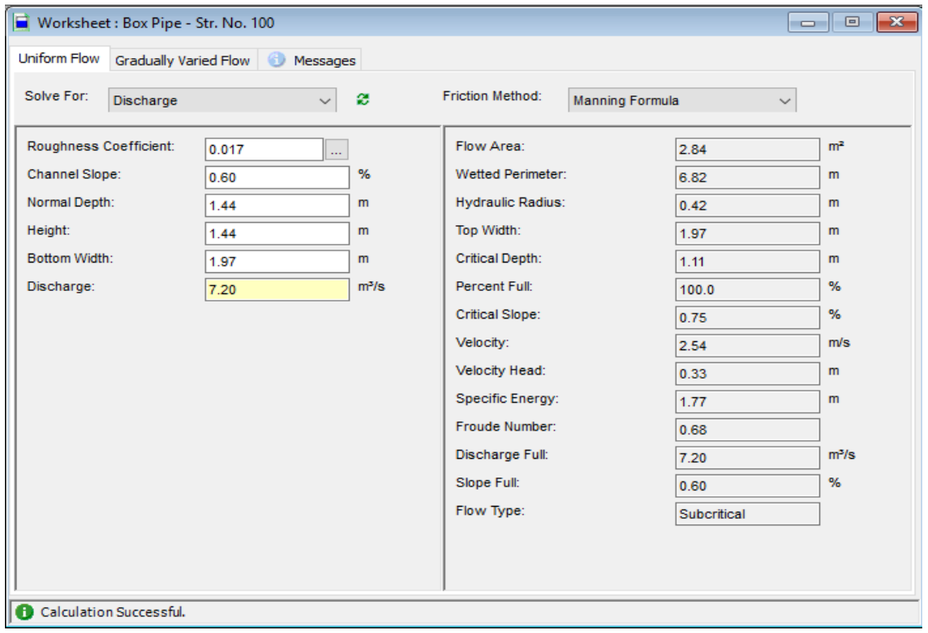

Figure 1: Assessment of the Existing Capacity of Crossing Structure No. 100 using Flow Master

Table 1: Structure Data of System 32 – Egberi River

Channel ID	Subbasin	Structure No.	Batch ID	Alternative ID	PIU List	No in PIU List	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification
32	OM3 Upper Omi West	1356	Batch 7				Olorunda Abaa, Road 1,Ogooluwa Estate	Natural Stream		0.3	606,591	826,139	Poor	1.36	
		1351	Batch 7				Eleshinla Village, Eleshinla Road	Footpath		0.7	607,291	825,674	Poor	3.71	Tertiary Road
		1352	Batch 7				Alapata Estate, Onireke Road	Culvert	1 BC (1.85 x 0.74)	1.1	607,294	824,992	Poor	4.74	Secondary Road
		101	Batch 0	64D	PIU 2nd List	7	TEMIDIER , SOKA ELEGA,	Culvert	1 CC (0.8 dia)	1.29	607,270	824,546	Fair	6.45	Tertiary Road
		1534	Batch 31				Harmony Estate, Kumapayi	Footpath		1.7	607,519	824,147	Poor	6.97	Tertiary Road
		100	Batch 0	5D	PIU 1st List	5	Jenriyin Adeyipo	Culvert	1 BC (1.97 x 1.44)	1.61	608,406	823,503	Erosion	8.70	Secondary Road
		931	Batch 13				Kute, Ibagun / Shokobi, Ibagun / Shokobi road	Culvert	2 BC (1.2 x 1.7)	1.9	608,657	823,092	Fair	10.28	Tertiary Road
		932	Batch 13				Kute, Farinto, Farinto	Culvert	1 BC (2.4 x 1.5)	1.71	608,756	822,837	Good	10.50	Tertiary Road
		972	Batch 13				Kute Area, Powerline, Powerline	Natural Stream		1.2	608,787	822,694	Poor	10.64	Tertiary Road
		974	Batch 13				Kute Area, Sobaloju, Sobaloju	Footpath		1.56	608,837	822,548	Fair	10.74	Tertiary Road
		933	Batch 13				Kute, Ifellodun zone 17, Ifelodun Zone 17	Culvert	1 BC (2.6 x 1.62)	1.87	608,817	822,433	Good	11.09	Tertiary Road
		97	Batch 0				SIONI/OPEOLU,	Culvert	2 CC (1.8 dia)	2.48	608,897	822,137	Fair	19.36	Tertiary Road
		990	Batch 13				Agbaja Olodo, Opeolu Layout, Behind Oremeji house	Natural Stream		1.64	608,977	822,016	Poor	19.40	Tertiary Road
		1522	Batch 31				Olodo kumapayi, Opeolu Agbaja	Natural Stream		1.5	609,242	821,545	Poor	19.83	Tertiary Road
		934	Batch 13				Arulogun Alaja, Along railway line, Railway line	Bridge	Br (2 Span 6.45)	5.57	609,335	821,475	Fair	19.87	Tertiary Road

Table 2: Structure Assessment of System 32 – Egberi River

Channel ID	Structure No.	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Condition	Catchment Area (km2)	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Stream Slope (%)	Manning For Structure	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necessity for a New structure
32	1356	Natural Stream		Poor	1.36	Flooded with heavy rainfall.	14.0	18.6	0.81	0.017	1.5	Inadequate	Inadequate	Yes
	1351	Footpath		Poor	3.71	Over flows when it rains heavy.	31.6	42.1	0.81	0.017	25.8	Inadequate	Inadequate	Yes
	1352	Culvert	1 BC (1.85 x 0.74)	Poor	4.74	Always over topping with heavy rainfall.	39.3	52.4	0.81	0.017	3.0	Inadequate	Inadequate	Yes
	101	Culvert	1 CC (0.8 dia)	Fair	6.45		49.1	65.5	0.60	0.017	0.8	Inadequate	Inadequate	Yes
	1534	Footpath		Poor	6.97		52.0	69.3	0.60	0.017	24.3	Inadequate	Inadequate	Yes
	100	Culvert	1 BC (1.97 x 1.44)	Erosion	8.7	Erosion around the culvert	61.4	81.8	0.60	0.017	7.2	Inadequate	Inadequate	Yes
	931	Culvert	2 BC (1.2 x 1.7)	Fair	10.28	Overflow during heavy	79.0	105.4	0.60	0.017	9.3	Inadequate	Inadequate	Yes
	932	Culvert	1 BC (2.4 x 1.5)	Good	10.5		79.0	105.4	0.60	0.017	9.8	Inadequate	Adequate	Yes
	972	Natural Stream		Poor	10.64		79.0	105.4	0.60	0.017	30.7	Inadequate	Inadequate	Yes
	974	Footpath		Fair	10.74		79.0	105.4	0.60	0.017	34.5	Inadequate	Inadequate	Yes
	933	Culvert	1 BC (2.6 x 1.62)	Good	11.09		79.0	105.4	0.60	0.017	12.1	Inadequate	Adequate	Yes
	97	Culvert	2 CC (1.8 dia)	Fair	19.36		129.0	171.9	0.60	0.017	13.6	Inadequate	Inadequate	Yes
	990	Natural Stream		Poor	19.4		129.0	171.9	0.60	0.017	36.7	Inadequate	Inadequate	Yes
	1522	Natural Stream		Poor	19.83		129.0	171.9	0.60	0.017	40.9	Inadequate	Inadequate	Yes
	934	Bridge	Br (2 Span 6.45)	Fair	19.87		129.0	171.9	0.60	0.017	293.0	Adequate	Inadequate	Yes

Structure Data																Structure Assessment							
Channel ID	Subbasin	Structure No.	Batch_ID	Alternative ID	PIU List	No in PIU List	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Stream Slope (%)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
Channel_ID	Subbasin						Location							Cat_A_Km2			Flow25CMS	Flow100CMS	Long_Slope				
Channel_ID	Subbasin	Structu_No	Batch_ID	Altrnat_ID	PIU_List	PIU_ListNo	Address	Ext_St_Typ	Ext_St_Dim	VD_RC	Easting	Northing	Condition	Cat_A_Km2	X_RoadClas	Remarks	Flow25CMS	Flow100CMS	Long_Slope	Ex_FlowCap	Hydr_Adeq	Struc_Adeq	Nec_New_st
11	Ob1 Ogbere Headwaters	713	Batch 12				Akobo, Opposite Amazing investment filling station Olohunda road	Culvert	2 CC (0.9 dia)	2.8	604,218	821,928	Good	1.18	Main Road		14.69	19.59	0.71	2.3	Inadequate	Adequate	Yes
		115	Batch 0				BASHORUN , ESTATE AKOBO	Culvert	1 BC (2.02 x 2.97)	2.33	604,023	821,298	Fair	2.27	Secondary Road		20.78	27.70	0.71	21.2	Inadequate	Inadequate	Yes
		114	Batch 0				GENERAL GAS - NANA CHURCH ROAD	Culvert	1 BC (3.2 x 2.05)	2.49	604,048	820,675	Fair	3.63	Secondary Road		42.57	56.76	0.71	23.8	Inadequate	Inadequate	Yes
		113	Batch 0				PAPA ELEWE-ODO	Culvert	1 BC (2.48 x 1.84)	2.23	603,980	820,317	Fair	4.78	Tertiary Road		42.57	56.76	0.71	14.8	Inadequate	Inadequate	Yes
12	Ob2 Upper Ogbere	703	Batch 12	G1			Elewi Odo, Elewi Odo, Ojo / Iwo road	Culvert	1 BC (3.03 x 2.42)	6.15	603,854	820,118	Good	4.96	Expressway	Flooded and enter nearby guest house	29.63	39.50	0.71	28.0	Adequate	Adequate	No
		704	Batch 12	G2			Bashorun, Surulere, Surulere street off Iwo road	Culvert	2 BC (3 x 1.92)	2.31	603,847	819,654	Good	5.44	Tertiary Road		29.63	39.50	0.44	31.4	Adequate	Adequate	No
		814	Batch 18				ARIJE AREA/IWO RAOD, OGBERE AKERE RIVER, SURULERE STREET	Natural Stream		1.8	603,829	819,514	Poor	5.48	Tertiary Road	FLOODED OCASSIONALLY	51.00	68.00	0.44	23.7			
		786	Batch 18				IWO ROAD, OGBERE RIVER, OLORUNBO STREET	Natural Stream		2.11	603,749	819,216	Poor	7.50	Tertiary Road		83.33	111.10	0.44	30.1			
		796	Batch 18	G3			BASORUN/IWO ROAD, ABIMBOLA CHANNEL, ABIMBOLA STREET	Culvert	3 BC (2.82 x 2.42)	2.9	603,682	819,010	Good	7.63	Tertiary Road		83.33	111.10	0.44	60.0	Adequate	Adequate	No
		796B					Iwo road/Abayomi/Sule-manager, Ogbere S.C., Olagoke Akano/CAC	Natural Stream		2.83	603,655	818,825	Fair	8.33	Tertiary Road		83.33	111.10	0.44	107.2			
		787	Batch 18	G4			IWO ROAD, IWO ROAD	Culvert	3 BC (4.1 x 3)	3.36	603,620	818,422	Good	8.76	Highway	CONSTRUCTION IS ON GOING	83.33	111.10	0.44	130.9	Adequate	Adequate	No
		788	Batch 18	G5			BODE KUMAPAYI/IWO ROAD, OGBERE RIVER, AKINWUNMI/ODEWENWA STREET	Culvert	2 BC (2.98 x 1.8)	2.1	603,448	817,986	Good	10.68	Tertiary Road	FLOODED ALWAYS NEED URGENT ATTENTION	83.33	111.10	0.44	28.5	Inadequate	Adequate	Yes
		304	Core 2				Old Ife Road, Onipepeye/Ogbeere Stream, Abayomi Street	Footpath		3.35	603,275	817,318	Good	12.10	Tertiary Road	The area is flooded during rain	94.50	126.00	0.44	518.6	Adequate	Adequate	No
		87	Batch 0	3T			ONIPEPEYE,	Culvert	1 BC (4 x 3)	3.5	603,291	817,189	Good	12.22	Highway		94.50	126.00	0.44	42.3	Inadequate	Adequate	Yes
		304B	Core 2	86			Onipepeye, Onipepeye Stream, Lagos-Ibadan Road	Bridge	Br (3.6m)	7	603,318	816,985	Good	12.27	Expressway		94.50	126.00	0.44	35.7	Inadequate	Adequate	Yes
		84	Batch 0	33T			OGBERE MORADEYO,	Culvert	2 BC (2.88 x 2.17)	2.4	603,327	816,097	Dilapidated	14.04	Secondary Road	The box culvert break down from the inlet	118.35	157.80	0.44	35.4	Inadequate	Inadequate	Yes
		82	Core 5				Oremeji, Babanla	Bridge	Br (2 Span 13.83)	5.69	603,586	815,730	Good	16.36	Main Road		130.88	174.50	0.44	645.1	Adequate	Adequate	No
		1562	Batch 31				Ogbere Idi Obi, Off Itamerin Road	Footpath		3.62	603,533	815,672	Poor	16.42	Tertiary Road		130.88	174.50	0.44	34.0			
		425	Core 4	74			Ogbere, Ogere Babarere, Seriki Market	Culvert	3 BC (3.9 x 3.55)	4	603,385	814,267	Good	18.29	Tertiary Road		154.31	205.75	0.44	154.5	Inadequate	Adequate	Yes
12C	Ob2 Upper Ogbere	797	Batch 18				IWO ROAD, AMUDA STREET	Culvert	1 BC (1.84 x 1.53)	4.5	604,059	819,437	Good	1.15	Expressway		12.38	16.50	1.43	11.0	Inadequate	Adequate	Yes
		795	Batch 19				JONKU/IWO ROAD, ARIJE FAFUNLAYO STREET	Culvert	1 BC (3.22 x 2.36)	2.64	603,920	819,420	Good	1.23	Tertiary Road	OCASSIONALY FLOODED	12.98	17.30	1.43	41.3	Adequate	Adequate	No
12F	Ob2 Upper Ogbere	802	Batch 18				IWO ROAD, ALAREPE STREET	Culvert	1 BC (2.46 x 1.9)	6.4	603,873	818,078	Good	1.48	Expressway	FLOODED ALWAYS	14.85	19.80	0.94	17.6	Inadequate	Adequate	Yes
		801	Batch 18				ABAYOMI ATELE/IWO ROAD, ATELE/OLADAPO STREET	Culvert	2 BC (1.42 x 2.62)	2.92	603,752	818,071	Good	1.51	Tertiary Road	FLOODED ALWAYS	15.08	20.10	0.94	25.3	Adequate	Adequate	No
		813	Batch 18				ABAYOMI/IWO ROAD, ABAYOMI IWO ROAD	Culvert	2 BC (2.39 x 2)	2.3	603,561	818,094	Good	1.56	Tertiary Road	FLOODED ALWAYS	15.45	20.60	0.94	36.3	Adequate	Adequate	No
12P	Ob2 Upper Ogbere	310	Core 2				Oke Koto Sawmill, Old Army Barrack	Culvert	1 BC (3.5 x 2.03)	2.24	603,963	816,427	Fair	1.06	Tertiary Road		11.70	15.60	1.05	31.9	Adequate	Inadequate	Yes
		83	Batch 0				MAKU , OGBERE IDI-OSAN	Culvert	2 BC (3.1 x 2.07)	2.47	603,840	816,143	Erosion	1.62	Secondary Road		15.90	21.20	1.05	56.3	Adequate	Inadequate	Yes
		1561	Batch 31				Ogbere Idi Obi	Footpath		2.13	603,720	815,983	Dilapidated	1.72	Tertiary Road		16.65	22.20	1.05	198.7	Adequate	Inadequate	Yes
		73	Batch 0				OGBERETIOYA,	Culvert	1 BC (8 x 3.39)	4.22	603,453	813,338	Erosion	21.32	Main Road		245.00	326.67	0.63	141.8	Inadequate	Inadequate	Yes
		7M					Ogbere Aba Onde single span bridge										275.00	366.67	0.63		Inadequate	Inadequate	Yes
13	Ob3 Middle Ogbere	68	Batch 0	1P			GBEGBA , OGBERE, Mosfala Road,	Bridge	Br (2 Span 14.05)	5.41	603,517	811,337	Good	25.70	Tertiary Road		297.20	396.27	0.63	770.9	Adequate	Adequate	No
		28D	PIU 1st List		PIU 1st List	28	ZONE 2 AND 3- PAPA ELEYE COMMUNITY , OLOMI AREA, IBADAN 2	Natural Stream			603,659	810,263	Inadequate	29.71	No Road	There is no structure and no crossing road near the confluence of Ogbere with Foworogbun	322.00	429.33	0.63		Inadequate	Inadequate	Yes
13A	Ob3 Middle Ogbere	427	Core 4				Ogbere, Transformer road	Culvert	2 BC (2.78 x 2.04)	2.34	603,775	813,873	Good	1.14	Tertiary Road		12.30	16.40	1.15	50.1	Adequate	Adequate	No
		426	Core 4				Ile eja bus stop Oritamrin road, Ifelodun street	Footpath		2.68	603,571	813,761	Poor	1.24	Tertiary Road		13.05	17.40	1.15	78.9	Adequate	Inadequate	Yes
13E	Ob3 Middle Ogbere	Size Change												1.50			15.00	20.00	1.20				
13K	Ob3 Middle Ogbere	909	Batch 24	72D	PIU 2nd List	15	MOSFALA, AMADIYA STREET	Footpath		3.34	602,432	811,575	Poor	1.32	Tertiary Road	FLOODED ALWAYS	13.65	18.20	1.08	222.2	Adequate	Inadequate	Yes
		1513	Batch 31				off Mosfala Road	Footpath		2.15	602,659	811,459	Poor	1.46	Tertiary Road		14.70	19.60	1.08	120.9	Adequate	Inadequate	Yes
		910	Batch 24				MOSFALA, ALATA STREET	Natural Stream		1.5	602,949	811,322	Poor	1.69	Tertiary Road	FLOODED OCCASSIONALLY	16.43	21.90	1.08	46.5	Adequate	Inadequate	Yes
		911	Batch 24				MOSFALA, TEMIDIRE OGUNDEPEO STREET	Culvert	1 BC (3 x 2.1)	2.56	603,078	811,275	Good	1.76	Tertiary Road	FLOODED OCCASSIONALLY	16.95	22.60	1.08	27.9	Adequate	Adequate	No
		67	Batch 0				ARAROMI OGUNDEPO	Culvert	2 BC (2.42 x 1.83)	2.05	603,362	811,268	Erosion	1.94	Tertiary Road		18.30	24.40	1.08	35.0	Adequate	Inadequate	Yes
13M	Ob3 Middle Ogbere	Size Change												1.50			15.00	20.00	1.20				
14	Ob4 Foworogbun	344	Core 2				Gbagi, Gbagi Market	Culvert	1 BC (1.55 x 1.5)	2.06	605,375	817,080	Fair	1.27	Tertiary Road	The area is flooded during rain	13.28	17.70	0.46	4.9	Inadequate	Inadequate	Yes
		342	Core 2				Onideure, Alebiosu road	Culvert	2 BC (3.1 x 2.1)	2.5	605,388	816,253	Good	2.81	Secondary Road		24.83	33.10	0.46	38.0	Adequate	Adequate	No
		353	Core 2				Gbaremu Area, Gbaremu Akinlade	Natural Stream			605,447	815,555	Poor	4.33	Tertiary Road		36.23	48.30	0.46	55.1	Adequate	Inadequate	Yes
		81	Batch 0	13D	PIU 1st List	13	GBAREMU OLOSUN	Culvert	2 BC (1.77 x 1.87)	2.2	605,534	815,454	Erosion	4.43	Main Road		36.98	49.30	0.46	15.6	Inadequate	Inadequate	Yes
		327	Core 2				Adenira Olosun, Adeniran/Olosun Stream, Adeniran/Olosun	Bridge	Br (2 Span 2.5)	2.1	605,713	814,749	Good	7.33	Secondary Road	Flooding is experienced during heavy rain	84.77	113.03	0.50	25.6	Inadequate	Adequate	Yes
		437	Core 4				Gangan -Paraa road, Odo Paraa, Paraa	Culvert	4 CC (0.7 dia) + BC (2.2 x 2.47)	2.63	605,834	814,084	Poor	10.44	Secondary Road		84.77	113.03	0.50	17.7	Inadequate	Inadequate	Yes
		445	Core 4				Foworogun Area, Odo Foworogun, Foworogun	Culvert	3 BC (0 x 2.9)	3.23	605,447	813,230	Good	11.95	Tertiary Road		117.86	157.14	0.50		Inadequate	Adequate	Yes

Structure Data																Structure Assessment							
Channel ID	Subbasin	Structure No.	Batch_ID	Alternative ID	PIU List	No in PIU List	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Stream Slope (%)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
14L	Ob4 Foworogbun	329	Core 2				Temidayo-Ogungbile, Temidire	Footpath		0.9	606,647	815,586	Erosion	1.05	Tertiary Road	It floods occassionally when it rains	11.63	15.50	0.78	53.1	Adequate	Inadequate	Yes
		80	Batch 0				AROYE / ORISUNBARE	Culvert	2 BC (1.55 x 1.57)	1.9	606,144	815,322	Fair	2.16	Main Road		19.95	26.60	0.78	13.4	Inadequate	Inadequate	Yes
		328	Core 2				Alagbayun, Oke ola/Alaba Road	Culvert	2 BC (2.6 x 1.2)	1.5	605,915	815,190	Good	2.32	Tertiary Road		21.15	28.20	0.78	17.8	Inadequate	Adequate	Yes
14Q	Ob4 Foworogbun	79	Batch 0				AIMASIKO	Culvert	3 BC (1.39 x 1.26)	1.5	606,741	814,678	Fair	1.63	Tertiary Road		15.98	21.30	0.86	13.6	Inadequate	Inadequate	Yes
		1524	Batch 31				Kate Idi Obi, Kate zone 1	Footpath		1.98	606,456	814,594	Poor	1.79	Tertiary Road		17.18	22.90	0.86	61.5	Adequate	Inadequate	Yes
		89	Batch 0				PAARA	Culvert	2 BC (2.43 x 1.21)	1.49	605,980	814,334	Fair	2.09	Secondary Road		19.43	25.90	0.86	17.4	Inadequate	Inadequate	Yes
14V	Ob4 Foworogbun	443	Core 4				Aseyori-Alapafon, Alapafon Estate	Footpath		1.45	606,521	813,225	Poor	1.22	Tertiary Road		12.90	17.20	0.90	28.8	Adequate	Inadequate	Yes
		442	Core 4				Bamitale-Alapafon	Footpath		1.16	606,202	813,304	Poor	1.78	Tertiary Road	The area is always flooded whenever it rain	17.10	22.80	0.90	17.3	Inadequate	Inadequate	Yes
		78	Batch 0	18D	PIU 1st List	18	MAKU , OGBERE IDI-OSAN	Footpath		1.2	605,959	813,243	Dilapidated	1.95	Tertiary Road	Footstep	18.38	24.50	0.90	15.7	Inadequate	Inadequate	Yes
		440	Core 4				Olunloyo Area, Irepodun Alapafon	Footpath		1.14	605,800	813,115	Poor	2.05	Tertiary Road		19.13	25.50	0.90	12.6	Inadequate	Inadequate	Yes
		439	Core 4				Alagbaa-Emilagbe, Oluwalogbon Church	Culvert	1 BC (1.8 x 1.3)	1.43	605,594	813,000	Good	2.45	2.45	2.45	2.45	2.45	0.90	6.8	Inadequate	Adequate	Yes
14X	Ob4	401	Core 4				Sogade, Ireakari Road	Culvert	2 CC (0.8 dia)	1.15	605,203	812,164	Fair	1.09	Tertiary Road		11.93	15.90	1.70	2.6	Inadequate	Inadequate	Yes
15	Ob4 Foworogbun	76	Batch 0	34T			OLUNLOYO IDIAGBON , ASOLO ROAD,	Culvert	2 BC (3.15 x 3.93)	3.4	605,091	812,124	Fair	16.84	Main Road		181.88	242.50	0.50	94.1	Inadequate	Inadequate	Yes
		20D	PIU 1st List		PIU 1st List	20	JOINT VIGILANTE GROUP, COMPRISES OF IFESEYI IDIAGBON, TEMIDIRE, OLUWAFIRANTI AND ISOKAN COMMUNTIY	Natural Stream			604,721	811,449	No Structure	18.05	No Road	There is no structure	165.80	221.06	0.50		Inadequate	Inadequate	Yes
		924	Batch 24				ALAAKA, ALAAKA/IDIOSAN			1.6	604,543	810,835	Fair	19.84		FLOODED ALWAYS	181.49	241.98	0.33		Inadequate	Inadequate	Yes
		904	Batch 25	35T			IDI OSAN, FOWOROGI, OGBERE/IDI OSAN	Culvert	2 BC (1.87 x 1.34)	1.64	604,278	810,482	Good	20.67		FLOODED ALWAYS	181.49	241.98	0.33		Inadequate	Adequate	Yes
15H	Ob4 Foworogbun	70	Batch 0	36T			ADEYE	Culvert	1 BC (1.65 x 0.65)	0.9	604,851	809,778	Fair	1.87	Secondary Road	The box culvert break down	17.78	23.70	0.80	2.1	Inadequate	Inadequate	Yes
		926	Batch 24				BALOGUN/ADEYORI, ADEYORI STREET	Culvert	1 BC (2.58 x 1.5)	1.74	604,479	809,728	Good	2.13	Tertiary Road	FLOODED ALWAYS	19.73	26.30	0.80	12.4	Inadequate	Adequate	Yes
		1509	Batch 31				orisumbare akeyo, orisumbare Road	Culvert	1 CC (1.28 dia)	1.58	604,130	809,838	Poor	2.44	Tertiary Road		22.05	29.40	0.80	3.2	Inadequate	Inadequate	Yes
		1510	Batch 31				Balogun 2	Footpath		0.68	603,972	809,894	Poor	2.52	Tertiary Road		22.65	30.20	0.80	13.9	Inadequate	Inadequate	Yes
16	Ob5 Lower Ogbere North	74D	PIU 2nd List		PIU 2nd List	17	ORISUMBARE GENERAL COMMUNITY DEVELOPMENT ASSOCIATION	Natural Stream			603,691	809,887	No Structure	53.61	No Road	There is no structure to cross Ogbere River, north of the Confluence with Foworogbun, communities lack connection, the area is always heavily flooded during the raining season.	365.88	487.84	0.63		Inadequate	Inadequate	Yes
		916	Batch 24	74D	PIU 2nd List	11	PAPA ELEYE, OGBERE RIVER, ZONE 4	Footpath		3.5	603,446	809,732	Poor	53.76	Tertiary Road	FLOODED OCCASSIONALLY	365.88	487.84	0.38	194.7	Inadequate	Inadequate	Yes
		1260	Batch 30				AKEYO-ODU, OGBERE, IDI-OSAN MUSLIM	Natural Stream		1.9	603,459	809,083	Fair	54.75	Tertiary Road	Get flooded and also affect some building.	365.88	487.84	0.38		Inadequate	Inadequate	Yes
		43D	PIU 1st List		PIU 1st List	43	APABIELESIN LANDLORDS AND LANDLADIES ASSOCIATION ORELOPE ISALE ALFA ZONE 2 UNIT 2 OLUYOLE	Natural Stream			603,372	808,874	No Structure	57.41	No Road	There is no structure to cross Ogbere River, south of the Confluence with Foworogbun, communities lack connection	365.88	487.84	0.38		Inadequate	Inadequate	Yes
		1270	Batch 30				ODO-DUDU, IRORUN OLUWA RD E, ODO-DUDU, OLOMI-OLUNDE AYEGUN	Natural Stream		1.2	602,858	807,953	Fair	60.30	Tertiary Road	Get flooded when it rains heavily.	463.03	617.37	0.38		Inadequate	Inadequate	Yes
16D	Ob5 Lower Ogbere North	1255	Batch 30				TEMIDIRE, AYETORO, MUSLIM, EGBEDA-TUBA	Natural Stream		0.18	604,980	808,806	Fair	1.22	Secondary Road	The stream is eroded, is likely to be flooded.	12.90	17.20	0.79		Inadequate	Inadequate	Yes
		1514	Batch 31				ifesowapo iremide ajogbelede, ifesowopo zone D	Culvert	1 CC (1.28 dia)	1.58	604,343	808,835	Fair	1.96	Tertiary Road		18.45	24.60	0.79	3.1	Inadequate	Inadequate	Yes
		1256	Batch 30				OLOKOFEFE, IDI-IROKO, FATUNSI AREA,OLUNDE	Culvert	2 CC (0.525 dia)	0.8	603,814	808,949	Fair	2.35	Tertiary Road	The culvert is sitting up already.	21.38	28.50	0.79	0.6	Inadequate	Inadequate	Yes
16F	Ob5 Lower Ogbere North	1258	Batch 30				TEMIDIRE,OLOWU, FATOSA, OLUNDE	Natural Stream		0.99	602,430	809,206	Fair	1.23	Tertiary Road	The stream needs dredging, its cross between the building	12.98	17.30	1.21		Inadequate	Inadequate	Yes
17	Ob5 Lower Ogbere North	1261	Batch 30				OBADA, OFF ISOKAN, AYEGUN RD, OLOMI	Culvert	1 BC (1.2 x 0.87)	1.12	604,453	807,669	Fair	2.69	Secondary Road	Get flooded when it rains heavily.	23.93	31.90	0.71	2.1	Inadequate	Inadequate	Yes
		1511	Batch 31				irepodun gbako, irepodun gbako road a	Footpath		0.5	603,575	807,763	Poor	3.78	Tertiary Road		32.10	42.80	0.71	45.5	Adequate	Inadequate	Yes
		1266	Batch 30				FATUNSI BRIDGE ODO-DUDU,ISOKAN, FATUNSI, ISOKAN, OLOMI-OLUNDE	Culvert	2 BC (2.56 x 1.82)	2.15	602,993	807,764	Good	5.25	Tertiary Road	Get flooded when it rains heavily.	46.27	61.69	0.14	13.5	Inadequate	Adequate	Yes
		1267	Batch 30				ODO-DUDU, IRORUN OLUWA ZONE 12, ODO-DUDU, ODO-DUDU OLOMI-OLUNDE	Natural Stream		0.54	602,926	807,861	Fair	5.30	Tertiary Road	Get floode when it rains heavily.	46.27	61.69	0.14		Inadequate	Inadequate	Yes
17H	Ob5 Lower Ogbere North	1263	Batch 30				ARANNSE OLUWA,IGBONNA, IGBONNA, OFF FATUSI	Culvert	2 BC (1.25 x 0.62)	1.15	603,281	807,333	Fair	1.01	Tertiary Road	Get flooded when it rains heavily.	11.33	15.10	1.33	3.7	Inadequate	Inadequate	Yes
		1512	Batch 31				irepodun zone, Area 1	Culvert	1 BC (4 x 0.88)	0.26	603,207	807,438	Good	1.06	Tertiary Road		11.70	15.60	1.33	12.1	Inadequate	Adequate	Yes
		1265	Batch 30				KAJOLA QUARTERS, FATUNSI AREA, MONDALA,OLOMI-OLUDE	Natural Stream		0.2	603,178	807,617	Fair	1.16	Tertiary Road	Get flooded and stream expanding for passage of people.	12.45	16.60	1.33		Inadequate	Inadequate	Yes
18	Ob5 Lower Ogbere	65B	Batch 30	37T			MAARUN, ARO FATUNSI, OGUNPA, MAARUN ARO, FATUNSI RD, NEW FELELE ACADEMY	Bridge	Br (3 Span 14.5)	7.16	602,045	807,453	Good	66.87	Main Road	Erosion cutoff some part of the bridge.	463.03	617.37	0.35	1538.3	Adequate	Adequate	No
18H	Ob5 Lower Ogbere	1274	Batch 30				ARO OGO, IFESOWAPO, AYEGUN RD, OLOMI	Culvert	2 CC (0.84 dia)	2.2	602,141	806,640	Fair	1.06	Main Road	Get flooded when it rains heavily	11.70	15.60	1.88	3.1	Inadequate	Inadequate	Yes

Structure Data																Structure Assessment							
Channel ID	Subbasin	Structure No.	Batch_ID	Alternative ID	PIU List	No in PIU List	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Stream Slope (%)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
1	Og1 Upper Ogunpa	693	Batch 12				Ashi, Emiola Awe road	Culvert	1 BC (3 x 2.09)	2.43	602,062	820,768	Good	1.79	Tertiary Road	Overflow during heavy rain	17.18	22.90	0.91	25.4	Adequate	Adequate	No
		692	Batch 12				Ashi, Ladosu Ladipo Close	Culvert	2 BC (1.85 x 2.05)	2.21	601,938	820,631	Good	1.85	Tertiary Road	Overflow during heavy rain	17.63	23.50	0.91	26.2	Adequate	Adequate	No
		46	Batch 0	26D3	PIU 1st List	26	OLUGA STREET , SALAMI ESTATE	Culvert	2 BC (2 x 0.87)	1.22	601,714	820,275	Erosion	2.51	Tertiary Road		22.58	30.10	0.91	8.8	Inadequate	Inadequate	Yes
		627	Batch 11				New Bodija, Ladoke Akintola Street Channel, Ladoke Akintola Street	Culvert	2 BC (3 x 2.73)	3.11	600,956	819,922	Good	5.76	Tertiary Road		76.88	102.50	0.44	50.9	Inadequate	Adequate	Yes
		44	Batch 11	1T			Secretariat, Restoration Bridge, Secretariat Road	Bridge	Br (2 Span 12.2)	5	600,556	819,787	Good	7.90	Highway		82.50	110.00	0.44	518.5	Adequate	Adequate	No
		43	Batch 0				AWOLOWO AVENUE , OLUOKUN STREET,				600,336	819,711	Dilapidated	8.16	Tertiary Road	a culvert, water passing aside	90.00	120.00	0.44		Inadequate	Inadequate	o be demolishe
		42	Batch 0	2T			FRANCIS OKEDEJI STREET , DAVIES HOTEL,	Culvert	2 BC (1.98 x 2.3)	3.1	600,088	819,678	Good	8.72	Tertiary Road		95.03	126.70	0.44	23.2	Inadequate	Adequate	Yes
		41	Batch 0	3T			ADEYI , OLD BODIJA,	Culvert	2 BC (1.8 x 1.97)	2.45	599,690	819,535	Fair	8.97	Tertiary Road		95.03	126.70	0.44	16.6	Inadequate	Inadequate	Yes
		40	Batch 0	4T			ADEYI , OLD BODIJA,	Culvert	1 BC (2.5 x 1.89)	2.07	599,430	819,287	Fair	10.61	Tertiary Road	Damaged culvert	95.03	126.70	0.44	12.1	Inadequate	Inadequate	Yes
1E	Og1 Upper Ogunpa	732	Batch 12				Salami Estate Bodija, Off Awele road	Natural Stream		1.12	601,627	819,989	Poor	1.24	Tertiary Road		13.05	17.40	0.78	3.5	Inadequate	Inadequate	Yes
		675	Batch 11	26D1	PIU 1st List	26	New Bodija,Salami Street	Culvert	2 CC (0.5 dia)	0.96	601,382	820,045	Poor	1.35	Tertiary Road	The Channel is too small, therefore it always flooded	13.88	18.50	0.78	0.5	Inadequate	Inadequate	Yes
1F	Og1 Upper Ogunpa	638	Batch 11				New Bodija, Oladunni Ayanndipe Street	Culvert	2 BC (2.63 x 1.69)	2.42	601,134	820,616	Good	1.09	Tertiary Road		11.93	15.90	1.00	33.5	Adequate	Adequate	No
		639	Batch 11				New Bodija, Aretedo	Natural Stream		1.8	601,161	820,528	Poor	1.17	Tertiary Road		12.53	16.70	1.00	48.7	Adequate	Inadequate	Yes
		45	Batch 0				KUNLE ABASS STREET , NEW BODIJA	Culvert	1 CC (1.05 dia) + BC (2.05 x 1.25)	1.45	601,313	820,169	Erosion	1.34	Tertiary Road		13.80	18.40	1.00	10.1	Inadequate	Inadequate	Yes
1H	Og1 Upper Ogunpa	1559	Batch 31				Oyeniyi Street Ikolaba GRA, Oyeniyi Str	Footpath		1.1	600,970	819,472	Poor	1.34	Tertiary Road		13.80	18.40	1.10	242.5	Adequate	Inadequate	Yes
		641	Batch 11				Ikolaba,Fadaaya Street	Culvert	1 BC (2.3 x 1.32)	1.5	600,898	819,572	Good	1.37	Tertiary Road	FLOODED DURING RAINING SEASONS	14.03	18.70	1.10	10.5	Inadequate	Adequate	Yes
		640	Batch 11				Ikolaba, Olufemi Ilori Close	Culvert	2 BC (1.6 x 1.32)	1.56	600,821	819,797	Good	1.46	Tertiary Road	FLOODED OCCASSIONALLY	14.70	19.60	1.10	13.2	Inadequate	Adequate	Yes
1P	Og1 Upper	642	Batch 11				Adeyi Estate, Beckley	Culvert	1 BC (1.84 x 1.53)	2.25	599,313	819,887	Good	1.12	Tertiary Road		12.15	16.20	1.08	9.6	Inadequate	Adequate	Yes
2	Og2 Middle Ogunpa	247	Core 1				Secretariat, Ogunpa(Dandaru), Paliament Road	Spillway			599,137	818,550	Good	12.93	Tertiary Road		123.18	164.24	0.45	179.0			No
		144B	Batch 0				DANDARU,	Culvert	1 BC (6.5 x 3.83)	4.78	598,918	818,202	Fair	13.23	Highway		125.56	167.41	0.45	111.7	Inadequate	Inadequate	Yes
		1552	Batch 31				Ireakari Area, Ogunpa, Queen Elizath Road	Footpath		3.55	598,591	818,082	Good	14.06	Secondary Road		132.15	176.20	0.45	136.8	Inadequate	Adequate	Yes
		246	Core 1				Mokola, Ogunpa, Mokola	Culvert	1 BC (13.2 x 4.33)		598,227	818,007	Good	14.35	Secondary Road		134.45	179.27	0.45	314.0	Adequate	Adequate	No
		245	Core 1				Mokola, Omitowoju Street	Culvert	1 BC (20.7 x 4.1)		598,046	817,528	Good	16.07	Secondary Road		148.11	197.48	0.45	481.6	Adequate	Adequate	No
		143B	Core 5				Salvation Army, Ogunpa, Atewoda Street	Bridge	Br (3 Span 5.36)	3.7	597,989	817,171	Good	16.34	Secondary Road		150.25	200.33	0.45	181.7	Inadequate	Adequate	Yes
		142B					Ogunpa, Ansarudeen Br., Anasrudeen	Bridge	Br (3 Span 5.85)	3.8	597,801	816,821	Good	17.29	Main Road		157.79	210.39	0.45	159.0	Inadequate	Adequate	Yes
		244	Core 1				Ogunpa, Ogunpa Stream, Ogunpa	Bridge	Br (19m)		597,670	816,676	Good	20.30	Tertiary Road		181.69	242.25	0.45	282.7	Adequate	Adequate	No
		243	Core 1				Ogunpa Market, Ogunpa Stream, Lebanon Street	Bridge	Br (20.2m)		597,697	816,375	Good	20.43	Main Road		182.72	243.63	0.45	486.6	Adequate	Adequate	No
		242	Core 1				Ogunpa Market, Ogunpa Stream, New Court Road	Bridge	Br (20m)		597,651	816,307	Good	20.99	Main Road		187.17	249.55	0.45	463.5	Adequate	Adequate	No
		241	Core 1				Foko Area, Ogunpa, Agbokojo street	Bridge	Br (25.6m)		597,526	816,017	Good	21.70	Secondary Road		192.80	257.07	0.45	517.4	Adequate	Adequate	No
		141B	Core 5				Foko Area, Ogunpa, Alubankudu street	Bridge	Br (3 Span 6.05)	4.8	597,455	815,586	Good	22.07	Tertiary Road		195.74	260.99	0.45	239.2	Adequate	Adequate	No
		235	Core 1				Gege, Ogunpa, Gege road	Bridge	Br (23.9m)		597,397	815,181	Good	23.08	Secondary Road		203.76	271.68	0.45	420.0	Adequate	Adequate	No
		236	Core 1				Isale Asake, Ogunpa, Asake	Bridge	Br (2 Span 9)		597,433	814,896	Good	23.11	Tertiary Road		204.00	271.99	0.45	322.5	Adequate	Adequate	No
		156B	Core 5				Akuro, Ogunpa, Oredeyin	Bridge	Br (3 Span 8.37)	3.68	597,628	814,613	Good	23.84	Tertiary Road		209.79	279.72	0.45	559.1	Adequate	Adequate	No
		64	Core 5				Poopo, Ogunpa, Poopo road	Bridge	Br (3 Span 8.13)	5.15	597,850	814,280	Good	24.12	Tertiary Road		212.01	282.69	0.45	574.8	Adequate	Adequate	No
		155B	Batch 0				OGUNPA,	Culvert	3 BC (8.1 x 3.23)	3.96	598,333	813,757	Good	26.72	Highway	The typical section along Ogunpa River for the points No. 141B, 142B, 143B, & 156B	226.53	302.04	0.45	342.2	Adequate	Adequate	No
2C	Og2 Middle Ogunpa	38	Core 5				Mokola, Sabo Road	Culvert	2 BC (2.7 x 2.41)	2.86	598,109	818,185	Fair	1.17	Main Road		12.53	16.70	0.93	54.7	Adequate	Inadequate	Yes
		290	Core 1				Mokola, Mokola Road	Culvert	2 BC (2.9 x 2.41)		598,149	818,021	Good	1.42	Highway		14.40	19.20	0.93	60.0	Adequate	Adequate	No
2F	Og2 Middle Ogunpa	37	Batch 0				ONIREKE ROAD	Culvert	2 BC (3.75 x 3.2)	4.4	597,321	817,865	Fair	1.43	Main Road		14.48	19.30	0.67	104.5	Adequate	Inadequate	Yes
		34	Batch 0				ONIREKE	Culvert	1 BC (1.65 x 1.13)	1.34	597,358	817,622	Dilapidated	1.65	Tertiary Road		16.13	21.50	0.67	4.3	Inadequate	Inadequate	Yes
		1549	Batch 31				Onireke	Footpath		1.1	597,327	817,517	Poor	1.71	Tertiary Road		16.58	22.10	0.67	7.8	Inadequate	Inadequate	Yes
		35	Batch 0				FAJUYI ROAD	Culvert	2 BC (2.35 x 1.55)	4.59	597,289	817,161	Erosion	2.47	Highway		22.28	29.70	0.67	21.0	Inadequate	Inadequate	Yes
		33	Batch 0				DUGBE-ALAWO ROAD	Culvert	1 BC (9.1 x 2)	2.92	597,376	816,933	Erosion	2.85	Tertiary Road		25.13	33.50	0.67	76.5	Adequate	Inadequate	Yes
2Q	Og2 Middle Ogunpa	248	Core 1				Titi Akala, Aladorin Isale Osi	Culvert	2 BC (6.4 x 2.7)		598,056	815,067	Fair	1.01	Tertiary Road		11.33	15.10	0.73	168.1	Adequate	Inadequate	Yes
		358	Core 3				Popo Area, Popo Road	Culvert	1 BC (6.5 x 2.44)	2.75	598,016	814,387	Fair	1.65	Tertiary Road	The area is usually flooded during heavy rain	16.13	21.50	0.73	73.7	Adequate	Inadequate	Yes
3	Og3 Kudeti	279	Core 1				Oluyoro, Oluyoro Road	Culvert	2 BC (1.8 x 1.55)		601,439	816,710	Poor	1.06	Secondary Road		11.70	15.60	0.86	16.9	Adequate	Inadequate	Yes
		278	Core 1				Oluyoro, Oluyoro-Aladorin Road	Culvert	2 BC (3.1 x 2.36)		601,439	816,556	Good	1.12	Secondary Road		12.15	16.20	0.86	60.9	Adequate	Adequate	No
		96	Batch 0				ODE AYE ALALUBOSA	Culvert	2 BC (1.98 x 1.62)	2.2	601,420	816,253	Erosion	1.68	Secondary Road		16.35	21.80	0.86	20.3	Adequate	Inadequate	Yes
		277	Core 1				Alabede, Alabede area	Culvert	2 BC (3 x 2.12)		601,502	815,940	Fair	1.83	Tertiary Road		17.48	23.30	0.86	50.3	Adequate	Inadequate	Yes
		324	Core 2				Aremo, Adekanbi Street	Footpath		1.17	601,543	815,655	Erosion	2.45	Tertiary Road	The area is flooded during rain	22.13	29.50	0.86	127.8	Adequate	Inadequate	Yes
		323	Core 2				Ilupeju Agugu, Binukonu Area	Culvert	3 BC (2.7 x 2.36)	2.76	601,545	815,500	Good	2.49	Tertiary Road	The area is flooded during rain	22.43	29.90	0.86	76.4	Adequate	Adequate	No
		276	Core 1				Aremo Adekile, Aremo grave yard	Culvert	3 BC (2.79 x 2.33)		601,383	815,137	Fair	3.65	Tertiary Road		31.13	41.50	0.86	78.3	Adequate	Inadequate	Yes
		275	Core 1				Aperin, Aperin Road	Culvert	2 BC (3 x 2.87)		601,199	814,885	Fair	4.55	Main Road		57.08	76.10	0.86	76.2	Adequate	Inadequate	Yes
		297	Core 1				Adelagun, Oluyoro Stream, Alamuyo Gbelekale	Natural Stream			600,566	815,020	Erosion	5.14	Tertiary Road		63.75	85.00	0.93	217.9	Adequate	Inadequate	Yes
		274	Core 1				Kosodo Area, Oluyoro Stream, Kosodo-Labo	Bridge	Br (31m)		600,242	815,076	Erosion	5.52	Tertiary Road		67.50	90.00	0.93	593.3	Adequate	Inadequate	Yes
		273	Core 1				Beere, Labo Stream, Beere road	Culvert	3 BC (2.9 x 3.05)		599,892	814,895	Fair	5.67	Main Road		67.50	90.00	0.93	123.6	Adequate	Inadequate	Yes

Structure Data																Structure Assessment							
Channel ID	Subbasin	Structure No.	Batch_ID	Alternative ID	PIU List	No in PIU List	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Stream Slope (%)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
4	Og3 Kudeti	51	Core 5				Yemetu, Alawada Area	Culvert	1 BC (8.7 x 2.4)	2.82	599,863	817,265	Fair	1.57	Main Road		15.53	20.70	0.83	107.1	Adequate	Inadequate	Yes
		1553	Batch 31				Yemetu Akabiako, Orogbangba Street	Footpath		0.73	599,876	816,948	Good	2.14	Tertiary Road		19.80	26.40	0.83	60.4	Adequate	Adequate	No
		265	Core 1				Yemetu-Adeoyo, Ade oyo Street	Culvert	2 BC (2.9 x 2.46)		599,883	816,838	Fair	2.18	Main Road		20.10	26.80	0.83	58.1	Adequate	Inadequate	Yes
		1554	Batch 31				Yemetu Akabiako, Orogbangba Street	Footpath		0.88	599,851	816,716	Fair	2.22	Tertiary Road		20.40	27.20	0.83	45.6	Adequate	Inadequate	Yes
		266	Core 1				Yemetu -Idi Ape Area, Traffic High way	Culvert	2 BC (2.7 x 2.05)		599,854	816,509	Fair	2.31	Highway		21.08	28.10	0.83	41.2	Adequate	Inadequate	Yes
		1555	Batch 31				Oje Ibadan, Temidire	Footpath		1.22	599,873	816,414	Good	2.40	Tertiary Road		21.75	29.00	0.83	112.2	Adequate	Adequate	No
		267	Core 1				Aderogba, Obasanjo Road	Culvert	2 BC (2.9 x 1.97)		599,935	816,282	Good	2.41	Secondary Road		21.83	29.10	0.83	42.7	Adequate	Adequate	No
		269	Core 1				Alafara Bashorun, Oje Igosu	Culvert	2 BC (3 x 2.65)		599,947	816,106	Poor	3.15	Main Road		27.38	36.50	0.83	67.2	Adequate	Inadequate	Yes
		270	Core 1				Abeni Ape	Culvert	2 BC (4.7 x 3.11)		600,004	815,933	Fair	4.72	Main Road		39.15	52.20	0.83	149.5	Adequate	Inadequate	Yes
		271	Core 1				Beere, Orita Aperin Beere road	Bridge	Br (14.8m)		599,658	815,053	Good	5.78	Main Road		53.85	71.80	0.67	314.0	Adequate	Adequate	No
5	Og3 Kudeti	272	Core 1				Asanke Street, Okun Stream, Asanke Street	Culvert	1 CC (0.9 dia) + BC (3.8 x 3.18)		599,456	814,724	Good	11.94	Secondary Road		108.02	144.02	0.59	248.5	Adequate	Adequate	No
		367	Core 3				Agbongbon, Beside Agbogbon pry health centre	Culvert	1 BC (12.3 x 5.16)	6.11	599,264	814,466	Fair	12.15	Secondary Road		108.02	144.02	0.59	427.3	Adequate	Inadequate	Yes
		393	Core 3				Idi Arere,	Culvert	1 BC (36.5 x 5.9)	5.9	599,016	814,140	Good	14.41	Secondary Road	Broken wing wall	122.81	163.74	0.59	1814.1	Adequate	Adequate	No
		363	Core 3				Molete, Ogunpa, Yejide Avenue	Footpath			598,458	813,439	Good	16.24	Tertiary Road		140.06	186.75	0.59	1057.7	Adequate	Adequate	No
5B	Og3 Kudeti	369	Core 3				Eleta, Eleta Road	Culvert	2 BC (3 x 1.73)	1.92	599,902	814,246	Fair	1.37	Main Road	Broken wing walls	14.03	18.70	1.08	42.4	Adequate	Inadequate	Yes
		365	Core 3				Olunloyo, Tewogbade	Culvert	1 BC (13.3 x 2.79)	2.79	599,684	814,229	Dilapidated	1.62	Tertiary Road		15.90	21.20	1.08	249.2	Adequate	Inadequate	Yes
		366	Core 3				Olunloyo, Tewogbade	Footpath		2.4	599,541	814,306	Poor	1.66	Tertiary Road	The area is usually flooded when it rain	16.20	21.60	1.08	148.2	Adequate	Inadequate	Yes
		368	Core 3				Agbongbon, Olunloyo Street	Culvert	3 BC (2.4 x 1.86)	2.11	599,406	814,352	Fair	1.72	Secondary Road	Broken wing walls	16.65	22.20	1.08	53.0	Adequate	Inadequate	Yes
5C	Og3 Kudeti	39D1	PIU 1st List		PIU 1st List	39	ODE-KERREWU LANDLORDS AND TENANTS ASSOCIATION	Natural Stream			599,436	813,331	No Structure	1.07	No Road	There is no structure	11.78	15.70					
		39D3	PIU 1st List		PIU 1st List	39	ODE-KERREWU LANDLORDS AND TENANTS ASSOCIATION	Natural Stream			599,301	813,384	No Structure	1.14	No Road	There is no structure	12.30	16.40					
		63	Batch 0				YEJIDE , KUDETI ROAD	Culvert	1 BC (3.4 x 1.28)	1.65	598,729	813,604	Dilapidated	1.39			14.18	18.90	0.80	13.7	Inadequate	Inadequate	Yes
6	Og4 Lower Ogunpa	376	Core 3				Molete, Ogunpa,	Bridge	Br (37.2m)	6.02	598,414	813,186	Good	43.30	Secondary Road		470.29	627.05	0.27	985.7	Adequate	Adequate	No
		866	Batch 23				FELELE, OGUNPA RIVER, GBANAMU AREA	Bridge	Br (4 Span 11.4)	4.86	598,439	812,109	Good	45.14	Tertiary Road		470.29	627.05	0.27	840.0	Adequate	Adequate	No
7	Og4 Lower Ogunpa	382	Core 3				Owode Academy				600,732	812,732	Good	1.11	Main Road		12.08	16.10	1.03		Inadequate	Adequate	Yes
		383	Core 3				Owode Academy, Adekola street	Culvert	2 BC (2.1 x 2.92)	3.27	600,382	812,848	Fair	1.38	Tertiary Road		14.10	18.80	1.03	52.6	Adequate	Inadequate	Yes
		384	Core 3				Elere, Odo ile Tawa	Footpath		1.6	599,982	812,706	Dilapidated	1.69	Tertiary Road	For Attention	16.43	21.90	1.03	140.0	Adequate	Inadequate	Yes
		385	Core 3				Elere, Odo oba elere	Culvert	2 BC (2.6 x 1.76)	2.18	599,739	812,449	Good	1.84	Secondary Road		17.55	23.40	1.03	35.5	Adequate	Adequate	No
		61	Batch 0				ODO OBA ELERE AREA	Culvert	2 BC (2.85 x 2.31)	2.57	599,657	812,206	Fair	2.07	Tertiary Road		19.28	25.70	1.03	58.2	Adequate	Inadequate	Yes
		888	Batch 23				SANYO, SANYO STREET			2.52	599,550	812,136	Poor	2.83	Secondary Road	FLOODED ALWAYS	24.98	33.30	1.03	58.4	Adequate	Inadequate	Yes
		889	Batch 23				SANYO, IREWUMI STREET	Footpath		3.9	599,306	811,933	Poor	3.05	Tertiary Road	FLOODED ALWAYS	26.63	35.50	1.03	752.0	Adequate	Inadequate	Yes
		880	Batch 23				SANYO, SANYO AREA	Natural Stream		1.6	599,151	811,557	Poor	3.49	Tertiary Road	FLOODED ALWAYS	29.93	39.90	1.03	24.7	Inadequate	Inadequate	Yes
		55B	Batch 0				OGUNPA RCC RIVER	Culvert	6 BC (3.72 x 3.41)	3.8	598,460	811,194	Good	6.94	Highway		64.82	86.42	1.03	420.4	Adequate	Adequate	No
7E	Og4 Lower Ogunpa	60	Batch 0				AKINFENWA	Culvert	1 BC (1.67 x 1.6)	1.99	600,343	810,823	Fair	1.30	Tertiary Road		13.50	18.00	1.14	9.2	Inadequate	Inadequate	Yes
		59	Batch 0				SANYO , BOLUWAJI	Culvert	1 BC (2.9 x 1.42)	1.59	599,864	811,032	Fair	2.25	Tertiary Road	Not working	20.63	27.50	1.14	15.7	Inadequate	Inadequate	Yes
		891	Batch 23				SANYO, OKESUNA STREET	Natural Stream		1.88	599,574	810,984	Poor	2.45	Tertiary Road		22.13	29.50	1.14	70.4	Adequate	Inadequate	Yes
		58	Batch 0				AGBAMU , TEMIDRE DAMO RIVER	Culvert	2 BC (3 x 2.18)	2.6	599,376	810,925	Erosion	2.56	Tertiary Road		22.95	30.60	1.14	60.3	Adequate	Inadequate	Yes
		57	Batch 0				TMIDIRE , DAMO RIVER	Culvert	1 BC (3.2 x 1.75)	2.12	599,152	811,006	Fair	2.77	Tertiary Road		24.53	32.70	1.14	24.0	Inadequate	Inadequate	Yes
		56					Sanyo/Sooka, Lagos/Ibadan Express	Culvert	1 BC (2.6 x 1.9)	7	598,875	811,184	Good	3.01	Expressway		26.33	35.10	1.14	20.7	Inadequate	Adequate	Yes
8	Og4 Lower Ogunpa	54B	Batch 23				SOKA, SOKA	Bridge	Br (3 Span 19.4)	6.09	598,377	811,002	Good	53.36	Expressway		482.76	643.68	0.47	2129.5	Adequate	Adequate	No
		1230	Batch 29				RED ROOF AREA, TOLL GATE, OGUNPA,TOLL GATE, LEAD CITY ,TOLL GATE	Natural Stream		1.7	597,001	809,195	Fair	57.33	Tertiary Road	Get flooded but flow	485.14	646.85	0.47		Inadequate	Inadequate	Yes
8D	Og4 Lower Ogunpa	883	Batch 23				IDI MANGORO/SOKA, AANU OLUWAPO STREET	Footpath			598,423	809,990	Poor	1.10	Tertiary Road	FLOODED ALWAYS	12.00	16.00	2.67	19.6	Adequate	Inadequate	Yes
		882	Batch 23				SOKA/IDI MANGORO, ENGR BAYO STREET	Culvert	2 BC (1.26 x 1.86)	1.86	598,306	810,096	Good	1.22	Secondary Road		12.90	17.20	2.67	23.4	Adequate	Adequate	No
9	Og4 Lower Ogunpa	71	Batch 0	15D	PIU 1st List	15	ATAGBA	Culvert	2 CC (0.9 dia) + BC (2.13 x 1.9)	1.9	600,249	809,301	Dilapidated	1.30	Tertiary Road		13.50	18.00	1.10	34.4	Adequate	Inadequate	Yes
		1221	Batch 29				OKE-ODE, AGBAMU, AGBAMU-SANYO	Culvert	1 BC (2.8 x 2.62)	2.91	599,817	809,461	Good	2.55	Tertiary Road	Get flooded when it rains heavily. About 3hrs before movement can commence	22.88	30.50	1.10	34.8	Adequate	Adequate	No
		1224	Batch 29	14D	PIU 1st List	14	INUEWE STRAIGT AJOFEEBO, ABA,AJOFEEBO	Culvert	2 CC (1.2 dia)	1.53	599,134	808,898	Poor	3.41	Tertiary Road	Get flooded when it rains heavily. About 7hrs before movement can commence	29.33	39.10	1.10	6.2	Inadequate	Inadequate	Yes
		1234	Batch 29				IFESOWAPO, IDI-IROKO,OLUNDE, ODO AARIN MEJI INUEWE, INU EWE,OLUNDE	Culvert	3 CC (0.9 dia)	1.27	598,853	808,835	Poor	5.34		Get flooded when it rains heavily.	63.66	84.88			Inadequate	Inadequate	Yes
		1237	Batch 29	7P			PEACE RD, MAJE, ODO MAJE, MAJE SOKA	Culvert	4 CC (1.26 dia)	1.8	598,369	808,827	Fair	6.10		Get flooded when it rains heavily	63.66	84.88			Inadequate	Inadequate	Yes
		1239	Batch 29				IRORUN OLUWA RD 48, IRORUN OLUWA, GATE B, NEW FELELE, SOKA	Culvert	2 CC (0.9 dia)	1.2	597,968	808,760	Poor	6.97		Culvert need to be relocated, not functioning cause of the expansion in erosion	63.66	84.88			Inadequate	Inadequate	Yes
		1226	Batch 29				SURULERE, Zone 19, SURULERE, NEW FELELE,SOKA	Culvert	1 CC (1.83 dia) + BC (1 x 2.2)	2.24	597,459	808,794	Fair	7.36		Get flooded when it rains heavily.	63.66	84.88			Inadequate	Inadequate	Yes
9F	Og4 Lower Ogunpa	1231	Batch 29	75D	PIU 2nd List	18	FARIA, OFF SANYO, FARIA, OLUNDE	Culvert	3 CC (0.716 dia)	1.68	599,553	808,449	Fair	1.55	Tertiary Road	Get flooded when it rains heavily	15.38	20.50	1.16	2.4	Inadequate	Inadequate	Yes
		1232	Batch 29				ABA AJOFEEBO, AGBAMU SANYO, ABA,AJOFEEBO	Culvert	1 CC (1.5 dia)	1.65	599,337	808,562	Fair	1.68	Tertiary Road	Get flooded when it rains heavily.	16.35	21.80	1.16	5.8	Inadequate	Inadequate	Yes
		1233	Batch 29				ABA AJOFEEBO,ZONE 7	Culvert	1 CC (1.18 dia)	1.95	599,212	808,709	Fair	1.82	Tertiary Road	Get flooded when it rains heavily.	17.40	23.20	1.16	3.1	Inadequate	Inadequate	Yes
10	Og4 Lower Ogunpa	1240	Batch 29				SURULERE, OGUNPA,SURULERE, NEW FELELE,SOKA	Natural Stream		1.8	597,217	808,497	Poor	65.20	Tertiary Road	Get flooded when it rains heavily.	508.74	678.32	0.25		Inadequate	Inadequate	Yes
10B	Og4 Lower Ogunpa	1246	Batch 29				BESIDE LENBOLA BLOCK,OLOJE SURULERE, NEW FELELE, SOKA	Footpath		0.6	597,376	807,858	Poor	2.67	Tertiary Road	Get flooded when it rains heavily.	23.78	31.70	1.40		Inadequate	Inadequate	Yes

Structure Data																Structure Assessment							
Channel ID	Subbasin	Structure No.	Batch_ID	Alternative ID	PIU List	No in PIU List	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Stream Slope (%)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
24	OM2 Omi Headwaters South	1369	Batch 8	59D	PIU 2nd List	2	Olodo-odan, Omi, Olujinle/Onimo	Culvert	2 BC (1.35 x 1.8)	1.86	611,610	826,770	Poor	32.94	Tertiary Road	Rain water always over topping the culvert and prevents people from passing. The culvert is old and very weak. For Attention	178.07	237.43	0.42	9.7	Inadequate	Inadequate	Yes
25	OM2 Omi Headwaters	1363	Batch 8				Onigbinde, Kojaja, Kojaja	Natural Stream		0.68	612,147	826,688	Poor	5.71	Tertiary Road	Heavily flooded with rainfall.	45.00	60.00	0.65	6.5	Inadequate	Inadequate	Yes
26	OM2 Omi Headwaters	1370	Batch 8				Onigbinde, Omi, Oloko-Kete	Culvert	1 BC (3.1 x 1.6)	1.9	612,052	826,059	Fair	40.12	Tertiary Road	Overflow on road during heavy down pour	217.75	290.33	0.38	11.7	Inadequate	Inadequate	Yes
27	OM2 Omi Headwaters South	1342					Atobaba/Alafia community, Alagbada	Culvert	1 CC (0.78 dia)	1.5	608,593	826,963	Fair	1.15		Always over topping with heavy rainfall.	12.38	16.50	0.82	0.9	Inadequate	Inadequate	Yes
		1343					Olorunda Abaa, Abaa Igbagbo	Natural Stream		0.65	608,761	826,767	Poor	1.86		Completely damaged culvert (ring),flooded with heavy rainfall.	17.70	23.60	0.82	3.1	Inadequate	Inadequate	Yes
		1344					Kutaayii, Kutaayii/Lamona	Culvert	1 CC (0.77 dia)	1.7	609,614	826,626	Fair	2.91		Always over topping with heavy rainfall.	25.58	34.10	0.82	0.8	Inadequate	Inadequate	Yes
		1345					Egba community zone 1, Road 14	Natural Stream		0.55	610,664	826,233	Poor	3.90			33.00	44.00	0.82	3.1	Inadequate	Inadequate	Yes
		1346					Egba community zone 1, Road 12	Natural Stream		0.75	610,679	826,113	Poor	4.06			34.20	45.60	0.82	6.7	Inadequate	Inadequate	Yes
		1535					Jenriyin, Egba Zone 1	Culvert	1 CC (0.8 dia)	1.2	610,727	825,876	Poor	4.17			35.03	46.70	0.82	0.9	Inadequate	Inadequate	Yes
		1346 Prime	Batch 7				, Ahere 1, Olorunda	Culvert	1 BC (2 x 1)	1.35	610,880	825,715	Dilapidated	6.70	Secondary Road	Collapsed culvert,needs urgent attention.	50.49	67.33	0.68	4.7	Inadequate	Inadequate	Yes
		1348	Batch 7	61D	PIU 2nd List	4	Odan-Elekan, Ahere 2, Akinlumo	Culvert	1 BC (1.8 x 1)	1.45	611,115	825,109	Dilapidated	7.70	Secondary Road	Culvert broken,flooded when it rains heavy,calls for attention!	55.93	74.58	0.68	4.1	Inadequate	Inadequate	Yes
		106	Batch 0				ASAJU , UNITY ESTATE,	Culvert	2 CC (0.81 dia)	1.35	611,611	824,614	Erosion	8.19	Tertiary Road		58.60	78.13	0.68	1.7	Inadequate	Inadequate	Yes
28	OM2 Omi Headwaters South	1383	Batch 14				ASAJU-IFESOWAPO, ASAJU, ROAD 1	Natural Stream		1	611,968	823,812	Fair	55.66	Tertiary Road	SURROUNDED WITH VEGETATIONS,FLOODED WITH HEAVY RAINFALL.	268.02	357.36	0.25		Inadequate	Inadequate	Yes
		1384	Batch 14				OGANLA, OMI, PAGUN	Culvert	1 BC (9.1 x 2.46)	2.8	612,097	823,015	Good	58.46	Tertiary Road	SURROUNDED WITH VEGETATIONS,INLET PARTIALLY BLOCKED WITH SAND.	279.47	372.62	0.25	64.4	Inadequate	Adequate	Yes
		105	Batch 0				OKE-OMI / OGA NLA,	Culvert	2 BC (3.07 x 3.37)	7.79	612,112	822,980	Fair	58.54			279.47	372.62	0.25	52.5	Inadequate	Inadequate	Yes
28A	OM2 Omi Headwaters South	973	Batch 13				Kore Estate-Olodo, Orita Odan road	Culvert	2 BC (0.8 x 1.04)	1.28	609,673	824,492	Fair	1.38			14.10	18.80	0.91	3.5	Inadequate	Inadequate	Yes
		979					Orita Odan Area-Jenriyin, Kute road	Culvert	1 CC (0.73 dia)	1.13	609,807	824,430	Fair	1.42			14.40	19.20	0.91	0.8	Inadequate	Inadequate	Yes
		980					Olodo Area, Odan Road	Culvert	2 BC (1.09 x 1.06)	1.36	610,788	824,385	Fair	2.55		Overflow on the road during heavy rain	22.88	30.50	0.91	5.4	Inadequate	Inadequate	Yes
		981					Iranlowo Oluwa Estate, Area C	Culvert	2 CC (0.75 dia)	1.1	611,371	824,191	Fair	3.32			28.65	38.20	0.91	1.6	Inadequate	Inadequate	Yes
		1372					ASAJU CENTRAL ESTATE, MAIN ROAD 1	Culvert	1 CC (0.85 dia)	1.05	611,690	824,148	Poor	3.49		FLOODED WITH HEAVY RAINFALL,SURROUNDED WITH VEGETATIONS	29.93	39.90	0.91	1.1	Inadequate	Inadequate	Yes
28D	OM2 Omi Headwaters South	1373		63D	PIU 2nd List	6	OGANLA, OMOLASO	Culvert	1 BC (1.8 x 1.1)	1.4	611,814	823,239	Fair	2.05		CULVERT CLUSTARD WITH VEGETATION AT INLET,FLOODED WITH HEAVY RAINFALL.	19.13	25.50	1.06	5.8	Inadequate	Inadequate	Yes
31	OM3 Upper Omi West	719	Batch 12				Akobo-Ojurin, Yawiri Road	Culvert	2 CC (0.9 dia)	1.46	605,421	823,709	Fair	1.85	Secondary Road	Overflow and prevents motorists from passing during heavy rain	17.63	23.50	0.93	2.7	Inadequate	Inadequate	Yes
		98	Batch 0				PAPA ATU	Culvert	1 BC (1.37 x 1.02)	1.34	605,911	823,360	Erosion	3.37	Tertiary Road		29.03	38.70	0.93	3.5	Inadequate	Inadequate	Yes
		939	Batch 13				Kute-Orisunbare zone 11, Shonekan, Shonekan road	Culvert	2 CC (0.6 dia)	0.92	607,750	822,613	Poor	6.36	Tertiary Road		48.65	64.86	0.67	0.8	Inadequate	Inadequate	Yes
		119	Batch 0				GBO-ADURA-OJU IRIN,	Culvert	2 BC (1.67 x 1.56)	1.92	608,399	822,107	Good	7.38	Secondary Road		54.19	72.26	0.67	13.6	Inadequate	Adequate	Yes
32	OM3 Upper Omi West	1356	Batch 7				Olorunda Abaa, Road 1,Ogooluwa Estate	Natural Stream		0.3	606,591	826,139	Poor	1.36		Flooded with heavy rainfall.	13.95	18.60	0.81	1.5	Inadequate	Inadequate	Yes
		1351	Batch 7				Eleshinla Village, Eleshinla Road	Footpath		0.7	607,291	825,674	Poor	3.71	Tertiary Road	Over flows when it rains heavy.	31.58	42.10	0.81	25.8	Inadequate	Inadequate	Yes
		1352	Batch 7				Alapata Estate, Onireke Road	Culvert	1 BC (1.85 x 0.74)	1.1	607,294	824,992	Poor	4.74	Secondary Road	Always over topping with heavy rainfall.	39.30	52.40	0.81	3.0	Inadequate	Inadequate	Yes
		101	Batch 0	64D	PIU 2nd List	7	TEMIDIER , SOKA ELEGA,	Culvert	1 CC (0.8 dia)	1.29	607,270	824,546	Fair	6.45	Tertiary Road		49.13	65.51	0.60	0.8	Inadequate	Inadequate	Yes
		1534	Batch 31				Harmony Estate, Kumapayi	Footpath		1.7	607,519	824,147	Poor	6.97	Tertiary Road		51.96	69.28	0.60	24.3	Inadequate	Inadequate	Yes
		100	Batch 0	5D	PIU 1st List	5	AKOKA,	Culvert	1 BC (1.97 x 1.44)	1.61	608,406	823,503	Erosion	8.70	Secondary Road	erosion around the culvert	61.37	81.83	0.60	7.2	Inadequate	Inadequate	Yes
		931	Batch 13				Kute, Ibagun / Shokobi, Ibagun / Shokobi road	Culvert	2 BC (1.2 x 1.7)	1.9	608,657	823,092	Fair	10.28	Tertiary Road	Overflow during heavy	79.04	105.39	0.60	9.3	Inadequate	Inadequate	Yes
		932	Batch 13				Kute, Farinto, Farinto	Culvert	1 BC (2.4 x 1.5)	1.71	608,756	822,837	Good	10.50	Tertiary Road		79.04	105.39	0.60	9.8	Inadequate	Adequate	Yes
		972	Batch 13				Kute Area, Powerline, Powerline	Natural Stream		1.2	608,787	822,694	Poor	10.64	Tertiary Road		79.04	105.39	0.60	30.7	Inadequate	Inadequate	Yes
		974	Batch 13				Kute Area, Sobaloju, Sobaloju	Footpath		1.56	608,837	822,548	Fair	10.74	Tertiary Road		79.04	105.39	0.60	34.5	Inadequate	Inadequate	Yes
		933	Batch 13				Kute, Ifellodun zone 17, Ifelodun Zone 17	Culvert	1 BC (2.6 x 1.62)	1.87	608,817	822,433	Good	11.09	Tertiary Road		79.04	105.39	0.60	12.1	Inadequate	Adequate	Yes
		97	Batch 0				SIONI/OPEOLU,	Culvert	2 CC (1.8 dia)	2.48	608,897	822,137	Fair	19.36	Tertiary Road		128.96	171.94	0.60	13.6	Inadequate	Inadequate	Yes
		990	Batch 13				Agbaja Olodo, Opeolu Layout, Behind Oremeji house	Natural Stream		1.64	608,977	822,016	Poor	19.40	Tertiary Road		128.96	171.94	0.60	36.7	Inadequate	Inadequate	Yes
		1522	Batch 31				Olodo kumapayi, Opeolu Agbaja	Natural Stream		1.5	609,242	821,545	Poor	19.83	Tertiary Road		128.96	171.94	0.60	40.9	Inadequate	Inadequate	Yes
		934	Batch 13				Arulogun Alaja, Along railway line, Railway line	Bridge	Br (2 Span 6.45)	5.57	609,335	821,475	Fair	19.87	Tertiary Road		128.96	171.94	0.60	293.0	Adequate	Inadequate	Yes
32C	OM3 Upper Omi West	103	Batch 0				AJARA	Culvert	1 BC (1.87 x 1.62)	2.27	606,692	826,640	Erosion	1.06	Main Road	The box culvert break down from the middle	11.70	15.60	0.80	9.1	Inadequate	Inadequate	Yes
32P	OM3 Upper	943	Batch 13				Unity Estate- Akoka, Road 4	Culvert	1 CC (0.75 dia)	0.99	608,695	823,356	Fair	1.10	Tertiary Road		12.00	16.00	1.67	1.1	Inadequate	Inadequate	Yes

Structure Data																Structure Assessment							
Channel ID	Subbasin	Structure No.	Batch_ID	Alternative ID	PIU List	No in PIU List	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Stream Slope (%)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
33	OM3 Upper Omi West	1527	Batch 31				Akobo, Iyana Church Road	Culvert	1 BC (2.86 x 1.7)	2.2	607,017	821,807	Good	1.29	Tertiary Road		13.43	17.90	0.92	18.0	Adequate	Adequate	No
		118	Batch 0				OKE-IBADAN ESTATE	Culvert	1 BC (1.8 x 1.96)	2.55	607,648	821,485	Fair	2.52	Tertiary Road		22.65	30.20	0.92	12.0	Inadequate	Inadequate	Yes
		1526	Batch 31				Iyana Church, Iyana Church Road	Culvert	1 BC (1.8 x 1.62)	1.76	608,169	821,406	Fair	3.02	Tertiary Road		26.40	35.20	0.92	9.3	Inadequate	Inadequate	Yes
		957	Batch 13				Wofun, Kute road	Culvert	2 BC (3.3 x 2.9)	3.3	608,801	821,121	Fair	3.54	Secondary Road		30.30	40.40	0.92	90.9	Adequate	Inadequate	Yes
		935	Batch 13				Wofun, ARCEDEM, ARCEDEM	Culvert	1 BC (2.5 x 2.01)	2.99	608,936	821,150	Good	5.71	Tertiary Road		45.11	60.15	0.67	16.3	Inadequate	Adequate	Yes
33F	OM3 Upper Omi West	116	Batch 13				WAKAJAIYE	Culvert	1 BC (3 x 1.96)	2.35	608,639	820,407	Erosion	1.16	Tertiary Road		12.45	16.60	1.00	24.4	Adequate	Inadequate	Yes
		117	Batch 0				IWDFUN , IWO EXPRESS WAY	Culvert	1 BC (3.12 x 1.87)	3.63	608,746	820,762	Erosion	1.64	Highway		16.05	21.40	1.00	24.0	Adequate	Inadequate	Yes
		956	Batch 13				Wofun, Kute road	Culvert	1 BC (3 x 1.55)	1.89	608,830	820,925	Fair	2.02	Secondary Road	Overflow on road during heavy down pour	18.90	25.20	1.00	17.4	Inadequate	Inadequate	Yes
34	OM3 Upper Omi West	936	Batch 13				Arulogun Alaja, By Ona-Iwa Mimo C& S Church, Railway line	Natural Stream		2	609,624	821,440	Poor	26.26	Tertiary Road		169.81	226.41	0.46	43.7	Inadequate	Inadequate	Yes
		937	Batch 13				Olodo, Ogberi, Galili	Culvert	1 BC (7.2 x 2.87)	2.97	610,060	821,451	Fair	26.84	Secondary Road		169.81	226.41	0.46	83.8	Inadequate	Inadequate	Yes
		955	Batch 13				Olodo Area, Behind The Jewels Nursery & Pry School, Aba Baale	Natural Stream		3.6	610,368	821,453	Poor	27.39	Tertiary Road		169.81	226.41	0.46	236.8	Adequate	Inadequate	Yes
		992	Batch 13				Olodo Nla, Egberi, Olodo way	Natural Stream		6	610,448	821,241	Poor	27.44			169.81	226.41	0.46		Inadequate	Inadequate	Yes
		104	Batch 13				Olodo Nla, Egberi, Olodo way	Culvert	1 BC (3 x 3.6)	7.35	610,628	821,290	Good	27.72	Highway	Overflow into nearby house	169.81	226.41	0.46	37.6	Inadequate	Adequate	Yes
		991	Batch 13				Custom Area-Oki, Imorole, Imorole	Natural Stream		1.8	610,933	820,399	Poor	29.99	Tertiary Road	Damaged culvet	169.81	226.41	0.46	55.2	Inadequate	Inadequate	Yes
		938	Batch 13				Isale Custom-Oki, Idera, Idera Street	Natural Stream		2	611,165	820,315	Poor	30.16	Tertiary Road		169.81	226.41	0.46	113.9	Inadequate	Inadequate	Yes
		1403	Batch 20				Majue, Egberi, Egberi	Bridge	Br (11.6m)	3.07	611,839	818,416	Poor	33.85	Tertiary Road	Heavily flooded with rainfall,steel pededstarian bridge.	176.55	235.40	0.46	148.9	Inadequate	Inadequate	Yes
		34D2	PIU 1st List		PIU 1st List	34	PEACE ESTATE (ZONE 9) RESIDENTS ASSOCIATION OGUNGBADE, OFF NEW IFE ROAD EGBEDA LG, IBADAN	Natural Stream			611,866	818,210	No Structure	33.93	No Road	No structure, no crossing roads across Omi river	176.55	235.40	0.46		Inadequate	Inadequate	Yes
34G	OM3 Upper Omi West	952	Batch 13				Oki, Olodo way	Culvert	1 BC (1.19 x 2)	2.35	610,238	820,375	Good	1.12	Secondary Road		12.15	16.20	2.55	11.5	Inadequate	Adequate	Yes
		1523	Batch 31				Olodo, Sooto Street	Footpath		3.12	610,557	820,445	Poor	1.30	Tertiary Road		13.50	18.00	2.55	107.8	Adequate	Inadequate	Yes
29	OM4 Upper Omi East	1361	Batch 8				Baale-Ajinti, Keshinjo Road	Natural Stream		0.2	613,990	825,609	Poor	3.58		Flooded with heavy rainfall.	30.60	40.80	0.68	1.2	Inadequate	Inadequate	Yes
		1360	Batch 8				Adeleye-Fatumo, Oloro, Oloro	Culvert	1 CC (0.85 dia)	0.71	614,171	824,756	Poor	5.93	Tertiary Road	Rain water always over topping the culvert.	46.31	61.74	0.73	1.0	Inadequate	Inadequate	Yes
		1537	Batch 31				Erunmu, Adewumi Olosunde	Footpath		0.92	613,870	824,430	Poor	6.90	Tertiary Road		53.74	71.65	0.73	6.9	Inadequate	Inadequate	Yes
		1536	Batch 31				Olodo, Erunmu	Natural Stream		0.5	613,668	824,186	Poor	7.21	Tertiary Road		53.74	71.65	0.73	13.8	Inadequate	Inadequate	Yes
		1393	Batch 14				OKE-OMI, ODO-OKOKO, ALAAKA	Culvert	1 CC (0.85 dia)	1.1	613,319	824,000	Fair	7.41	Tertiary Road	HEAVILY FLOODED WITH RAINFALL,INLET FULLY COVERED WITH VEGETATIONS.	54.35	72.47	0.73	1.0	Inadequate	Inadequate	Yes
		1394	Batch 14				OKE-OMI, ESE-ONA, ESE-ONA/OLD ROAD				612,631	823,257		9.23	Tertiary Road	No culvet	66.38	88.50	0.73		Inadequate	Inadequate	Yes
		1395	Batch 14				OKE-OMI, OMI, IWO-ROAD EXPRESS	Culvert	1 BC (2.96 x 2.5)	4.15	612,644	823,167	Fair	9.27	Highway	OUTLET COVERED WITH VEGETATION, PARTLY FILLED WITH SAND.	66.38	88.50	0.73	28.6	Inadequate	Inadequate	Yes
29E	OM4 Upper Omi East	1359	Batch 8				Baale-Ajinti, Ifelodun Road	Culvert	1 CC (1 dia)	1.33	614,489	825,075	Poor	1.53		The water level is higher than the crown level	15.23	20.30	1.00	1.8	Inadequate	Inadequate	Yes
30	OM4 Upper Omi East	1385	Batch 14				KOKOKO ESTATE, OMI, ARUBIEWE/OJUIRIN	Bridge	Br (m)	6.25	612,431	822,271	Good	69.86	Tertiary Road		284.58	379.44	0.22		Inadequate	Adequate	Yes
		110	Batch 0				OGODU,	Culvert	2 BC (2.83 x 3.04)	3.53	612,519	821,874	Erosion	73.79	Secondary Road		296.37	395.16	0.22	38.3	Inadequate	Inadequate	Yes
		1386	Batch 14				IKUMAPAYI-OLODO, OMI, IDI-OSAN/AREKE	Footpath		0.6	612,461	820,067	Poor	79.10	Secondary Road		312.30	416.40	0.22	1968.3	Adequate	Inadequate	Yes
		111	Batch 0	6D	PIU 1st List	6	OKU OSEJU,	Culvert	2 BC (1.86 x 1.88)	2.12	612,331	819,378	Erosion	80.30	Tertiary Road		315.90	421.20	0.22	11.5	Inadequate	Inadequate	Yes
		1400	Batch 20				Oke-omi/Ogundipe, Omi, Koojo	Natural Stream			612,167	818,759	Poor	80.99	Tertiary Road	Confluence of osun and Omi river.Could not measure due to the level of water	317.97	423.96	0.22		Inadequate	Inadequate	Yes
30D	OM4 Upper	1538	Batch 31				Kumapayi, Kumapayi Road	Boardwalk		0.9	614,243	823,035	Poor	1.46			14.70	19.60	1.28	3.0	Inadequate	Inadequate	Yes
30H	OM4 Upper Omi East	1378	Batch 14	31D2	PIU 1st List	31	AHOYAYA VILLAGE, ROAD 1	Footpath		1.05	612,474	820,914	Poor	1.16		FLOODED WITH HEAVY RAINFALL,SURROUNDED WITH VEGETATIONS.	12.45	16.60	0.71	18.9	Adequate	Inadequate	Yes
35	OM4 Upper Omi East	34D1	PIU 1st List		PIU 1st List	34	PEACE ESTATE (ZONE 9) RESIDENTS ASSOCIATION OGUNGBADE, OFF NEW IFE ROAD EGBEDA LG, IBADAN	Natural Stream			611,909	818,061	No Structure	116.05	No Road	No structure, no crossing roads across Omi river	392.98	523.97	0.25		Inadequate	Inadequate	Yes
		1401	Batch 20				Ogungbade, Omi, Agbede/Adesoji Road.A	Natural Stream			611,987	817,613	Poor	116.70	Tertiary Road	Heavilly flooded when rainfall. Could not measure due to the level of water	392.98	523.97	0.25		Inadequate	Inadequate	Yes
		1025	Batch 19				Ikumoda, Oloro, Iso ege	Culvert	2 BC (2.42 x 2.44)	3.97	611,420	816,365	Fair	118.85	Secondary Road		392.98	523.97	0.25	24.9	Inadequate	Inadequate	Yes
		93	Batch 19				Ikumoda, By Buso rock hotel, Old Ife road	Bridge	Br (14.7m)	6.7	611,432	816,148	Good	119.01	Expressway	The staff could not reach the bottom,so the measured height is to the water surface	392.98	523.97	0.25	388.8	Adequate	Adequate	No

Structure Data																Structure Assessment							
Channel ID	Subbasin	Structure No.	Batch_ID	Alternative ID	PIU List	No in PIU List	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Stream Slope (%)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
39	OM5 Middle Omi East	1413	Batch 20				Alapata, Alapata, Egbeda	Culvert	3 CC (0.9 dia)	2	613,161	816,618	Fair	14.91	Secondary Road	Heavily flooded with rainfall.	95.29	127.05	0.73	3.5	Inadequate	Inadequate	Yes
		1414	Batch 20				Ajoda, Ajoda, Road.3	Culvert	1 BC (0.9 x 1.5)	2.84	612,658	816,200	Good	15.72	Tertiary Road		99.54	132.72	0.73	2.9	Inadequate	Adequate	Yes
		94	Batch 0				AJODA-NEW TOWN IFE-IBADAN EXPRESS ROAD,	Culvert	2 BC (1.85 x 1.57)		612,541	816,069	Fair	16.00	Expressway		101.06	134.75	0.52	13.9	Inadequate	Inadequate	Yes
		1415	Batch 20				Ifeoluwatedo, Zone 2	Natural Stream		0.65	612,471	815,719	Poor	16.62	Tertiary Road	Heavily flooded with rainfall.	104.43	139.25	0.52	5.1	Inadequate	Inadequate	Yes
		1416	Batch 20				Ifeoluwatedo Estate, Ifeoluwatedo, Road.14	Culvert	1 BC (2.4 x 1.22)	1.44	612,187	815,465	Fair	17.01	Tertiary Road	Always over topping the culvert when it rains.	106.55	142.07	0.52	6.8	Inadequate	Inadequate	Yes
		52D1	PIU 1st List		PIU 1st List	52	PROGBESSIVE LANDLORDS/LANDLADIES ASSOCIATION OFF AKINBODE ROAD, OLUWO AREA EGBEDA LGA.	Culvert	1 BC (2.4 x 1.22)	1.44	612,033	815,373	Destroyed	17.25	Tertiary	Request for culvert,It is a link road for communities.Also, the whole community is flooded whenever there is heavy Rainfall.	107.86	143.81	0.52	6.8	Inadequate	Inadequate	Yes
36	OM6 Middle Omi West	960	Batch 13				Onibuore, Iwo road	Culvert	1 CC (0.93 dia)	3.5	606,628	820,104	Fair	1.13	Highway		12.23	16.30	0.80	1.3	Inadequate	Inadequate	Yes
		962	Batch 13				Onibuore, Arowolo	Footpath		2.3	606,776	819,845	Poor	2.92	Tertiary Road		25.65	34.20	0.80	75.6	Adequate	Inadequate	Yes
		1031	Batch 19				Ebenesary Area, Jinarere	Culvert	2 CC (0.85 dia)	1.1	607,761	819,431	Fair	3.72	Tertiary Road		31.65	42.20	0.80	2.1	Inadequate	Inadequate	Yes
		1032	Batch 19				Ebenesary Area, Adogba Road	Culvert	2 BC (1.3 x 1.34)	1.6	607,815	819,365	Fair	3.84	Tertiary Road		32.55	43.40	0.80	8.7	Inadequate	Inadequate	Yes
		1034	Batch 19				Ebenesary Area 3, Road A	Culvert	2 CC (0.9 dia) + BC (1.8 x 1.56)	1.81	607,887	819,314	Fair	3.99	Tertiary Road		33.68	44.90	0.80	10.7	Inadequate	Inadequate	Yes
		1035	Batch 19	38T			Alakia, Isabo, Isabo			2.22				9.18	Main Road		87.59	116.79	0.39	5.7	Inadequate	Inadequate	Yes
		1036	Batch 19				Seke, Comfort Memorial School, Comfort Memorial School	Footpath		1.77				10.38	Tertiary Road		87.59	116.79	0.39	64.2	Inadequate	Inadequate	Yes
		1055	Batch 19				Seke Apomu, Lekan Hussein, Lekan Hussein Street	Footpath		2.1	609,068	818,505	Poor	10.55	Tertiary Road		87.59	116.79	3.50	125.2	Adequate	Inadequate	Yes
		1033	Batch 19				Oke- Odo Alapata, Eternity Nursery & Primary School, Eternity Nursery & Primary School Road	Footpath		1.4	609,453	818,232	Poor	11.70	Tertiary Road	Urgent attention is needed here because a boy of 12 years old was swept away by this river while trying to cross the Irish the previous day	87.59	116.79	3.50	281.7	Adequate	Inadequate	Yes
		1049	Batch 19				Oke- Odo Alapata, Fimiiti Oluwa, Fimiiti Oluwa	Natural Stream		2	609,727	817,938	Poor	12.16	Tertiary Road		87.59	116.79	3.50	267.6	Adequate	Inadequate	Yes
		1037	Batch 19				Oke- Odo Alapata, Olosan, Olosan	Culvert	3 BC (2.25 x 2.76)	3.3	609,897	817,890	Good	12.23	Tertiary Road		87.59	116.79	3.50	148.8	Adequate	Adequate	No
		1038	Batch 19				Alakia, Oluwatedo Quarters, Oluwatedo Quarters	Culvert	2 BC (3.73 x 2.16)	2.16	610,060	817,726	Poor	12.35	Tertiary Road		87.59	116.79	0.56	55.1	Inadequate	Inadequate	Yes
		1021	Batch 19				Adegbayi, Oloro, Abatiti Olode	Culvert	3 BC (2.99 x 1.91)	2.2	610,817	816,448	Good	16.99	Secondary Road		113.11	150.81	0.56	52.6	Inadequate	Adequate	Yes
		92	Batch 19	28T			Celica, Oloro, Oloro	Culvert	1 BC (2.4 x 1.85)	5	610,995	816,102	Good	17.79	Expressway		113.11	150.81	0.56	12.7	Inadequate	Adequate	Yes
36A	OM6 Middle Omi West	729	Batch 12				Agric, Iwo road	Culvert	1 BC (3.7 x 1.75)	3.75	606,350	819,968	Good	1.37			14.03	18.70	0.86	24.9	Adequate	Adequate	No
		728					Agric bus stop, Gospel mission faith church road	Culvert	1 BC (1.8 x 1.48)	1.74	606,452	819,948	Good	1.57		Flooded into nearby shops during heavy rain	15.53	20.70	0.86	7.9	Inadequate	Adequate	Yes
		961	Batch 13				Onibuore, Odo eran	Culvert	1 BC (1.5 x 1.14)	1.34	606,660	819,943	Fair	1.69	Tertiary Road		16.43	21.90	0.86	4.4	Inadequate	Inadequate	Yes
36D	OM6 Middle Omi West	812	Batch 18				AGORO/ MANATAN, AGORO STREET	Culvert	2 BC (1.23 x 1.68)	1.89	606,461	819,106	Fair	1.06	Tertiary Road	FLOODED ALWAYS NEED URGENT ATTENTION	11.70	15.60	0.72	10.3	Inadequate	Inadequate	Yes
		1039	Batch 19				Aroko- Agoro, Zone 4	Footpath		2.67	606,644	819,047	Poor	1.16	Tertiary Road		12.45	16.60	0.72	47.5	Adequate	Inadequate	Yes
		1040	Batch 19				Agoro, Adesina Street	Natural Stream		2.05	606,759	818,968	Poor	1.32	Tertiary Road		13.65	18.20	0.72	33.5	Adequate	Inadequate	Yes
		1520	Batch 31				Adogba	Footpath		2.29	607,017	818,805	Fair	2.53	Tertiary Road		22.73	30.30	0.72	106.2	Adequate	Inadequate	Yes
		1043	Batch 19				Alalubosa, Ago Irapada	Natural Stream		2.1	607,263	818,774	Poor	2.61	Tertiary Road		23.33	31.10	0.72	82.7	Adequate	Inadequate	Yes
36D-5	OM6 Middle	1521	Batch 31				Adogba	Footpath		1.15	606,812	818,672	Poor	1.04	Tertiary Road		11.55	15.40	1.20	35.6	Adequate	Inadequate	Yes
36D-7	OM6 Middle	1045	Batch 19				Alalubosa, Mojawe	Culvert	1 BC (2.6 x 2)	2.4	607,558	818,475	Good	1.64	Tertiary Road		16.05	21.40	0.73	17.8	Inadequate	Adequate	Yes
36M	OM6 Middle Omi West	1028	Batch 19				Alakia Area, Amuro Onilu Temidire Zone D	Footpath		2.12	610,038	817,585	Poor	1.85	Tertiary Road		17.63	23.50	1.92	95.8	Adequate	Inadequate	Yes
		1027	Batch 19				Alakia Area, Amuro Onilu Temidire Zone D	Footpath		1.33	610,129	817,577	Poor	1.86	Tertiary Road		17.70	23.60	1.92	103.0	Adequate	Inadequate	Yes
37	OM6 Middle Omi West	998	Batch 19				Iyana Agbala, Old Ife road	Culvert	2 CC (0.9 dia)	5	609,501	816,189	Fair	1.12	Expressway		12.15	16.20	1.35	3.2	Inadequate	Inadequate	Yes
		997	Batch 19	90D	PIU 4th List	7	Iyana Agbala, Kuelu	Culvert	1 BC (2.3 x 1.75)	2	609,756	815,718	Good	3.56	Tertiary Road		30.45	40.60	1.35	17.2	Inadequate	Adequate	Yes
		996	Batch 19				Kuelu Area, Zone D	Culvert	2 BC (1.55 x 1.62)	1.82	609,853	815,387	Good	3.72	Tertiary Road	Overflow during heavy rain	31.65	42.20	1.35	18.5	Inadequate	Adequate	Yes
		995	Batch 19	13P			Omiri, Adekola road	Culvert	2 CC (1.2 dia) + BC (2.35 x 2.11)	2.5	609,907	815,310	Good	4.42	Secondary Road		36.90	49.20	1.35	29.8	Inadequate	Adequate	Yes
		994	Batch 19				Ogo Oluwa Community Zone B, Morning Star International School	Culvert	2 BC (2.4 x 1.74)	2.67	610,225	815,282	Good	4.59	Tertiary Road		38.18	50.90	2.63	50.3	Adequate	Adequate	No
37D	OM6 Middle Omi West	1010	Batch 19				Adegbayi, Ikuogbolekun	Culvert	2 BC (1.53 x 1.89)	2.09	608,602	815,825	Good	1.39	Tertiary Road		14.18	18.90	1.25	21.4	Adequate	Adequate	No
		1008	Batch 19				Adegbayi, Off Ikuogbolekun	Footpath		1.25	608,688	815,811	Poor	1.41	Tertiary Road		14.33	19.10	1.25	9.2	Inadequate	Inadequate	Yes
		1007	Batch 19				Adegbayi, Akomolafe-Road C	Footpath		1.55	608,878	815,830	Poor	1.67	Tertiary Road		16.28	21.70	1.25	13.0	Inadequate	Inadequate	Yes
		1006	Batch 19	51D	PIU 1st List	51	Adegbayi, Aba Odan	Culvert	2 BC (1.95 x 1.15)	1.71	609,057	815,881	Good	1.76	Tertiary Road		16.95	22.60	1.25	14.9	Inadequate	Adequate	Yes
		1005	Batch 19				Adegbayi, Ajia road			1.58	609,361	815,895		1.96	Tertiary Road		18.45	24.60	1.25	8.8	Inadequate	Inadequate	Yes
		1004	Batch 19				Adegbayi, Kuelu	Culvert	1 BC (2.3 x 1.4)	1.7	609,419	815,909	Good	1.99	Secondary Road		18.68	24.90	1.25	12.1	Inadequate	Adequate	Yes

Structure Data																Structure Assessment							
Channel ID	Subbasin	Structure No.	Batch_ID	Alternative ID	PIU List	No in PIU List	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Stream Slope (%)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
40	OM7 Middle Omi South	1422	Batch 20				Egbeda/Iyana-Ajia, Ife/Ibadan Express Way	Culvert	1 CC (0.78 dia)	1.6	615,792	815,231	Fair	1.44	Expressway		14.55	19.40	0.88	0.9	Inadequate	Inadequate	Yes
		1423	Batch 20				Egbeda, Jekaoyinfa Road	Culvert	1 BC (3.16 x 1.9)	2.1	615,551	815,139	Good	1.75	Tertiary Road	Newly constructed by community.	16.88	22.50	0.88	23.4	Adequate	Adequate	No
		1424	Batch 20				Bethel Estate, Celestial Village	Culvert	1 BC (1.64 x 0)		615,299	815,097	Good	1.96	Tertiary Road	Fairly ok.	18.45	24.60	0.88		Inadequate	Adequate	Yes
		1425	Batch 20				Oke-odo, Agudu Road	Culvert	3 CC (0.67 dia)	1.28	614,977	814,877	Good	2.67	Tertiary Road	When heavily flooded it over tops the culvert.	23.78	31.70	0.88	1.8	Inadequate	Adequate	Yes
		1426	Batch 20				Moleke-Agudu, Road.5	Footpath		1.27	614,688	814,911	Poor	2.87	Tertiary Road	Heavily flooded with rainfall.	25.28	33.70	0.88	8.4	Inadequate	Inadequate	Yes
		1427	Batch 20				Wisdom estate, Edun villa	Culvert	2 CC (0.79 dia) + BC (2.02 x 0.94)	1.34	614,191	814,871	Fair	4.10	Tertiary Road	Culvert has three cells (One box and two rings)	34.50	46.00	0.88	6.7	Inadequate	Inadequate	Yes
		1428	Batch 20				Olorunsogo, Akinjole Zone 2	Natural Stream		0.45	613,917	814,992	Poor	4.44	Tertiary Road	Usually flooded with heavy rainfall.	37.05	49.40	0.88	5.4	Inadequate	Inadequate	Yes
		1429	Batch 20				Akinjole/Omoloju, Akinjole Zone 2	Footpath		2.05	613,758	815,045	Fair	4.64	Tertiary Road	Heavily flooded with rainfall.	38.55	51.40	0.88		Inadequate	Inadequate	Yes
		1517	Batch 31				Logun, Odo Loogun, Road 3	Footpath		1.16	613,485	814,893	Poor	5.61	Tertiary Road		44.69	59.58	0.80	64.8	Adequate	Inadequate	Yes
		1430	Batch 20				Olode/Ajamaro, Olode, Okewusi Road 1.A	Culvert	2 BC (2.17 x 1.55)	1.96	612,880	814,597	Fair	6.15	Tertiary Road	Outlet has sand deposit.,usually floods area.	47.50	63.34	0.80	20.8	Inadequate	Inadequate	Yes
		1516	Batch 31				Masopa estate, Road C, Lane 1	Natural Stream		0.7	612,680	814,293	Poor	7.12	Tertiary Road		71.80	95.73	0.80	9.0	Inadequate	Inadequate	Yes
		1441	Batch 26				Areokuta, Omi S.C., Wemimo	Natural Stream		0.55	611,991	813,755	Poor	7.97	Tertiary Road	Always heavily flooded.	71.80	95.73	0.80		Inadequate	Inadequate	Yes
		1515	Batch 31				Oke Anu Alaro Ibadan, Ire Akari Str.	Footpath		0.68	611,681	813,526	Poor	8.16	Tertiary Road		71.80	95.73	0.80	2.3	Inadequate	Inadequate	Yes
		1142	Batch 25				Komolafe Estate, Komolafe, Off Ajia Road	Natural Stream		0.4	611,420	813,279	Poor	9.77	Tertiary Road		71.80	95.73	0.80	1.8	Inadequate	Inadequate	Yes
40Q	OM7 Middle	1437	Batch 26				Arinokuta, Wemimo/Alaro Estate	Culvert	1 CC (0.8 dia)	1.25	611,856	813,404	Fair	1.00	Tertiary Road	Usually floods.	11.25	15.00	1.56	1.3	Inadequate	Inadequate	Yes
41	OM7 Middle	1173	Batch 25	52D2	PIU 1st List	52	Araba Redeem, Oomi River, Redeem	Natural Stream			611,443	814,433	Poor	161.51	Tertiary Road	No access to measure it	432.67	576.89	0.19		Inadequate	Inadequate	Yes
	Omi South	1141	Batch 25	50D	PIU 1st List	50	Ejikeye Alaro, Oomi River, Ajia Road	Bridge	Br (3 Span 5.6)	3.15	611,036	813,009	Good	174.43	Secondary Road		444.78	593.04	0.19	90.8	Inadequate	Adequate	Yes
42	OM7 Middle Omi South	1170 Prime	Batch 25				Aiport, Perimeter fence road	Culvert	1 BC (1.3 x 1.05)	1.5	608,411	813,998	Good	1.27	Tertiary Road		13.28	17.70	2.24	5.2	Inadequate	Adequate	Yes
		1170	Batch 25				Aiport, Off Perimeter fence road	Natural Stream		0.3	608,405	813,929	Poor	1.40	Tertiary Road		14.25	19.00	2.24	3.8	Inadequate	Inadequate	Yes
		1130	Batch 25				Oke Ibukun, Road 1	Natural Stream		1.15	608,691	813,466	Poor	1.97	Tertiary Road		18.53	24.70	2.24	30.7	Adequate	Inadequate	Yes
		1132	Batch 25				Kobiowu Akintunde, Kobiowu Akintunde	Natural Stream		1.5	609,056	812,845	Poor	3.52	Tertiary Road		30.15	40.20	2.24	78.7	Adequate	Inadequate	Yes
		1133	Batch 25				Kobiowu Akintunde,	Culvert	2 BC (1.5 x 1.39)	1.7	609,085	812,683	Good	3.57	Secondary Road	Overflow during heavy rain	30.53	40.70	2.24	18.5	Inadequate	Adequate	Yes
42J	OM7 Middle Omi South	1139	Batch 25				Lato, Soobu Merin Street	Footpath		2.8	608,476	812,408	Poor	3.07	Tertiary Road		26.78	35.70	4.80	68.9	Adequate	Inadequate	Yes
		90	Batch 0				AKINTUNDE	Culvert	2 BC (2.5 x 2.2)	2.48	609,009	812,610	Dilapidated	3.53	Secondary Road	The water pass under the box culvert	30.23	40.30	1.18	49.1	Adequate	Inadequate	Yes
43	OM7 Middle	1174	Batch 25				Igbaotun, Oomi River, Aba Oloosa				610,916	811,417		185.99	Tertiary Road	No Access to measure it	455.62	607.49	0.30		Inadequate	Inadequate	Yes
45	OM7 Middle Omi South	1445	Batch 31				Ona-ara, Omi Br., Akanran	Bridge	Br (3 Span 4.2)	6.9	610,275	808,832	Fair	203.10	Main Road	Height&Road level measured is from the surface of water,depth not accessible.	471.66	628.88	0.24	254.6	Inadequate	Inadequate	Yes
45E	OM7 Middle Omi South	1164	Batch 25				Akindele Atea, Irepodun Estate	Culvert	1 BC (1.95 x 1.09)	1.42	609,743	811,087	Good	1.02	Tertiary Road		11.40	15.20	1.10	6.5	Inadequate	Adequate	Yes
		1161	Batch 25				Aba Epo, Ayetuntun	Culvert	2 CC (0.75 dia) + BC (1.5 x)	1.35	609,943	810,726	Fair	1.37	Tertiary Road	The culvert is damaged so the crown level could not be measured	14.03	18.70	1.10	1.8	Inadequate	Inadequate	Yes
		1160	Batch 25				Aba Epo, Akanran	Culvert	1 BC (1.9 x 1.1)	1.36	610,139	810,281	Good	1.83	Tertiary Road		17.48	23.30	1.10	6.4	Inadequate	Adequate	Yes
		1530	Batch 31				Oluwalogbon Community, Zone 1	Natural Stream		1.15	610,319	809,872	Poor	2.06	Tertiary Road		19.20	25.60	1.10	18.9	Inadequate	Inadequate	Yes
		1159	Batch 25				Ogo Oluwa Estate, Zone G	Footpath		1.46	610,377	809,768	Poor	2.09	Tertiary Road		19.43	25.90	1.10	65.8	Adequate	Inadequate	Yes
		1158	Batch 25				Ogo Oluwa Estate, Road 2	Natural Stream		1.6	610,400	809,653	Poor	2.12	Tertiary Road		19.65	26.20	1.10	27.9	Adequate	Inadequate	Yes
		1442	Batch 31				Idi-ose, Ogo-oluwa Estate zone.6	Culvert	2 BC (0.83 x 1.24)	1.4	610,442	809,551	Poor	2.16	Tertiary Road	Eroded	19.95	26.60	1.10	5.0	Inadequate	Inadequate	Yes
45H	OM7 Middle Omi South	1150	Batch 25				Oloya Area, Akaran	Culvert	1 BC (1.95 x 1.43)	1.75	608,801	810,377	Good	1.14	Tertiary Road		12.30	16.40	1.29	10.3	Inadequate	Adequate	Yes
		1154	Batch 25				Araromi, Oke-Odo	Culvert	3 CC (0.75 dia) + BC (2.15 x 1.85)	2.1	609,176	810,246		2.12	Tertiary Road	Overflow during heavy rain	19.65	26.20	1.29	19.5	Inadequate	Inadequate	Yes
		1155	Batch 25				Ab a Eku, Irewole	Culvert	1 BC (2.8 x 1.6)	1.9	609,465	809,767	Fair	2.82	Tertiary Road		24.90	33.20	1.29	19.0	Inadequate	Inadequate	Yes
		1443	Batch 31				Idi-ose off Akanran Road, Ifelagba zone.5	Culvert	2 BC (1.8 x 2.25)	2.5	609,978	809,363	Fair	3.47	Tertiary Road	Overtops	29.78	39.70	1.29	34.0	Inadequate	Inadequate	Yes
		1444	Batch 31				Idi-ose, Irewole	Natural Stream		1.3	610,079	809,291	Poor	3.56	Tertiary Road	Heavily flooded when it rains heavy,over flow and floods area.	30.45	40.60	1.29	50.2	Adequate	Inadequate	Yes
66	ON6 Upper Ona West	167	Batch 1	35D1	PIU 1st List	35	Onikankan-Onilu, Odo Onilu, Iyana Apete Road	Culvert	1 BC (6.2 x 1.6)	2.15	598,383	832,534	Fair	66.84	Secondary Road		376.27	501.69	0.25	21.5	Inadequate	Inadequate	Yes
		186	Batch 1				Aba Onilu, Odo Onilu, Aba Onilu	Bridge	Br (14.18m)	1.64	598,436	832,067	Poor	67.22	Tertiary Road		376.27	501.69	0.25	84.4	Inadequate	Inadequate	Yes
66C	ON6 Upper Ona West	178	Batch 1				Moniya, Old Oyo Road	Culvert	1 BC (3.1 x 2)	2.62	600,598	833,009	Good	1.44	Highway		14.55	19.40	0.85	24.0	Adequate	Adequate	No
		1578	Batch 31				Monya, Moniya Market	Natural Stream		2.54	600,394	832,939	Poor	1.50	Tertiary Road		15.00	20.00	0.85	189.2	Adequate	Inadequate	Yes
		184	Batch 1	2T			Ayobomi Abiola (Moniya), Iseyin-Ibadan Road	Culvert	1 BC (2.6 x 1.8)	2.33	600,062	832,874	Good	2.01	Main Road		18.83	25.10	0.85	16.6	Inadequate	Adequate	Yes
		123B					Moniya, Isale-odo,Balogun Lane.3	Culvert	2 BC (2.42 x 1.48)	1.93	599,789	832,762	Poor	2.63	Tertiary Road	Always heavily flooded with rainfall.	23.48	31.30	0.85	23.0	Inadequate	Inadequate	Yes
		166	Batch 1				Balogun	Natural Stream		2.2	599,652	832,636	Erosion	2.70	Tertiary Road	the Culvert break down in the year 2014	24.00	32.00	0.85	111.1	Adequate	Inadequate	Yes
		165	Batch 1				Balogun	Natural Stream		2.3	599,518	832,559	Erosion	3.00	Tertiary Road		26.25	35.00	0.85	106.9	Adequate	Inadequate	Yes
		164	Batch 1	35D2	PIU 1st List	35	Onilu	Natural Stream		1.4	598,940	832,136	Dilapidated	3.36	Tertiary Road		28.95	38.60	0.85	61.1	Adequate	Inadequate	Yes
		35D3	PIU 1st List		PIU 1st List	35	ONILU LANDLORDS ASSOCIATION, MONIYA,IBADAN	Natural Stream			598,733	831,929	No Structure	3.49	No Road	There is no structure	29.93	39.90	0.85		Inadequate	Inadequate	Yes
68	ON6 Upper	187	Batch 1	3D	PIU 1st List	3	Guuwin - Lagbe, Odo Guumin, Guumin Road	Culvert	3 BC (2 x 1.3)	1.88	598,674	830,266	Good	81.45	Tertiary Road	Block with sand	402.88	537.17	0.15	9.6	Inadequate	Adequate	Yes
68A	ON6 Upper Ona West	173	Batch 1				Akingbile	Culvert	1 BC (2.2 x 1.77)	1.98	600,307	830,919	Good	1.01	Tertiary Road	Clear water	11.33	15.10	1.15	15.2	Adequate	Adequate	No
		172	Batch 1				Fatokun	Footpath		2.12	599,903	830,852	Poor	1.79	Tertiary Road	Clear water	17.18	22.90	1.15	65.6	Adequate	Inadequate	Yes
		171	Batch 1				Fatokun	Natural Stream		1.08	599,765	830,847	Fair	1.95	Tertiary Road	Clear water	18.38	24.50	1.15	19.1	Inadequate	Inadequate	Yes
		192	Batch 1				Ogunsinde	Natural Stream		1.82	599,427	830,810	Dilapidated	2.27	Tertiary Road		20.78	27.70	1.15	119.6	Adequate	Inadequate	Yes
		191	Batch 1				Idiamu Akingbile	Culvert	1 CC (0.6 dia)	4	598,928	830,601	Good	2.66	Tertiary Road	The dam usually over fow during the raining season thereby causing flooding in thr area	23.70	31.60	1.15	0.5	Inadequate	Adequate	Yes

Structure Data																Structure Assessment							
Channel ID	Subbasin	Structure No.	Batch_ID	Alternative ID	PIU List	No in PIU List	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Stream Slope (%)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
68C	ON6 Upper	189	Batch 1				Agbe, Agbe Road	Culvert	2 BC (1.4 x 0.71)	1.3	598,228	829,878	Good	3.07	Tertiary Road		26.78	35.70	1.05	4.5	Inadequate	Adequate	Yes
53G	ON7 Upper Ona East	1581	Batch 31				Arulogun, Arulogun Road	Culvert	1 CC (0.8 dia)	1.3	606,221	832,884	Fair	1.08	Main Road		11.85	15.80	1.31	1.1	Inadequate	Inadequate	Yes
		219	Batch 2				Ifesowapo community, Kole zone F	Natural Stream		0.87	606,038	832,868	Erosion	1.16	Tertiary Road		12.45	16.60	1.31	6.5	Inadequate	Inadequate	Yes
		218	Batch 2				Kole Aroro, Kole road 6	Culvert	1 BC (1.47 x 0.73)	1	605,534	832,708	Fair	1.44	Tertiary Road		14.55	19.40	1.31	2.8	Inadequate	Inadequate	Yes
		217	Batch 2				Kole	Natural Stream		0.6	605,239	832,734	Erosion	1.55	Tertiary Road		15.38	20.50	1.31	2.3	Inadequate	Inadequate	Yes
53J	ON7 Upper Ona East	121B	Batch 0				KOLE OSHE , ARULOGUN ROAD	Culvert	1 CC (1 dia)	1.77	605,770	832,161	Fair	4.09	Main Road		34.43	45.90	0.81	1.6	Inadequate	Inadequate	Yes
		214	Batch 2				Agrifamily Estate	Culvert	1 BC (1.35 x 1)	1.24	605,084	832,352	Fair	4.48	Tertiary Road		37.35	49.80	0.81	3.1	Inadequate	Inadequate	Yes
53M	ON7 Upper Ona East	212	Batch 2				Oke funfun 2, Oke funfun Road	Culvert	1 CC (0.73 dia)	1.13	605,914	831,295	Good	1.10	Tertiary Road		12.00	16.00	1.00	0.8	Inadequate	Adequate	Yes
		211	Batch 2				Arulogun, Arulogun road	Culvert	1 CC (0.7 dia)	2.1	605,632	831,220	Poor	1.37	Main Road	the inlet is not accessible	14.03	18.70	1.00	0.7	Inadequate	Inadequate	Yes
54	ON7 Upper Ona East	222	Batch 2				Aiku, Aiku road	Natural Stream		0.56	603,882	833,658	Erosion	1.24	Main Road	Break down culvert	13.05	17.40	0.94	3.6	Inadequate	Inadequate	Yes
		220	Batch 2				Bagadaje-Baale, Odo Apon, Ogo oluwa	Natural Stream		0.6	603,263	832,113	Erosion	5.70		Break down irish cross	58.94	78.58	0.67	5.1	Inadequate	Inadequate	Yes
54D	ON7 Upper	221	Batch 2				Orieni, Orieni road	Natural Stream		0.5	603,180	833,128	Erosion	2.24	Main Road		20.55	27.40	1.00	4.6	Inadequate	Inadequate	Yes
55	ON7 Upper Ona East	204	Batch 2				Ajoda (Peace avenue), Ajoda	Natural Stream		0.5	603,192	831,199	Erosion	78.66	Tertiary Road		331.63	442.17	0.32	2.8	Inadequate	Inadequate	Yes
		203	Batch 2				Aroro Makinde, Makinde	Natural Stream		0.65	602,891	831,048	Erosion	78.79	Tertiary Road		331.63	442.17	0.32	5.7	Inadequate	Inadequate	Yes
		37D	PIU 1st List		PIU 1st List	37	AKINRINOLA, EWE INA, DIVINE FAVOUR WITH ARORO MAKINDE, ARULOGUN AREA TO IBADAN-ILORIN EXPRESSROAD AT IDI-OSE.	Natural Stream			602,891	831,048	No Structure	81.10	No Road	There is no structure, abandoned road, upper Ona main River, communities lack a motorable road for connection	331.63	442.17	0.32		Inadequate	Inadequate	Yes
		47D	PIU 1st List		PIU 1st List	47	AKINRINOLA COMMUNITY DEVELOPMENT ASSOCIATION OFF IDI-OSE OYO ROAD AKINYELE LGA	Natural Stream			602,492	830,351	No Structure	82.56	No Road	There is no structure, communities lack connection in upper Ona	335.38	447.17	0.32		Inadequate	Inadequate	Yes
		205	Batch 2				Akinrinola Village, Odo Ona, Akinrinola	Footpath		2.1	602,448	830,247	Fair	82.61	Tertiary Road		335.38	447.17	0.32	75.3	Inadequate	Inadequate	Yes
55B	ON7 Upper Ona East	200	Batch 2				Apapa, Akuro-Apapa road	Culvert	2 BC (2.88 x 2.14)	2.59	602,012	831,949	Good	1.12	Main Road		12.15	16.20	1.33	60.4	Adequate	Adequate	No
		201	Batch 2				Apapa	Footpath		2.05	602,148	831,779	Erosion	1.65	Tertiary Road		16.13	21.50	1.33	26.1	Adequate	Inadequate	Yes
		85D1	PIU 4th List		PIU 4th List	2	DAUDA ZONE COMMUNITY, BAGADAJE/OLOBI AREA. ARORO MAKINDE MONIYA ROAD	Natural Stream			602,663	831,576	No Structure	1.99	No Road	It is an abandoned road,Require culvert to be motor able,It is a link road for communities.	18.68	24.91	1.33		Inadequate	Inadequate	Yes
		202	Batch 2	71D1	PIU 2nd List	14	Bagadaje	Natural Stream		1.08	602,928	831,163	Fair	2.27	Tertiary Road		20.78	27.70	1.33	14.9	Inadequate	Inadequate	Yes
55F	ON7 Upper	206	Batch 2					Natural Stream		0.75	602,080	830,087	Erosion	1.01	Tertiary Road		11.33	15.10	1.84	27.1	Adequate	Inadequate	Yes
56	ON8 Upper Ona South	210	Batch 2				Model City	Footpath		0.6	605,877	829,807	Poor	1.53	Tertiary Road		15.23	20.30	0.87	3.6	Inadequate	Inadequate	Yes
		209	Batch 2	32D1	PIU 1st List	32	Model City	Culvert	2 BC (0.73 x 0.95)	1.07	605,822	829,568	Good	1.15	Tertiary Road		12.38	16.50	0.87	2.6	Inadequate	Adequate	Yes
		560	Batch 6	32D2	PIU 1st List	32	Holiness Estate, Higher ground Road	Culvert	1 CC (0.5 dia)	1.12	605,498	829,021	Good	3.55	Tertiary Road	the area is usually flooded	30.38	40.50	0.87	0.3	Inadequate	Adequate	Yes
		561	Batch 6	32D3	PIU 1st List	32	Omilabu, Omilabu-Olorunda Road	Culvert	1 BC (1 x 1.26)	1.51	605,265	828,858	Fair	3.88	Secondary Road	the area is usually flooded	32.85	43.80	0.87	2.9	Inadequate	Inadequate	Yes
		1582	Batch 31				Ojoo, Alapata Street	Footpath		2	604,035	828,932	Poor	9.60	Tertiary Road		101.15	134.87	0.58	26.5	Inadequate	Inadequate	Yes
		123A	Batch 0				ARULOGUN ROAD,	Culvert	1 BC (4.1 x 2.03)	2.29	603,514	828,989	Fair	10.71	Main Road		101.15	134.87	0.58	28.8	Inadequate	Inadequate	Yes
		124A	Batch 0	4D	PIU 1st List	4	ARORO , MAKINDE,	Culvert	1 BC (2.18 x 1.29)	1.76	603,052	829,038	Fair	13.28	Tertiary Road		101.15	134.87	0.58	6.9	Inadequate	Inadequate	Yes
56H	ON8 Upper Ona South	555	Batch 6				Abutu				604,307	828,652	Dilapidated	2.75	Secondary Road	the inlet has collapse therefore no proper measurement can be carried out.	24.38	32.50	0.82		Inadequate	Inadequate	Yes
56K	ON8 Upper Ona South	122A	Batch 6				ADELOLA ESTATE , ARULOGUN	Culvert	1 BC (1.84 x 1.03)	1.33	603,873	829,978	Fair	1.13	Tertiary Road		12.23	16.30	0.93	5.1	Inadequate	Inadequate	Yes
		536	Batch 6				Alapata, Alaafia road	Culvert	2 CC (0.93 dia)	1.41	603,468	829,432	Good	1.79	Tertiary Road	the area is always flooded during heavy rainfall	17.18	22.90	0.93	2.9	Inadequate	Adequate	Yes
		537	Batch 6				Arulogun	Footpath		0.5	603,434	829,171	Poor	1.96	Tertiary Road		18.45	24.60	0.93	41.7	Adequate	Inadequate	Yes
58	ON8 Upper Ona South	511	Batch 5				Akingbile, New Road	Natural Stream		1.12	601,148	828,118	Erosion	106.73	Tertiary Road		373.20	497.60	0.26	21.8	Inadequate	Inadequate	Yes
		126A	Batch 5	8T			Akingbile, New Road	Bridge	Br (2 Span 24)		601,101	828,095	Good	107.63	Tertiary Road		387.16	516.21	0.26	998.9	Adequate	Adequate	No
		127	Batch 0	9T			IITA IDI DSE,	Culvert	1 BC (6.4 x 3.01)	3.75	600,833	827,949	Fair	107.80	Highway		387.16	516.21	0.26	59.0	Inadequate	Inadequate	Yes
57	ON8 Upper Ona South	551	ederal Housir				Barack, Off Range road before cemetery	Culvert	2 CC (0.9 dia)	1.8	603,555	826,984	Good	1.81	Tertiary Road		17.33	23.10	0.84	2.5	Inadequate	Adequate	Yes
		550	ederal Housir				Barack, KTJ Minimah	Culvert	1 BC (1.8 x 1.9)	3.5	603,069	826,715	Fair	2.47	Tertiary Road		22.28	29.70	0.84	11.0	Inadequate	Inadequate	Yes
		549	ederal Housir				Barack, Range Road	Culvert	1 BC (1.8 x 1.85)	3	602,480	826,978	Fair	3.82	Tertiary Road		32.40	43.20	0.84	10.6	Inadequate	Inadequate	Yes
		578		125A			Ojoo, Jerusalem Cv., Arulogun/jerusalem junction	Culvert	2 CC (0.9 dia)	1.68	602,242	827,517	Poor	5.32		Always over tops culvert when it rains heavy.	52.07	69.43	0.84	2.5	Inadequate	Inadequate	Yes
		547	Batch 6				Ilupeju Community, Off Arulogun Road	Natural Stream		1.2	602,164	827,694	Poor	5.50			52.07	69.43	0.84	15.4	Inadequate	Inadequate	Yes
		546	Batch 6				Ilupeju Community, Off Arulogun Road	Natural Stream		1.05	602,169	827,733	Poor	5.52			52.07	69.43	0.84	23.8	Inadequate	Inadequate	Yes
		545	Batch 6				Goodness Estate Ojoo, Jerusalem	Footpath		1.9	602,069	827,935	Poor	6.03			52.07	69.43	0.84	38.9	Inadequate	Inadequate	Yes
		544	Batch 6				Aba Eko Ojoo, L.A. Adisa-Aba eko road	Culvert	1 BC (2.4 x 1.94)	2.25	601,940	828,213	Poor	6.31			52.07	69.43	0.84	16.5	Inadequate	Inadequate	Yes
70	ON9 Orogun	567	ederal Housir				Barack, Adekunle Fajuyi Central Mosque road	Culvert	2 CC (0.9 dia)	2	603,128	823,758	Fair	2.71	Tertiary Road		24.08	32.10	1.00	2.8	Inadequate	Inadequate	Yes
		565	ederal Housir				Barack, Commandant house road, Commandant house road	Culvert	1 BC (1.8 x 1.9)	3	602,126	823,622	Good	7.55			48.75	65.00					
		678	Batch 12				Agbowo Express, Irepodun, Irepodun Street	Culvert	1 BC (2.3 x 1.83)	2.19	601,746	823,690	Good	8.71			48.75	65.00					
		677	Batch 12				Irepodun Ojo road, Police Station, Police Station road	Culvert	1 BC (3.6 x 2.85)	6	601,611	823,754	Good	8.79			59.93	79.90					
		634	Batch 11				Agbowo, Orogun River, Oriolowo street Junction	Footpath		1.7	601,182	823,698	Fair	11.66		Flooded ocassionally	82.53	110.04					
		633	Batch 11				Agbowo, Orogun Bridge Agbowo, Aba Apata Kekere street	Culvert	2 BC (2.58 x 2.2)	2.54	600,784	823,752	Fair	12.04		Flooded ocassionally	82.53	110.04					
		122B	Batch 0	5T			OROGUN,	Culvert	2 BC (2.7 x 2.68)	3.3	600,092	824,064	Erosion	15.88			164.00	218.67					

Structure Data																Structure Assessment							
Channel ID	Subbasin	Structure No.	Batch_ID	Alternative ID	PIU List	No in PIU List	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Stream Slope (%)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
70J	ON9 Orogun	553	ederal Housir				Barack, Command day secondary school road	Culvert	1 BC (1.9 x 1.3)	2.8	603,367	825,257	Fair	1.15	Main Road		12.38	16.50	1.00	7.7	Inadequate	Inadequate	Yes
70P	ON9 Orogun	552	Batch 6				Orogun Express	Footpath		0.74	601,710	824,769	Poor	1.42	Tertiary Road		14.40	19.20	0.97	5.0	Inadequate	Inadequate	Yes
		681	Batch 12				Kajorepo Ojo, Kajorepo Secondary school road	Culvert	1 BC (1.82 x 1.42)	1.65	601,731	824,471	Good	1.56	Tertiary Road	The area need urgent attention because it is flooded during heavy rain	15.45	20.60	0.97	8.1	Inadequate	Adequate	Yes
		680	Batch 12				Kajola, Temidire Street	Culvert	1 BC (2.95 x 1.27)	1.7	601,689	824,350	Good	2.00	Tertiary Road		18.75	25.00	0.97	12.6	Inadequate	Adequate	Yes
		679	Batch 12				Kajola, Iwo road	Culvert	1 BC (2.4 x 1.81)	5.4	601,602	824,175	Good	2.35	Expressway		21.38	28.50	0.97	16.1	Inadequate	Adequate	Yes
		1548	Batch 31				Agbowo, Fijabi Bus Stop	Culvert	1 BC (3.1 x 2.72)	3.12	601,583	823,898	Fair	2.51	Tertiary Road		22.58	30.10	0.97	39.3	Adequate	Inadequate	Yes
70Q	ON9 Orogun	636	Batch 11				Farayola Bodija, Farayola Street	Culvert	1 BC (4.6 x 1.63)	2.21	601,232	822,380	Good	1.18	Tertiary Road		12.60	16.80	1.00	31.4	Adequate	Adequate	No
		128	Batch 0				MAJEOBAJE AGBOWO	Culvert	1 BC (3.16 x 2.21)	2.43	601,207	822,599	Fair	1.26	Tertiary Road		13.20	17.60	1.00	30.8	Adequate	Inadequate	Yes
		125B	Batch 0				OMOTARA , AGBOWO	Culvert	2 BC (1.73 x 1.4)	1.9	600,993	822,758	Erosion	2.25	Tertiary Road		20.63	27.50	1.00	15.1	Inadequate	Inadequate	Yes
		668	Batch 11				Agbowo, Adewumi Street	Natural Stream		1	600,978	822,818	Poor	2.29	Tertiary Road		20.93	27.90	1.00	24.5	Inadequate	Inadequate	Yes
		1547	Batch 31				Agbowo, Adewunmi Street	Footpath		1.3	600,948	822,880	Fair	2.29	Tertiary Road		20.93	27.90	1.00	259.9	Adequate	Inadequate	Yes
		667	Batch 11				Agbowo, Adeoye Off Carpenter Street	Culvert	1 BC (3.5 x 2.56)	2.9	600,828	823,247	Good	2.59	Tertiary Road		23.18	30.90	1.00	43.0	Adequate	Adequate	No
		126B					Agbowo-Barika, Adegbite Estate/Majeroku street	Natural Stream		1.7	600,724	823,554	Poor	2.80	Tertiary Road	Heavily flooded with rainfall,presence of completely damaged culvert.	24.75	33.00	1.00	104.7	Adequate	Inadequate	Yes
69	ON10	490	Batch 5				University of Ibadan, Ajibode Road	Culvert	1 BC (29.2 x 4.1)	4.6	599,429	824,926	Good	210.83	Main Road		435.20	580.27	0.21	479.8	Adequate	Adequate	No
69C	ON10 Middle Ona	502	Batch 5				University of Ibadan, Ajibode Road	Culvert	2 CC (0.9 dia) + BC (2.9 x 1.94)	2.18	599,749	826,235	Good	1.57			15.53	20.70	0.89	46.0	Adequate	Adequate	No
71	ON10 Middle Ona North	489	Batch 5				University of Ibadan, Ajibode Road	Culvert	1 BC (43.9 x 5.8)	6.3	599,180	824,753	Good	229.57	Main Road		435.20	580.27	0.16	1129.7	Adequate	Adequate	No
		628	Batch 11				Ajibode, Aho River, Odo Ona way	Natural Stream		1.64	598,591	824,474	Good	230.17	Tertiary Road	FLOOD ONLY HEAVY RAINING SEASON	435.20	580.27	0.16	25.0	Inadequate	Adequate	Yes
71C	ON10 Middle Ona North	481	Batch 5				Laniba	Culvert	1 BC (6.7 x 0)	1.08	597,836	826,961	Poor	1.33	Tertiary Road	Silted Culvert	13.73	18.30	0.73		Inadequate	Inadequate	Yes
		482	Batch 5				Ajibode, Ajibode Road	Culvert	1 CC (0.8 dia)	1.5	597,905	826,757	Fair	1.42	Tertiary Road		14.40	19.20	0.73	0.9	Inadequate	Inadequate	Yes
		484	Batch 5				Area 3	Footpath		1.25	598,367	825,196	Poor	3.79	Tertiary Road		32.18	42.90	0.73	20.7	Inadequate	Inadequate	Yes
		485	Batch 5				Ajibode (Lakoto), Lakoto Apete Road	Culvert	1 BC (1.56 x 1.56)	1.96	598,287	824,943	Good	4.02	Main Road		33.90	45.20	0.73	6.5	Inadequate	Adequate	Yes
		486	Batch 5				Ajibode, Ajibode Road	Culvert	1 CC (0.8 dia)	1	598,407	824,628	Poor	4.19	4.19	4.19	35.18	46.90	0.73	0.9	Inadequate	Inadequate	Yes
72	ON10 Middle Ona North	475	Batch 4				Balogun, Balogun Road	Natural Stream		0.3	596,087	826,758	Poor	4.17	Tertiary Road		35.03	46.70	0.82	1.3	Inadequate	Inadequate	Yes
		474	Batch 4	42D	PIU 1st List	42	Jamade, Odo Jamade, Jamade Road	Footpath		1.36	596,424	825,749	Poor	6.79	Tertiary Road		85.01	113.35	0.69	27.9	Inadequate	Inadequate	Yes
		487	Batch 5				Jamade,	Culvert	2 BC (1.4 x 1.5)	1.9	596,523	825,472	Good	7.54	Tertiary Road		85.01	113.35	0.69	10.4	Inadequate	Adequate	Yes
		488	Batch 5				Osajin, odo ola-adua,	Footpath		1	596,716	824,776	Poor	8.83	Tertiary Road		85.01	113.35	0.69	16.3	Inadequate	Inadequate	Yes
		625B		11T			Ojoo-Ajibode, Laniba Cv., Laniba	Culvert	2 BC (3 x 2)		596,804	824,486	Good	9.45	Tertiary Road	Newly constructed bridge by state government.	85.01	113.35	0.69	41.7	Inadequate	Adequate	Yes
		625	Batch 11				Onigbodogi, Sasa River, Ajibode Raod	Culvert	1 BC (2.2 x 2.48)	2.8	596,887	824,082	Good	9.45	Main Road	FLOODED OCASSIONALLY	85.01	113.35	0.69	18.6	Inadequate	Adequate	Yes
		626	Batch 11	1T			Onigbodogi, Apete River, Ola Adura Road	Culvert	3 BC (3 x 2)		596,985	824,082	Good	9.53	Tertiary Road	FLOODED OCASSIONALLY	85.01	113.35	0.69	62.6	Inadequate	Adequate	Yes
72H	ON10 Middle Ona	468	Batch 4				Onikoko	Footpath		1.4	595,725	826,064	Erosion	1.17	Tertiary Road		12.53	16.70	1.20	7.4	Inadequate	Inadequate	Yes
		470	Batch 4				Ilupeju	Footpath		1.67	595,922	826,016	Poor	1.34	Tertiary Road		13.80	18.40	1.20	23.5	Adequate	Inadequate	Yes
73	ON10	133	Batch 11	14T			Apete, Apete Birdge, Apete	Bridge	Br (3 Span 19.77)	4.5	596,659	823,241	Good	247.99	Main Road		508.61	678.15	0.20	680.6	Adequate	Adequate	No
73D	ON10 Middle Ona North	623	Batch 10				Oloya Apete, Jeje road	Natural Stream		0.8	595,858	824,011	Poor	1.13	Tertiary Road	Under Construction	12.23	16.30	0.75		Inadequate	Inadequate	Yes
		132	Batch 0	9D1	PIU 1st List	9	APETE , AWTAN ROAD	Culvert	1 BC (2.2 x 1.39)	1.77	596,314	823,519	Erosion	1.84	Main Road		17.48	23.30	0.75	8.8	Inadequate	Inadequate	Yes
		599	Batch 10	9D2	PIU 1st List	9	Iyanamorubo Apete, Iyanamorubo	Culvert	1 CC (2.8 dia) + BC (2.53 x 1.82)	2.16	596,373	823,353	Fair	1.97	Tertiary Road		18.53	24.70	0.75	55.3	Adequate	Inadequate	Yes
74	ON10 Middle Ona North	659	Batch 11	44D	PIU 1st List	44	Sango, Polytechnic road	Culvert	1 BC (2.45 x 2.48)	2.97	598,794	821,034	Good	1.21	Main Road		12.83	17.10	0.72	21.9	Adequate	Adequate	No
		676	Batch 11				Sango, Odugbemi Road	Footpath		1.48	598,574	820,978	Fair	1.63	Tertiary Road	The area is flooded during heavy rain	15.98	21.30	0.72	13.4	Inadequate	Inadequate	Yes
		657	Batch 11				Sango, Alenuloke Street	Culvert	2 BC (2.08 x 2.02)	2.41	598,435	820,995	Fair	1.71	Tertiary Road		16.58	22.10	0.72	26.8	Adequate	Inadequate	Yes
		1544	Batch 31				Eleyele, Elewure	Footpath		1.69	598,363	820,973	Fair	1.73	Tertiary Road		16.73	22.30	0.72	42.6	Adequate	Inadequate	Yes
		656	Batch 11				Sango, Idito road	Culvert	2 BC (2.47 x 2.05)	2.28	598,249	820,975	Good	1.81	Tertiary Road		17.33	23.10	0.72	34.3	Adequate	Adequate	No
		647	Batch 11				Alaro, Alaro road	Culvert	4 BC (1.54 x 1.9)	2.17	598,027	820,901	Good	2.20	Tertiary Road	Overflow into nearby shops during heavy rain	20.25	27.00	0.72	32.9	Adequate	Adequate	No
		137		18T			Sango-Eleyele road, Eleyele road,Ijokodo	Culvert	1 BC (2.45 x 2.45)	2.97	597,663	821,038	Fair	3.77	Main Road		32.03	42.70	0.72	21.6	Inadequate	Inadequate	Yes
		651	Batch 11				Polytechnic Ibadan, Ijokodo Estate Road, Ibadan Poly	Culvert	2 BC (1.68 x 2.2)	2.9	597,333	821,719	Good	4.50	Tertiary Road	Always flooded whenver there is rain. It need urgent attention	37.50	50.00	0.72	22.4	Inadequate	Adequate	Yes
74N	ON10 Middle Ona North	654	Batch 11				UI, Zik Road	Culvert	2 BC (1.88 x 1.24)	2.25	599,189	822,630	Good	1.53	Tertiary Road		15.23	20.30	0.80	12.7	Inadequate	Adequate	Yes
		1545	Batch 31				UI, Zoo	Culvert	1 BC (4 x 2)	2.6	598,764	822,808	Good	1.77	Tertiary Road		17.03	22.70	0.80	32.1	Adequate	Adequate	No
		1546	Batch 31				UI, Zoo	Culvert	1 BC (4 x 2)	2.6	598,709	822,811	Good	1.86	Tertiary Road		17.70	23.60	0.80	32.1	Adequate	Adequate	No
		653	Batch 11				UI, Tech Road	Culvert	2 BC (3.88 x 1.86)	3	598,659	822,845	Good	1.91	Tertiary Road		18.08	24.10	0.80	55.6	Adequate	Adequate	No
		652	Batch 11				Polytechnic Ibadan, Bookshop Road	Culvert	5 CC (1.25 dia)	2.3	597,289	822,529	Good	4.03	Tertiary Road	INTELT WAS BLOCKED WITH SIDEMENTS	33.98	45.30	0.80	14.8	Inadequate	Adequate	Yes
		135	Batch 0	16T			IJOKODO , APETE ROAD	Culvert	1 BC (2.97 x 1.66)	2.27	597,102	822,359	Good	4.21	Main Road		35.33	47.10	0.80	17.0	Inadequate	Adequate	Yes
75E	ON10 Middle Ona	611	Batch 10				Alakuta Idimango, Alakuta/Papa Ajisafe road	Culvert	2 CC (0.75 dia)	1.17	595,236	822,359	Fair	1.21	Tertiary Road		12.83	17.10	0.78	1.5	Inadequate	Inadequate	Yes

Structure Data																Structure Assessment							
Channel ID	Subbasin	Structure No.	Batch_ID	Alternative ID	PIU List	No in PIU List	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Stream Slope (%)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
79	ON11 Alapata South	458	Batch 4				Peace Estate, Peace Estate	Culvert	1 BC (3.25 x 1.89)	2.06	592,683	826,296	Good	28.16	Tertiary Road		207.53	276.70	0.70	21.4	Inadequate	Adequate	Yes
		459	Batch 4				Peace Estate, Peace Estate	Natural Stream		0.45	592,640	826,159	Fair	28.21	Tertiary Road		207.53	276.70	0.70	6.6	Inadequate	Inadequate	Yes
		460	Batch 4				Alapata, Alapa	Natural Stream		1.25	592,714	825,943	Fair	30.60	Tertiary Road		207.53	276.70	0.70	10.7	Inadequate	Inadequate	Yes
		476	Batch 4				Akowo Idi Osan, Odo Oteru, Akowo	Culvert	2 CC (0.7 dia) + BC (2.2 x 1.26)	1.56	593,122	825,244	Poor	32.63	Tertiary Road	there is a box culvert above the two ring measuring 1X1.5X1.15	207.53	276.70	0.70	8.6	Inadequate	Inadequate	Yes
		1507	Batch 31				Akowojo -Ijokodo, Akowojo, Lane H	Culvert	2 BC (2.78 x 1.78)	2.06	593,121	824,958	Fair	33.69	Tertiary Road		207.53	276.70	0.70	32.3	Inadequate	Inadequate	Yes
		472	Batch 4				Akowo Idi Osan, Odo Oteru, Akowo Idi Osan	Footpath		2.24	593,212	824,736	Poor	33.88	Tertiary Road		207.53	276.70	0.70	74.9	Inadequate	Inadequate	Yes
		473	Batch 4				Akufo, Odo Oteru, Akufo Road	Footpath		1.93	593,262	824,570	Poor	34.02	Tertiary Road		207.53	276.70	0.70	47.1	Inadequate	Inadequate	Yes
		594	Batch 10				Oke Odo Balogun Area, Oteru Stream, Akufo road	Culvert	1 BC (2.8 x 1.5)	2.11	593,427	824,082	Good	34.54	Secondary Road		207.53	276.70	0.70	12.8	Inadequate	Adequate	Yes
		598	Batch 10				Adeosun, Oteru Stream, Unity road	Culvert	1 CC (0.8 dia) + BC (1.2 x 1.2)	1.57	593,948	823,392	Poor	39.59	Secondary Road	For attention-People cannot pass during heavy rain	235.10	313.47	0.70	4.0	Inadequate	Inadequate	Yes
79B	ON11 Alapata South	Size Change	Batch 4											2.00			18.75	25.00	1.38				
79D	ON11	461	Batch 4	13T			Alapata, Akufo Road	Culvert	1 BC (1.8 x 1.21)	1.6	593,306	825,399	Poor	1.33	Main Road		13.73	18.30	1.09	6.8	Inadequate	Inadequate	Yes
79G	ON11	604	Batch 10				Alatare Zone C, Olonde Estate road	Footpath		0.55	591,787	823,673	Poor	1.71	Tertiary Road		16.58	22.10	0.88	17.5	Inadequate	Inadequate	Yes
79L	ON11 Alapata South	463	Batch 4				Adaba Co-operative	Culvert	1 BC (1.1 x 1.3)	1.55	594,473	824,959	Good	1.13	Tertiary Road	the curlvert here is under construction	12.23	16.30	0.88	3.5	Inadequate	Adequate	Yes
		1539	Batch 31				Happy people Community, Road 11	Culvert	2 CC (0.8 dia)	1	594,451	824,724	Good	1.27	Tertiary Road		13.28	17.70	0.88	1.9	Inadequate	Adequate	Yes
		609	Batch 10				Jeje Powerline, Unity Quarters Street	Footpath		1.34	594,553	824,473	Poor	1.56	Tertiary Road		15.45	20.60	0.88	18.6	Inadequate	Inadequate	Yes
		130	Batch 0				LIFEORTR ROAD	Culvert	1 BC (1.7 x 1.02)	2.56	594,465	823,788	Fair	2.31	Main Road		21.08	28.10	0.88	4.4	Inadequate	Inadequate	Yes
		131	Batch 0				LIFE FORTE	Footpath			594,289	823,387	Dilapidated	2.98	Tertiary Road	Footstep	26.10	34.80	0.88	25.7	Inadequate	Inadequate	Yes
81	ON12 Middle Ona West	593	Batch 9				Harmony Gold Estate Olounde, Lorikem College	Culvert	2 BC (1.8 x 1.4)	2.08	590,248	823,229	Good	1.71	Tertiary Road		16.58	22.10	0.83	14.5	Inadequate	Adequate	Yes
		592	Batch 9				Aba Agbopa Ologuneru, Ogunremi Road	Footpath		0.5	590,240	822,858	Poor	2.19	Tertiary Road	Allow people to pass even at heavy rainfall	20.18	26.90	0.83	12.7	Inadequate	Inadequate	Yes
		591	Batch 9				Ogunremi, Ogunremi Road	Footpath		1.75	590,164	822,589	Poor	2.30	Tertiary Road		21.00	28.00	0.83	9.3	Inadequate	Inadequate	Yes
		579	Batch 9				Alafara, Zone 2 Ayedade	Footpath		1.33	590,693	821,383	Poor	5.95	Tertiary Road		48.86	65.15	0.67	4.4	Inadequate	Inadequate	Yes
		580	Batch 9				Alafara, Alafara, Elenusonso Ido Road	Culvert	1 BC (2.5 x 1.8)	2.09	591,000	820,939	Good	8.01	Secondary Road		71.68	95.57	0.67	14.0	Inadequate	Adequate	Yes
		581	Batch 9				Alafara, Alafara, Off Elenusonso road	Natural Stream		0.9	591,116	820,588	Poor	8.46	Tertiary Road		71.68	95.57	0.67	23.0	Inadequate	Inadequate	Yes
		621	Batch 10				Abela near Shallom Christian College, Abela Stream, Agbofi Eti road	Culvert	2 CC (0.6 dia) + BC (0.8 x 1.35)	1.95	591,534	819,760	Good	10.36	Tertiary Road		149.94	199.92	0.67	2.8	Inadequate	Adequate	Yes
		741	Batch 16				Aba Asa- Iddo, Allahu Lateef, Aba Asa / Allahu Lateef road	Culvert	3 CC (0.76 dia)		591,658	818,936	Good	11.34	Tertiary Road		149.94	199.92	0.67	2.1	Inadequate	Adequate	Yes
		742	Batch 16				Ifelodun Community, Odo Ona, Road 12	Footpath		1.75	591,875	818,817	Poor	11.51	Tertiary Road		149.94	199.92	0.67	43.5	Inadequate	Inadequate	Yes
		743	Batch 16				Lasokun Araromi, Bokusoro, Lasokun Araromi	Culvert	2 BC (1.88 x 1.66)	1.91	592,576	818,152	Fair	12.17	Tertiary Road		149.94	199.92	0.67	17.3	Inadequate	Inadequate	Yes
		1	Batch 0				LASOKUN OLUBODE , OFF GBEKUBA,	Culvert	2 BC (3.05 x 1.54)	1.77	592,725	817,795	Good	12.47	Tertiary Road		149.94	199.92	0.67	28.8	Inadequate	Adequate	Yes
		744	Batch 16	38D2	PIU 1st List	38	Lasokun Gbakuba Apata, Ile omo olugbade, Ile omo olugbade street	Culvert	2 BC (1.43 x 0.9)	1.03	592,858	817,639	Poor	12.58	Tertiary Road		149.94	199.92	0.67	5.2	Inadequate	Inadequate	Yes
		2	Batch 0	38D1	PIU 1st List	38	OLUGBODE ESTATE , ALAFARA STREAM,	Culvert	2 CC (0.8 dia)	1.1	592,957	817,479	Good	12.65	Tertiary Road		149.94	199.92	0.67	1.6	Inadequate	Adequate	Yes
81F	ON12	1541	Batch 31				Ifesowapo Area	Natural Stream		0.8	589,744	822,250	Poor	2.29	Tertiary Road		20.93	27.90	0.75	4.2	Inadequate	Inadequate	Yes
81J	ON12 Middle Ona West	584	Batch 9				Itesiwaju estate-Ologuneru	Culvert	3 CC (0.77 dia)	1.7	590,880	821,958	Poor	1.05	Tertiary Road	For attention Tilted culvert	11.63	15.50	1.13	2.9	Inadequate	Inadequate	Yes
		583	81J-R3				Itesiwaju estate-Ologuneru, Alagutan road	Culvert	3 CC (0.77 dia)	1.4	590,834	821,783	Poor	1.13	Tertiary Road	For attention Tilted culvert	12.23	16.30	1.13	2.9	Inadequate	Inadequate	Yes
82	ON12 Middle Ona West	1117	Batch 15				Apata, All saint college road	Culvert	1 BC (1.5 x 1.43)	1.6	590,132	819,376	Fair	4.47	Tertiary Road		37.28	49.70	0.85	5.9	Inadequate	Inadequate	Yes
		1060	Batch 15				Apata, Behind NNPC, Behind NNPC	Culvert	2 BC (2.09 x 1.2)	1.45	590,712	818,449	Fair	6.39	Tertiary Road		63.84	85.12	0.56	11.6	Inadequate	Inadequate	Yes
		1061	Batch 15				Apata, Ekun odebe, Ekun odebe	Natural Stream		1.4	590,929	818,025	Poor	7.24	Tertiary Road		63.84	85.12	0.56	36.7	Inadequate	Inadequate	Yes
		6	Batch 0	30D	PIU 1st List	30	OLADELE NEW TOWN , GBEKUBA,	Culvert	2 BC (2.8 x 2.14)	2.38	591,398	817,720	Good	10.40	Tertiary Road		70.61	94.15	0.56	37.7	Inadequate	Adequate	Yes
		5	Batch 0				OLADELE NEW TOWN , GBEKUBA,	Natural Stream		1.7	591,726	817,610	Dilapidated	10.94	Tertiary Road		73.55	98.07	0.56	34.0	Inadequate	Inadequate	Yes
		4	Batch 0				OLADELE NEW IOWN , GBEKUBA APATA,	Natural Stream		1.76	591,931	817,473	Dilapidated	11.01	Tertiary Road		82.96	110.61	0.56	44.9	Inadequate	Inadequate	Yes
		3	Batch 0				ABA-ALFA GBEKUBA,	Culvert	1 BC (2.9 x 1.45)	1.75	592,293	817,379	Good	11.33	Tertiary Road		82.96	110.61	0.56	11.4	Inadequate	Adequate	Yes
		745	Batch 16				Gbekuba Apata, Bello Tade Layout, Bello Tade Layout	Culvert	2 BC (2.39 x 1.5)	1.9	592,707	817,244	Good	12.16	Tertiary Road	Overflow during heavy rain	90.01	120.01	0.56	18.8	Inadequate	Adequate	Yes
82E	ON12	1572	Batch 31				Ilori village, Biodun Obisesan Av	Culvert	1 CC (0.8 dia)	1	589,700	819,651	Fair	1.09	Tertiary Road		11.93	15.90	1.07	1.0	Inadequate	Inadequate	Yes
82J	ON12	1571	Batch 32				Isoka Area	Footpath		1.22	589,984	818,813	Poor	1.03	Tertiary Road		11.48	15.30	1.00	12.0	Inadequate	Inadequate	Yes
82M	ON12 Middle Ona West	1110 Prime	Batch 15				Apata, NNPC	Natural Stream		1.4	589,712	817,971	Poor	1.19	Tertiary Road		12.68	16.90	0.90	28.2	Adequate	Inadequate	Yes
		1119	Batch 15				Apata, NNPC	Natural Stream		1.6	590,428	817,633	Poor	1.65	Tertiary Road		16.13	21.50	0.90	25.6	Adequate	Inadequate	Yes
		1119 Prime	Batch 15				Apata, NNPC	Natural Stream		1.45	590,519	817,543	Fair	1.71	Tertiary Road		16.58	22.10	0.90	15.6	Inadequate	Inadequate	Yes
		1109	Batch 15				Apata, NNPC	Culvert	4 CC (0.75 dia) + BC (4.04 x 1.03)	1.52	590,566	817,397	Fair	2.17	Tertiary Road		20.03	26.70	0.90	16.0	Inadequate	Inadequate	Yes
		1118	Batch 15				Apata Area, Temidire	Culvert	1 BC (4.4 x 1.8)	2.1	590,595	817,404	Good	2.17	Tertiary Road		20.03	26.70	0.90	32.7	Adequate	Adequate	No
		9	Batch 0				ADEBISI LAYOUT , OPPOSITE NNPC	Natural Stream		1.5	590,735	817,468	Dilapidated	2.23	Tertiary Road		20.48	27.30	0.90	18.7	Inadequate	Inadequate	Yes
		8	Batch 0				ADEBISI LAYOUT	Natural Stream		1	590,902	817,509	Dilapidated	2.28	Tertiary Road		20.85	27.80	0.90	25.2	Inadequate	Inadequate	Yes
		7	Batch 0				ISOKAN , GBEKUBA	Culvert	2 BC (1.55 x 1.92)	2.56	591,057	817,596	Good	2.83	Tertiary Road		24.98	33.30	0.90	18.8	Inadequate	Adequate	Yes
80	ON13 Middle Ona South	138B					New Eleyele road, Eleyele Bridge, New Eleyele Road	Bridge	Br (2 Span 15.1)	5.2	594,089	819,802	Good	318.60	Main Road		551.57	735.43	0.15	304.7	Inadequate	Adequate	Yes
		145A	Batch 31				Nihort, Ona, Nihort	Culvert	2 BC (2.9 x 1.7)	2.32	593,038	818,818	Fair	326.30	Secondary Road		551.57	735.43	0.15	14.8	Inadequate	Inadequate	Yes
		734	Batch 16				Lasokun-Baskol, Odubanjo, Odubanjo	Bridge	Br (2 Span 11.03)	2.9	593,506	817,782	Good	327.65	Tertiary Road	The true height cannot be measured because the staff cannot reach the bottom of the river.Only the height to the water surface was measured.	551.57	735.43	0.15	104.3	Inadequate	Adequate	Yes

Structure Data																Structure Assessment							
Channel ID	Subbasin	Structure No.	Batch_ID	Alternative ID	PIU List	No in PIU List	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Stream Slope (%)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
80A	ON13	619	Batch 10				Oba Ado, Oba Ado / Idiosan road	Culvert	1 CC (1.9 dia)	1.03	593,838	821,449	Poor	1.34		Under construction	13.80	18.40	0.85	9.3	Inadequate	Inadequate	Yes
80B	ON13 Middle Ona South	601	Batch 10				Benjamin Eleyele, Adeleke Street	Culvert	2 BC (2.65 x 1.2)	1.5	595,913	819,955	Good	2.47	Tertiary Road	The area usually flooded with water	22.28	29.70	0.83	18.9	Inadequate	Adequate	Yes
		595	Batch 10				Babalegba Eleyele, Sango-Eleyele road	Culvert	1 BC (2.85 x 1.51)	4	595,759	820,119	Fair	2.55	Main Road		22.88	30.50	0.83	14.4	Inadequate	Inadequate	Yes
80B-3	ON13	602	Batch 10				Eleyele, Ladeti Street	Culvert	1 BC (2.47 x 1.24)	1.53	595,866	819,585	Good	1.01	Tertiary Road		11.33	15.10	0.95	9.7	Inadequate	Adequate	Yes
80K	ON13 Middle Ona South	1543	Batch 31				Elenusonso Iletuntun, Elufisayo Rd	Footpath		1.1	592,449	819,747	Poor	1.81	Tertiary Road		17.33	23.10	0.60	10.5	Inadequate	Inadequate	Yes
		624	Batch 10				Ologuneru, Off Nihort / Elenusonso road Behind Olu Ojelabi close	Natural Stream		0.82	592,558	819,605	Poor	1.92	Tertiary Road		18.15	24.20	0.60	7.6	Inadequate	Inadequate	Yes
80L	ON13 Middle Ona South	749	Batch 16				Eleyele, Police Barack	Culvert	3 CC (0.9 dia) + BC (1.8 x 1.45)	3	595,010	818,851	Fair	1.26	Tertiary Road		13.20	17.60	0.77	11.0	Inadequate	Inadequate	Yes
		751	Batch 16				NIHORT, Eleyele road	Culvert	1 BC (3.4 x 1.81)	3.6	593,803	819,030	Good	2.32	Tertiary Road		21.15	28.20	0.77	22.4	Inadequate	Adequate	Yes
80U	ON13	1540	Batch 31				Idi Isin Ajumose GRA, Ajumose GRA	Culvert	2 BC (1.98 x 1.54)	1.82	593,666	817,395	Good	1.49	Tertiary Road		14.93	19.90	1.50	25.1	Adequate	Adequate	No
83	ON14 Lower Ona North	735	Batch 16				Peku, Railway, Railway line	Bridge	Br (12.1m)	5.36	593,288	816,999	Good	354.77	Tertiary Road		551.57	735.43	0.21	224.0	Inadequate	Adequate	Yes
		139B	Batch 0	70D	PIU 2nd List	13	ODO-ONA GADA , APATA,	Culvert	2 BC (10.9 x 5)		593,529	816,144	Fair	356.98	Highway		551.57	735.43	0.21	424.0	Inadequate	Inadequate	Yes
		146B	Batch 22	22T			Oluyole Extension, Beside Zion House, Owodu road	Bridge	Br (3 Span 13.35)	3.7	594,035	814,096	Good	366.82	Secondary Road		551.57	735.43	0.21	342.8	Inadequate	Adequate	Yes
		147B	Batch 0	23T			OLUYOLE ESTATE ROAD,	Culvert	3 BC (3.08 x 3.16)	3.76	594,056	813,654	Fair	367.28	Main Road		563.60	751.47	0.21	67.0	Inadequate	Inadequate	Yes
		816	Batch 31	N1			Zartech, Ona, Zartech compound	Bridge	Br (13.4m)	4	594,258	812,882	Fair	372.32			563.60	751.47	0.21	172.4	Inadequate	Inadequate	Yes
83F	ON14 Lower Ona North	756	Batch 16				Kuole by Emmanuel Baptist Church, Railway line	Culvert	1 BC (2.4 x 2.06)	6	594,266	816,238	Good	2.92	Tertiary Road		25.65	34.20	0.88	18.4	Inadequate	Adequate	Yes
		757	Batch 16				Odo Ona Ayileka, Emmanuel Baptist Church	Culvert	2 BC (1.38 x 1.39)	1.6	594,105	816,228	Good	2.94	Tertiary Road		25.80	34.40	0.88	10.4	Inadequate	Adequate	Yes
		758	Batch 16				Odo Ona, Adeola Street	Culvert	2 BC (1.15 x 1.51)	1.67	593,967	816,082	Good	3.08	Tertiary Road		26.85	35.80	0.88	9.1	Inadequate	Adequate	Yes
		140					ODO-ONA OLUGBODE APATA	Culvert	1 BC (3.4 x 3.75)	4.32	593,882	815,959	Fair	3.27			28.28	37.70	0.88	65.2	Adequate	Inadequate	Yes
83G	ON14 Lower Ona North	774	Batch 16				Ago Taylor, Ring road	Culvert	1 BC (1.98 x 1.5)	6	594,783	815,519	Good	1.02	Main Road		11.40	15.20	1.58	12.4	Inadequate	Adequate	Yes
		775	Batch 16				Ago Taylor, Akinyemi way	Culvert	1 BC (1.5 x 1.23)	6	594,668	815,469	Good	1.30	Main Road		13.50	18.00	1.58	6.6	Inadequate	Adequate	Yes
		776	Batch 16				Odo Ona, Abdullahi Street	Culvert	1 BC (2 x 2.01)	2.5	594,332	815,415	Good	1.42	Tertiary Road		14.40	19.20	1.58	18.7	Adequate	Adequate	No
		777	Batch 16				Odo Ona, Off Fatimo Street	Culvert	1 BC (3.6 x 1.4)	1.64	594,085	815,318	Good	1.51	Tertiary Road		15.08	20.10	1.58	23.5	Adequate	Adequate	No
		778	Batch 16				Oke Ayo-Odo Ona, Fatimo Street	Culvert	1 BC (3.6 x 1.72)	2.1	594,035	815,300	Good	1.64	Tertiary Road	It overflowed once during the time a dam was opened	16.05	21.40	1.58	31.8	Adequate	Adequate	No
83H	ON14 Lower Ona North	780	Batch 16				Federal college of Animal health & Production Technology	Culvert	1 BC (1.5 x 1.24)	1.64	593,093	815,614	Good	1.12	Tertiary Road		12.15	16.20	1.27	6.0	Inadequate	Adequate	Yes
		771	Batch 16				Federal college of Animal health & Production Technology, IA & RT road	Culvert	2 CC (0.9 dia)	1.4	593,161	815,599	Good	1.14	Tertiary Road		12.30	16.40	1.27	3.1	Inadequate	Adequate	Yes
		770	Batch 16				Federal college of Animal health & Production Technology, Main gate road	Culvert	1 BC (2.9 x 1)	1.34	593,283	815,567	Good	1.19	Tertiary Road		12.68	16.90	1.27	9.9	Inadequate	Adequate	Yes
83M	ON14 Lower Ona North	154	Batch 0				OLUAWO ROAD	Culvert	2 BC (2.8 x 1.86)	2.26	595,774	814,343	Fair	2.24	Tertiary Road		20.55	27.40	0.85	38.2	Adequate	Inadequate	Yes
		360	Core 3				Jogor Centre	Culvert	2 BC (3 x 1.12)	2.36	595,686	814,267	Good	2.26	Tertiary Road		20.70	27.60	0.85	19.9	Inadequate	Adequate	Yes
		819	Batch 22				Ring Road	Culvert	3 CC (1.2 dia) + BC (1.55 x 1.26)	3.36	595,145	814,263	Fair	2.74	Main Road		24.30	32.40	0.85	18.6	Inadequate	Inadequate	Yes
		818	Batch 22				Oluyole Estate, 14 Avenue	Culvert	2 BC (3 x 2.92)	3.22	594,272	813,529	Fair	4.14	Tertiary Road		34.80	46.40	0.85	77.5	Adequate	Inadequate	Yes
84	ON15 Alaro	1289	Batch 21				OLU-OJO STRT,OFF IDI-AHUN	Natural Stream		0.43	588,898	813,617	Fair - Erosion	1.76	Local Road	Get flooded when it rains heavily	16.95	22.60	1.00		Inadequate	Inadequate	Yes
		1290		24D	PIU 1st List	24	ODEGBAMI LAYOUT, OLUYOLE EXT. ELEBU	Culvert	1 CC (0.8 dia)	0.85	589,151	813,650	Poor - Erosion	2.07	Local Road	Culvert need expansion,swamy and also get flooded when it rains	19.28	25.70	1.00	1.0	Inadequate	Inadequate	Yes
		1322					OKE-IBUNKUN ALONG,PIPELINE ELEBU	Culvert	3 CC (0.7 dia)	1.05	589,325	813,587	Fair - Erosion	2.21	Tertiary Road		20.33	27.10	1.00	2.1	Inadequate	Inadequate	Yes
		1291					IFELODUN, ABA- PANU,OFF DALE COLLEGE	Natural Stream		0.58	589,427	813,493	Fair	2.29	Tertiary Road	Get flooded when it rains heavily	20.93	27.90	1.00		Inadequate	Inadequate	Yes
		1298					IFELODUN, ABA- PANU	Culvert	1 CC (0.76 dia)	0.98	589,740	813,181	Fair	2.51	No Road	Get flooded when it rains heavily.	22.58	30.10	1.00	0.9	Inadequate	Inadequate	Yes
		1299	Batch 21	56D1	PIU 1st List	56	ORITA MERIN JUNCTION,OFF ELEBU, ODO ALAGBA, OLUYOLE EXTENSION, ELEBU	Natural Stream		0.47	589,990	813,220	Poor - Erosion	5.33	Secondary Road	Get flooded when it rains heavily.	44.90	59.86	0.73		Inadequate	Inadequate	Yes
		1300	Batch 21				OLADIPUPO GBOLAHAN STRT. ELEBU, ODO ALAGBA, LABUTA RD, ELEBU	Footpath		1.43	590,421	813,285	Poor - Erosion	5.70	Tertiary Road	Swampy area and its also get flooded.	44.90	59.86	0.73	29.7	Inadequate	Inadequate	Yes
		19	Batch 0				AKALA ROAD,	Culvert	1 BC (2.95 x 2.75)	3.3	591,432	813,598	Good	6.94	Main Road		51.80	69.07	0.73	32.4	Inadequate	Adequate	Yes
84D	ON15 Alaro	1293	Batch 21				JIM-ROCK BLOCK INDUSTRY RD, IDI-AHUN ELEBU	Natural Stream		0.24	588,693	812,781	Fair - Erosion	1.04	Tertiary Road	Stream level is expanding.	11.55	15.40	1.00		Inadequate	Inadequate	Yes
		1294		56D3	PIU 1st List	56	BESIDE MAXWELL MONTESSORI SCH, ALONG IDI-AHUN	Culvert	1 BC (2 x 1.4)	1.77	589,119	812,812	Good	1.74	Local Road		16.80	22.40	1.00	9.1	Inadequate	Adequate	Yes
		1295	Batch 21				ARoROMI ALONG IDI-AHUN	Culvert	1 BC (2.87 x 0.88)	1.16	589,199	812,828	Fair - Erosion	1.80	Tertiary Road	Culvert not in use, need filling and also swampy area.	17.25	23.00	1.00	7.2	Inadequate	Inadequate	Yes
		1296	Batch 21				BEFORE GETHSEMAN CHURCH,ORITA -MERIN	Culvert	1 BC (1.1 x 1.14)	1.34	589,562	813,013	Fair - Erosion	2.25	Tertiary Road		20.63	27.50	1.00	3.1	Inadequate	Inadequate	Yes
		1297		56D2	PIU 1st List	56	ARAROMI ALONG , IDI-AHUN ROAD	Culvert	1 CC (0.68 dia)	1.28	589,618	813,042	Fair	2.33	Secondary Road	Get flooded when it rains heavily.	21.23	28.30	1.00	0.7	Inadequate	Inadequate	Yes

Structure Data																Structure Assessment							
Channel ID	Subbasin	Structure No.	Batch_ID	Alternative ID	PIU List	No in PIU List	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Stream Slope (%)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
85	ON15 Alaro	1095	Batch 15				Apata	Culvert	1 BC (2.9 x 1.14)	1.45	587,694	815,254	Fair	1.03	Tertiary Road	Flooded the area during heavy rain	11.48	15.30	0.79	9.5	Inadequate	Inadequate	Yes
		1122	Batch 15				Apata	Culvert	2 CC (1.2 dia)	1.55	587,863	815,718	Fair	1.93	Tertiary Road		18.23	24.30	0.79	5.3	Inadequate	Inadequate	Yes
		1096	Batch 15				Bembo Area	Culvert	1 BC (1.6 x 1.53)	1.76	588,622	815,726	Fair	3.09	Tertiary Road	Heavy flooding during rain	26.93	35.90	0.79	6.8	Inadequate	Inadequate	Yes
		1097	Batch 15				Oloruntumo	Footpath		1.05	588,801	815,677	Poor	3.67	Tertiary Road		31.28	41.70	0.79	3.6	Inadequate	Inadequate	Yes
		1098	Batch 15				Olakunle	Natural Stream		1.4	588,930	815,673	Poor	3.78	Tertiary Road		32.10	42.80	0.79	16.1	Inadequate	Inadequate	Yes
		1573	Batch 31				Olorun Tumo Road	Natural Stream		1.3	589,020	815,700	Poor	3.86	Tertiary Road		32.70	43.60	0.79	18.9	Inadequate	Inadequate	Yes
		1099	Batch 15				Apata	Footpath		1.44	589,091	815,700	Poor	3.93	Tertiary Road	Overflow and the culvert is damaged	33.23	44.30	0.79	11.8	Inadequate	Inadequate	Yes
		1574	Batch 31				Olorun Tumo Road	Footpath		1.26	589,230	815,719	Poor	4.07	Tertiary Road		34.28	45.70	0.79	58.6	Adequate	Inadequate	Yes
		1121	Batch 15				Oloruntumo	Footpath		1.13	589,391	815,758	Poor	4.15	Tertiary Road		34.88	46.50	0.79	37.1	Inadequate	Inadequate	Yes
		1575	Batch 31				Olorun Tumo Road	Footpath		1.84	589,503	815,823	Poor	4.27	Tertiary Road		35.78	47.70	0.79	35.2	Inadequate	Inadequate	Yes
		1062	Batch 15				Apata	Culvert	2 BC (2.5 x 2.53)	2.78	589,572	815,877	Good	4.33	Tertiary Road		36.23	48.30	0.79	48.5	Adequate	Adequate	No
		1063	Batch 15				Apata, Alafia Estate, Alafia Estate	Culvert	1 BC (3.06 x 1.7)	2.04	589,973	815,979	Good	5.84	Tertiary Road	Overflow during heavy rain	60.13	80.17	0.60	15.8	Inadequate	Adequate	Yes
		1576	Batch 31				Onigele Apata, Apata, Onigele	Natural Stream		1.3	590,107	815,974	Poor	5.91	Tertiary Road		60.13	80.17	0.60	18.6	Inadequate	Inadequate	Yes
		1064	Batch 15	19D6	PIU 1st List	19	Iyana cele, Iyana cele, Off NNPC Road	Culvert	1 BC (1.6 x 1.58)	1.67	590,239	815,966	Fair	5.97	Main Road		60.13	80.17	0.60	6.2	Inadequate	Inadequate	Yes
		1577	Batch 31				Cele Road Apata, Cele Road	Footpath		1.75	590,327	815,943	Poor	5.97	Tertiary Road		60.13	80.17	0.60	21.4	Inadequate	Inadequate	Yes
		10	Batch 0				BEMBU ROAD , ABA-ALAMU,	Culvert	2 BC (2.4 x 1.84)	1.96	590,492	815,880	Fair	8.20	Main Road		60.13	80.17	0.60	26.0	Inadequate	Inadequate	Yes
		11	Batch 0				REPODUN , ALEXANDA AREA,	Natural Stream		2.5	590,579	815,669	Fair	8.57	Tertiary Road		87.07	116.09	0.60	44.3	Inadequate	Inadequate	Yes
		12	Batch 0				ILUPEJU , APATA,	Culvert	1 BC (2.85 x 1.8)	2.06	590,715	815,409	Fair	8.83	Tertiary Road		87.07	116.09	0.60	15.7	Inadequate	Inadequate	Yes
		1065	Batch 15				Kuola Apata, Chief Awopeju Ogumbe, Chief Awopeju Ogumbe Street	Natural Stream		1.6	590,804	814,866	Poor	12.05	Tertiary Road		105.11	140.15	0.60	45.7	Inadequate	Inadequate	Yes
		15	Batch 0				ABA ALADIE,	Culvert	2 BC (2.98 x 2.48)	2.68	590,967	814,563	Fair	12.30	Secondary Road		105.11	140.15	0.60	51.8	Inadequate	Inadequate	Yes
		16	Batch 0				SHARP CORNER , OLUYOLE ESTATE,	Culvert	1 BC (5.8 x 2.7)	2.85	591,152	814,281	Good	13.63	Tertiary Road		115.47	153.96	0.60	67.5	Inadequate	Adequate	Yes
		17	Batch 0				OLUYOLE ESTATE (ABA OLU ODE STATE),	Culvert	2 BC (3.08 x 2.97)	3.27	591,510	813,929	Good	13.98	Tertiary Road		115.47	153.96	0.60	69.1	Inadequate	Adequate	Yes
85F	ON15 Alaro	1080	Batch 15				Apata, Oloruntumo Road	Culvert	2 CC (0.8 dia)	1.24	589,487	816,059	Fair	1.24	Tertiary Road	Get flooded when it rains heavily	13.05	17.40	1.25	2.2	Inadequate	Inadequate	Yes
85G	ON15 Alaro	1086	Batch 15				Apata, Tanimowo road,behind Krisbvow International hotel	Culvert	1 BC (2.4 x 1.65)	1.75	589,948	816,634	Good	1.12		Overflow during heavy rain	12.15	16.20	1.00	14.4	Inadequate	Adequate	Yes
		19D5	PIU 1st List		PIU 1st List	19	APATA-PATE COMMUNITY	Natural Stream			590,061	816,393	No Structure	1.33	No Road	Houses are encroaching on the flood plain but there is no crossing road	13.73	18.30					
		19D4	PIU 1st List		PIU 1st List	19	APATA-PATE COMMUNITY	Natural Stream			590,097	816,328	No Structure	1.37	No Road	Houses are encroaching on the flood plain but there is no crossing road	14.03	18.70					
		19D3	PIU 1st List		PIU 1st List	19	APATA-PATE COMMUNITY	Natural Stream			590,174	816,290	No Structure	1.39	No Road	Houses are encroaching on the flood plain but there is no crossing road	14.18	18.90					
		19D2	PIU 1st List		PIU 1st List	19	APATA-PATE COMMUNITY	Natural Stream			590,187	816,245	No Structure	1.39	No Road	Houses are encroaching on the flood plain but there is no crossing road	14.18	18.90					
		1087		19D1	PIU 1st List	19	APATA-PATE COMMUNITY	Culvert	1 BC (1.6 x 1.65)	1.96	590,267	816,172	Inadequate	1.44	Secondary Road	Erosion downstream	14.55	19.40	1.00	8.5	Inadequate	Inadequate	Yes
		1088					Iyana cele, Prince Abayomi Oladeinde Street	Natural Stream		1.2	590,383	816,080	Poor	1.53		Collapsed Culvert	15.23	20.30	1.00	7.8	Inadequate	Inadequate	Yes
		1089					Aba Alamu Apata, Mosyln Royal International School Road	Culvert	1 BC (3.7 x 0.9)	1.2	590,429	815,973	Poor	2.12		Oveflow and some houses have been vacated around the area	19.65	26.20	1.00	9.9	Inadequate	Inadequate	Yes
85L	ON15 Alaro	1090	Batch 15				Kuola Apata, Aba Elesin	Culvert	1 BC (2.2 x 1.55)	1.72	589,527	814,724	Poor	1.32	Secondary Road		13.65	18.20	1.16	12.7	Inadequate	Inadequate	Yes
		1059	Batch 15				Kuola Apata,Jimoh Soyombo	Natural Stream		1.3	589,847	814,828	Poor	1.72	Tertiary Road		16.65	22.20	1.16	21.6	Adequate	Inadequate	Yes
		13		1D	PIU 1st List	1	APATA , PIPE LINE	Culvert	2 BC (2.43 x 1.95)	2.18	590,062	814,869	Good	1.91			18.08	24.10	1.16	39.8	Adequate	Adequate	No
		14	Batch 15				Kuola Apata, Off Confidence road	Natural Stream		1.81	590,188	814,915	Poor	2.02	Tertiary Road	Urgent attention.The road has been damaged since 4 years ago	18.90	25.20	1.16	40.3	Adequate	Inadequate	Yes
86	ON15 Alaro	18	Batch 0				OLUSOJI COMMUNITY,	Culvert	2 BC (3.04 x 3.22)	3.72	591,982	813,848	Good	21.24	Tertiary Road		160.79	214.39	0.47	66.9	Inadequate	Adequate	Yes
		20	Batch 0				ALARO AREA ONE COMMUNITY,	Culvert	2 BC (3.25 x 2.48)	3.03	592,467	813,420	Fair	22.69	Tertiary Road		160.79	214.39	0.47	51.3	Inadequate	Inadequate	Yes
		22	Batch 0	10D	PIU 1st List	10	ABULEX ROAD ELEWURE,	Culvert	3 BC (2.75 x 2.69)	3.3	592,789	813,119	Fair	24.89	Tertiary Road		181.62	242.16	0.47	69.0	Inadequate	Inadequate	Yes
		827	Batch 22				Oluyole Extension, Off Zartech road, Off Zartech road	Culvert	5 BC (1.75 x 1.7)	2.03	593,288	813,018	Good	25.69			181.62	242.16	0.47	34.1	Inadequate	Adequate	Yes
		23	Batch 0	22D	PIU 1st List	22	ZATECH ROAD METERS,	Culvert	1 BC (1.95 x 8.2)	2.5	593,589	812,694	Fair	25.96			199.40	265.87	0.47	54.9	Inadequate	Inadequate	Yes
86C	ON15 Alaro	25	Batch 0				AKURU SECOND BORE HOLE	Natural Stream		1.3	591,753	812,727	Erosion	1.17	Tertiary Road		12.53	16.70	1.27	20.8	Adequate	Inadequate	Yes
		825	Batch 22				Akuru, By Ishola Alarape close	Culvert	2 CC (0.6 dia)	0.7	592,199	812,901	Poor	1.40	Tertiary Road	The area is flooded during heavy rain	14.25	19.00	1.27	1.1	Inadequate	Inadequate	Yes
		21	Batch 0				AKURU EXPRESS ROAD	Culvert	1 BC (3.4 x 2.85)	3.45	592,348	812,957	Dilapidated	1.85	Main Road		17.63	23.50	1.27	54.2	Adequate	Inadequate	Yes
		1570	Batch 31				Cherry Lane	Natural Stream		1.4	592,551	813,090	Poor	1.95	Tertiary Road		18.38	24.50	1.27	18.4	Inadequate	Inadequate	Yes
86G	ON15 Alaro	24	Batch 0					Culvert	2 BC (2.7 x 3.03)	3.43	593,340	812,253	Erosion	1.15	Main Road		12.38	16.50	1.52	94.6	Adequate	Inadequate	Yes
		1568	Batch 31				Oke Alaro Orelope Community, Oke Alaro Street	Culvert	2 BC (1.76 x 1.29)	1.8	593,503	812,311	Poor	1.22	Tertiary Road		12.90	17.20	1.52	17.0	Adequate	Inadequate	Yes
		829	Batch 22				Orelope Community, Lane 17	Natural Stream		1	593,577	812,328	Poor	1.27	Tertiary Road		13.28	17.70	1.52	15.7	Inadequate	Inadequate	Yes
		830	Batch 22				Orelope Community-Oluyole, Zartech road	Culvert	1 BC (1.77 x 0.88)	1.2	593,656	812,411	Fair	1.33	Tertiary Road		13.73	18.30	1.52	5.0	Inadequate	Inadequate	Yes

Structure Data																Structure Assessment							
Channel ID	Subbasin	Structure No.	Batch_ID	Alternative ID	PIU List	No in PIU List	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Stream Slope (%)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
89	ON16 Agara Kasumu	1304	Batch 21				BESIDE DANGOTE CEMENT DEPORT,ALAAKA IBUDO EST	Culvert	2 BC (1.265 x 1.1)	1.3	589,589	811,449	Fair	2.58	Tertiary Road	Outlet block, not accessible.	23.10	30.80	0.84	6.6	Inadequate	Inadequate	Yes
		1306	Batch 21				FEDERAL HOUSING EST. AREA,ALONG HALLELUYAH HOUSE	Natural Stream		0.13	590,196	811,187	Fair	4.77	Secondary Road	Swampy area, get flooded when it rains	39.53	52.70	0.84		Inadequate	Inadequate	Yes
		1308	Batch 21				AREA 1, BOTA EST LIBERTY ACADEMY	Culvert	1 CC (0.6 dia)	1.36	590,445	810,941	Fair - Erosion	4.77	Tertiary Road	Get flooded when it rains heavily	39.53	52.70	0.84	0.4	Inadequate	Inadequate	Yes
		1309	Batch 21				OFF JANEADEY WAY, FEDERAL LOW COST AREA, ODO LOW COST, BOTA ROAD, ODO-ONA ELEWE	Natural Stream		0.36	590,575	810,839	Fair - Erosion	5.32	Tertiary Road	Get flooded when it rains heavily	56.69	75.59	0.60		Inadequate	Inadequate	Yes
		1310	Batch 21				BESIDE ST.ANNE'S COMPREHENSIVE COLLEGE, ODO ST.ANNE'S, ODEKU, IDI-IROKO ODO-ONA ELEWE	Culvert	1 BC (2.5 x 1.87)	2	590,834	810,509	Fair	5.91	Secondary Road	Inlet not accessible.	56.69	75.59	0.60	14.0	Inadequate	Inadequate	Yes
		1311	Batch 21				BESIDE ILE AANU-MAJEMU,BEHIND ST.ANNE COMPREHENSIVE COLLEGE, ODO BESIDE ILE MAJEMU CHURCH, FEDERAL HOUSING RD ALONG IDI-IROKO	Culvert	2 CC (1.2 dia)	1.72	590,956	810,432	Fair - Erosion	5.95		Swampy area. Get floode when it rains heavily	56.69	75.59	0.60	4.6	Inadequate	Inadequate	Yes
		1318	Batch 21				ALONG TOM-TIN BLOCK INDUSTRY, ODEKU VILLAGE, ODO OLUWAWE,ODEKU, ODO-ONA ELEWE, ACADEMY.	Natural Stream		0.8	591,199	810,367	Fair - Erosion	8.85	Tertiary Road	Swampy area, get flooded when it rains heavily	73.51	98.01	0.60		Inadequate	Inadequate	Yes
		1319	Batch 21				ALONG GOSPEL INT. CHURCH, ODEKU VILLAGE, ODO ODEKU, ODO-ONA ELEWE, ACADEMY.	Culvert	2 CC (1.3 dia)	1.55	591,354	810,428	Fair - Erosion	9.02	Tertiary Road	Stream level is expanding.	73.51	98.01	0.60	5.7	Inadequate	Inadequate	Yes
		1320	Batch 21				KOGUO AREA, ALONG IDI-IROKO, ODO ODEKU, IDI-IROKO,ODO-ONA ELEWE	Footpath		0.8	591,500	810,521	Poor - Erosion	9.17	Tertiary Road	Pedestrian passade is bad and stream level is expanding.	73.51	98.01	0.60		Inadequate	Inadequate	Yes
		862	Batch 22				Oke Odo-Bola, Eri-Kalofih, Eri-Kalofih Street	Culvert	2 BC (2.15 x 1.3)	1.5	591,963	810,538	Good	10.51	Tertiary Road		108.34	144.45	0.60	13.9	Inadequate	Adequate	Yes
		856	Batch 22				Odo Ona -Bola, Open heaven, Open heaven Avenue	Culvert	2 BC (2.68 x 2.45)	2.76	592,058	810,458	Good	10.58	Tertiary Road		108.34	144.45	0.60	44.4	Inadequate	Adequate	Yes
		857	Batch 22				Oke Odo-Bola, Ogunse, Ogunse road	Footpath		1.2	592,266	810,414	Poor	10.70	Tertiary Road	For Attention	108.34	144.45	0.60	93.4	Inadequate	Inadequate	Yes
		858	Batch 22				Isale Olosan, Ifesowapo, Ifesowapo road	Footpath		0.8	592,646	810,309	Poor	11.48	Tertiary Road	The area is usually flooded during heavy rain	108.34	144.45	0.60	30.7	Inadequate	Inadequate	Yes
		30	Batch 0	45D2	PIU 1st List	45	ASIPA ROAD,	Culvert	2 BC (3.78 x 2.15)	2.45	593,434	809,962	Fair	13.46	Tertiary Road		108.34	144.45	0.60	57.5	Inadequate	Inadequate	Yes
		31	Batch 0	58D	PIU 2nd List	1	DALUTE,	Culvert	3 BC (3 x 2)	2.5	594,212	809,654	Good	14.48	Secondary Road		108.34	144.45	0.60	58.2	Inadequate	Adequate	Yes
		1214	Batch 28				KASUMU, AGARA KASUMU, ZONE B	Footpath		1.1	594,675	809,438	Poor	14.99	Tertiary Road	FLOODED ALWAYS	108.34	144.45	0.60	11.7	Inadequate	Inadequate	Yes
89L	ON16 Agara Kasumu	1312	Batch 21				OFF ALALADE FAMILY RD,BOTA EST AREA	Culvert	2 CC (0.7 dia)	1.3	589,785	809,957	Fair - Erosion	1.16	Tertiary Road	Outlet not accessible, blocked with bush and sand	12.45	16.60	0.97	1.4	Inadequate	Inadequate	Yes
		1313	Batch 21				BESIDE JIMI BLOCK INDUSTRY AREA, NNPC PIPELINE	Natural Stream		0.16	590,346	809,795	Fair - Erosion	1.87	Secondary Road	Swampy area, stream is expanding also get flooded when it rains	17.78	23.70	0.97		Inadequate	Inadequate	Yes
		1316	Batch 21				ESTATE EXTENSION, LANE 6 PIPELINE AREA	Natural Stream		0.42	590,609	809,832	Fair - Erosion	2.00	Tertiary Road	Swampy area, get flooded when it rains heavily	18.75	25.00	0.97		Inadequate	Inadequate	Yes
		1317	Batch 21				BEHIND ILE AANU-MAJEMU,BEHIND ST.ANNE COMPREHENSIVE COLLEGE	Culvert	2 CC (0.76 dia)	0.84	591,011	810,332	Fair - Erosion	2.72	Tertiary Road	Swampy area, get flooded when it rains heavily	24.15	32.20	0.97	1.7	Inadequate	Inadequate	Yes
89M	ON16 Agara	854					Bola Estate, Idi-Iroko road	Culvert	2 CC (0.85 dia)	1.29	591,807	810,701	Good	1.07			11.78	15.70	0.89	2.2	Inadequate	Adequate	Yes
87	ON17 Lower Ona East	870	Batch 23				CHALLENGE, RING ROAD	Culvert	2 BC (1.48 x 1.24)	6.5	596,761	812,580	Good	1.63	Main Road		15.98	21.30	0.75	9.0	Inadequate	Adequate	Yes
		1567	Batch 31				Oluyole, Abiodun Tomori Avenue	Footpath		2.66	596,599	812,526	Poor	1.72	Tertiary Road		16.65	22.20	0.75	76.9	Adequate	Inadequate	Yes
		839	Batch 22				Elewura Challenge	Culvert	2 BC (1.84 x 1.6)	1.9	596,362	812,507	Fair	1.81	Tertiary Road	Needs urgent attention its excessive overflow has drown two pupils during a particular heavy rainfall	17.33	23.10	0.75	17.0	Inadequate	Inadequate	Yes
		1566	Batch 31				Kola Oyewuwo Street, Road 5	Footpath		1.3	596,073	812,237	Poor	3.58	Tertiary Road		30.60	40.80	0.75	73.4	Adequate	Inadequate	Yes
		1560	Batch 31				Oke Odo Titun, Road 4	Natural Stream		2.4	596,075	812,056	Poor	3.66	Tertiary Road		31.20	41.60	0.75	98.1	Adequate	Inadequate	Yes
		842	Batch 22				Orita Challenge, Oladapo Adesanya Street	Culvert	2 BC (2.84 x 2.95)	3.28	596,002	811,864	Good	4.68	Tertiary Road		38.85	51.80	0.75	68.7	Adequate	Adequate	No
87E	ON17 Lower Ona East	836	Batch 22				Challenge ring road, Bolumole Street	Natural Stream		1.5	596,074	812,675	Poor	1.48	Tertiary Road	Overflow during heavy rain	14.85	19.80	1.10	34.6	Adequate	Inadequate	Yes
		837	Batch 22				Challenge ring road ,Popoola Street	Culvert	1 BC (4.8 x 1.98)	2.38	596,095	812,606	Fair	1.52	Tertiary Road		15.15	20.20	1.10	46.2	Adequate	Inadequate	Yes
		838	Batch 22				Fodacis Area ring road,	Footpath		1.96	596,110	812,462	Poor	1.56	Tertiary Road		15.45	20.60	1.10	176.6	Adequate	Inadequate	Yes
88	ON17 Lower Ona East	148B	Batch 0	24T			ODO-ONA ELEWE,	Culvert	2 BC (8.95 x 2.87)	3.47	594,751	811,112	Fair	408.68	Tertiary Road		564.70	752.93	0.21	147.3	Inadequate	Inadequate	Yes
		149B	Batch 22	25T			New Garage, Agara river, Akala road	Bridge	Br (2 Span 10.2)	4.67	595,014	810,452	Good	411.75	Main Road		574.26	765.68	0.21	192.5	Inadequate	Adequate	Yes
		1584	Batch 31				Akala, Ona River, Akala				595,102	810,265	Erosion	413.34	Tertiary Road	We could not take measurement due to water level	574.26	765.68					
		1215	Batch 28				OPERE, ODO ONA, ROAD 1, ZONE 2	Natural Stream		1.7	595,086	809,340	Poor	415.18	Tertiary Road	FLOODED ALWAYS	574.26	765.68	0.21		Inadequate	Inadequate	Yes
88D	ON17 Lower Ona East	843	Batch 22				Orita Challenge, Ogundipe Street	Culvert	2 BC (1.5 x 1.55)	1.8	596,361	810,804	Good	1.25	Tertiary Road	Flooded the area and created another path way beside the culvet	13.13	17.50	0.94	13.9	Inadequate	Adequate	Yes
		844	Batch 22				Orita Challenge, Old lagos road	Culvert	2 CC (1.2 dia) + BC (3.05 x 1.92)	2.6	595,989	810,772	Good	1.59	Highway		15.68	20.90	0.94	29.1	Adequate	Adequate	No
		847	Batch 22				New Garage, Itesiwaju road	Culvert	2 BC (1.3 x 1.78)	2.24	595,282	810,561	Fair	2.52	Tertiary Road	Overflow during heavy rainfall	22.65	30.20	0.94	13.7	Inadequate	Inadequate	Yes
88E	ON17 Lower Ona East	1565	Batch 31				Iyana Agara, Zone 4	Culvert	1 BC (4.8 x 1.55)	1.95	594,721	810,483	Good	1.39	Tertiary Road		14.18	18.90	0.77	26.8	Adequate	Adequate	No
		29	Batch 0	17D2	PIU 1st List	17	AGARRA ODO-EJA	Culvert	1 BC (1.85 x 0.9)	0.9	594,799	810,477	Fair	1.43	Tertiary Road		14.48	19.30	0.77	3.9	Inadequate	Inadequate	Yes
		1585	Batch 31	17D1	PIU 1st List	17	Akala Road, Omotosho Akanji Estate	Natural Stream		1.77	594,876	810,487	Fair	1.46	Tertiary Road		14.70	19.60	0.77	5.9	Inadequate	Inadequate	Yes

Structure Data																Structure Assessment							
Channel ID	Subbasin	Structure No.	Batch_ID	Alternative ID	PIU List	No in PIU List	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Stream Slope (%)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
88G	ON17 Lower	1186	Batch 28				OPERE/OLOGEDE, OFF ALHAJI ADEEYO STR.	Footpath		2.09	595,433	809,510	Fair	1.09	Tertiary Road		11.93	15.90	2.09	126.6	Adequate	Inadequate	Yes
		1185	Batch 28				ONIPON COMMUNITY, ODO ONA, OFF AYODELE ALAKIU ST.	Bridge	Br (11.7m)	7.84	595,239	808,352	Fair	431.99	Tertiary Road	FLOODED ALWAYS	599.84	799.79	0.11	248.0	Inadequate	Inadequate	Yes
91	ON18 Lower Ona South	1216	Batch 28	33D	PIU 1st List	33	ABA IBEJI, ODO ONA RIVER, IYANA COLLEGE	Natural Stream			595,318	807,403	Poor	447.34	Tertiary Road	NOT MEASURABLE FLOODED ALWAYS	599.84	799.79	0.11		Inadequate	Inadequate	Yes
		150B	Batch 28	26T			ODO ONA KEKERE, ODO ONA RIVER, OLD LAGOS ROAD	Bridge	Br (2 Span 13)		595,479	806,271	Fair	452.22	Highway	FLOODED ALWAYS	603.38	804.51	0.11		Inadequate	Inadequate	Yes
		1196	Batch 28				AKERELE, ODO ONA, OLD LAGOS ROAD	Bridge	Br (2 Span 13.85)	3.28	595,491	806,158	Fair	452.28	Tertiary Road	FLOODED	603.38	804.51	0.11	116.1	Inadequate	Inadequate	No
		151B	Batch 28				LAGOS/IBADAN EXPRESS WAY, ODO ONA RIVER, GURU AREA	Bridge	Br (23.7m)		595,581	805,840	Good	452.73	Expressway		603.38	804.51	0.11		Inadequate	Adequate	Yes
		1204	Batch 28				ABAMBA AREA, ABORE STR.	Culvert	1 CC (0.62 dia)	1.22	593,715	806,644	Poor	1.83	Tertiary Road	FLOODED ALWAYS	17.48	23.30	0.93	0.5	Inadequate	Inadequate	Yes
		129	Batch 0				SIMISOLA FARM	Culvert	3 CC (0.75 dia)	1.54	593,864	806,681	Dilapidated	2.10	Secondary Road		19.50	26.00	0.93	2.4	Inadequate	Inadequate	Yes
		1203	Batch 28				ARAPAJA, ALAFIA ESTATE RD.	Culvert	2 CC (0.8 dia)	0.98	594,168	806,769	Poor	2.58	Tertiary Road	FLOODED ALWAYS	23.10	30.80	0.93	1.9	Inadequate	Inadequate	Yes
91H	ON18 Lower Ona South	1202	Batch 28				ARAPAJA/ODO ONA KEKERE, ORISUNBARE STREET	Culvert	6 CC (0.77 dia)	2.28	594,289	806,790	Poor	2.71	Tertiary Road	UNDER CONSTRUCTION,FLOODED OCCASSIONALLY	24.08	32.10	0.93	5.2	Inadequate	Inadequate	Yes
		1201	Batch 28				ARAPAJA, LOVE STREET	Culvert	1 CC (0.76 dia)	0.92	594,381	806,747	Poor	2.77	Tertiary Road	FLOODED ALWAYS	24.53	32.70	0.93	0.8	Inadequate	Inadequate	Yes
		1200	Batch 28				RAINBOW ESTATE, RAINBOW RD.	Natural Stream		1	594,611	806,691	Poor	2.98	Tertiary Road	FLOODED ALWAYS	26.10	34.80	0.93	9.4	Inadequate	Inadequate	Yes
		1199	Batch 28				RAINBOW ESTATE, RAINBOW RD.	Culvert	1 CC (0.96 dia) + BC (1.79 x 2)	2.23	594,630	806,701	Poor	3.07	Tertiary Road	IT CONTAIN BOYH RING AND CURVET, FLOODED ALWAYS	26.78	35.70	0.93	13.9	Inadequate	Inadequate	Yes
		1198	Batch 28				ABA IBEJI, ORE OFE ROAD	Culvert	1 BC (3 x 2.6)	2.9	595,090	806,641	Fair	3.35	Tertiary Road		28.88	38.50	0.93	34.7	Inadequate	Inadequate	Yes
		1324	Batch 27				AYEGUN, AMULETIGBO ROAD	Natural Stream		0.28	589,505	808,607		0.99	Tertiary Road	Gets Flooded when it rains heavily	11.18	14.90	0.87		Inadequate	Inadequate	Yes
		1325	Batch 27				AYEGUN OLEYO, LAFIAJI ROAD	Culvert	1 BC (1.8 x 1.78)	2.35	589,638	808,504	Fair	1.27	Tertiary Road	Inlet and outlet covered with bushes	13.28	17.70	0.87	10.3	Inadequate	Inadequate	Yes
		1329	Batch 27				OGO-OLUWA AYEGUN, AYEGUN ROAD	Culvert	1 BC (2 x 1.28)	1.5	589,948	808,361	Good	1.52	Tertiary Road	Newly constructed by community	15.15	20.20	0.87	7.5	Inadequate	Adequate	Yes
		1330	Batch 27				ABADA, ABADA ROAD	Natural Stream		0.12	590,671	807,851	Poor	3.67	Secondary Road	Marshy, Gets flooded when it rains heavily	31.28	41.70	0.87		Inadequate	Inadequate	Yes
90	ON19 Lower Ona West	1333	Batch 27	60D	PIU 2nd List	3	ABADA, ABADA ROAD	Natural Stream		0.35	590,935	807,812	Fair	4.32	Tertiary Road	Gets flooded when it rains heavily	36.15	48.20	0.87		Inadequate	Inadequate	Yes
		1180	Batch 28				ASUNLE AREA, ASUNLE CHANEL, OFF CHURCH CLOSE STREET	Culvert	1 BC (2.43 x 1.38)	1.66	592,597	808,085	Fair	10.03	Secondary Road	FLOODED ALWAYS	101.28	135.04	0.51	8.1	Inadequate	Inadequate	Yes
		32					Regent Estate/14 Acres, Asunle Cv., Atere/Ilugusi	Culvert	1 BC (1.96 x 1.2)	1.74	593,704	808,186	Fair	11.92	Tertiary Road	Heavily flooded with rainfall,and over tops culvert.	101.28	135.04	0.51	5.1	Inadequate	Inadequate	Yes
		1181	Batch 28				KASUMU/ABA IBEJI, KASUMU CHANNEL, KASUMU	Culvert	1 CC (1.2 dia)	1.38	594,531	808,188	Poor	13.12	Tertiary Road	FLOODED ALWAYS	127.25	169.67	0.51	2.1	Inadequate	Inadequate	Yes
		1182	Batch 28				ONIPON/ABA IBEJI, ONIKIN RIVER, ONIPON ESTATE RD.	Culvert	1 CC (1.4 dia)	1.7	595,051	808,000	Poor	13.50	Tertiary Road	NEED URGENT ATTENTION, FLOODED ALWAYS	127.25	169.67	0.51	3.2	Inadequate	Inadequate	Yes

Annex

9

Sizing of Channels and Crossing Structures lying on Proposed Channels

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Overview

The drainage masterplan includes the proposed structural measures such as channels, dikes, dams and crossing structures (roads with waterways). Figure 1.2 presents the Drainage Masterplan with 69 proposed main systems and their associative sub-systems making a total of 188 systems, the figure also includes the existing system dimensions of Middle Ogunpa (System 2). The next sections present the design of the above systems (proposed channels and crossing structures) and the basis for their design. In addition, a tabularized form for the design of the proposed channels in the drainage masterplan, with structures lying on it, is presented in the tables at the end.

The proposed channel sizes are also presented on a larger map divided into 2 part plans (a northern part and a southern part), refer to Figure 1.3 and Figure 1.4. While, all channelized rivers and tributaries are presented in part plans in Volume 3 with a scale of 1: 10,000.

1 Proposed Channels

As mentioned above, there are 188 systems comprising of Rivers and Tributaries that are proposed for channelization. These channels lie in different areas in Ibadan. In order to organize the design in coherent way; each group of channels are gathered in a specified subbasin. In addition, each channel is divided into a set of reaches. New reaches are identified when there is either a change in the size dimensions, a crossing structure dividing the channel or a change in the system numbering. In other words, only one structure is located on a single reach. However, it is not necessarily that a reach includes a crossing structure.

Figure 1.1 presents an example for the channelization of Yemetu Stream or Upper Kudeti (System 3), the systems is divided into reaches 3-R1, 3-R2, 3-R3,…etc. A crossing structure lies on their reaches such as structures no: 279, 278 and 96. The existing and proposed dimensions of crossing structures are also presented. This data is also copied to the GIS geodatabase.

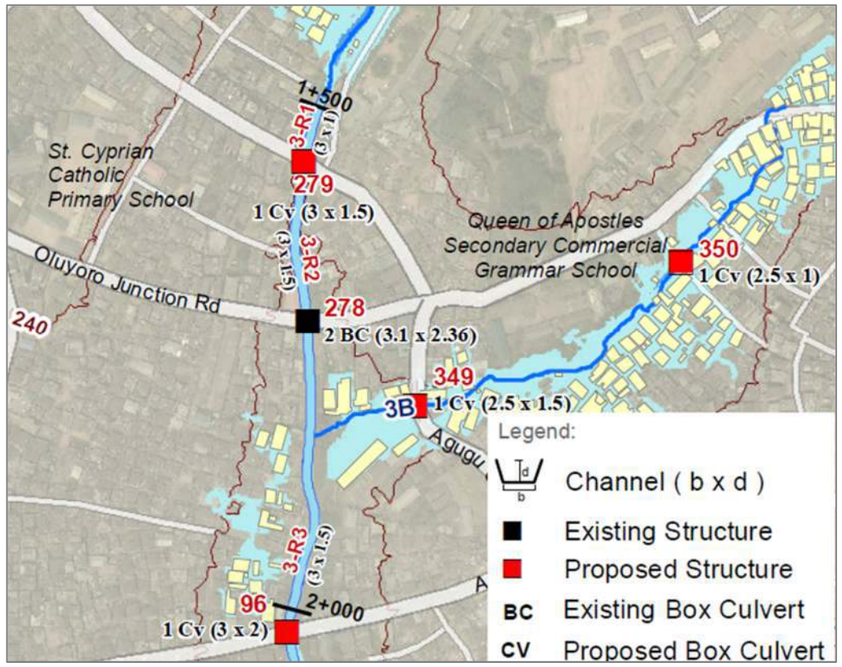

Figure 1.1: Reaches and Crossing Structures

1.1 Design Basis

Channels are designed based on the following:

a- Channels are sized according to the application of Manning's formula for open channels. The design is prepared using a hydraulic model (FlowMaster) and checked by another hydraulic model (SAA).

b- Channels and their associative crossing structures are designed altogether. The design basis of crossing structures is illustrated in Section 0.

c- Channels are designed with trapezoidal shaped sections having side slopes of 2H:1V.

d- The design longitudinal slopes are proposed to match the natural ground slope as much as possible to minimize earthworks.

e- The channel is proposed to be excavated/dredged by an average of 0.5m to ensure that the size of the channel is fitted and the channel may convey the flow within the proposed cross-section.

f- The design flow is extracted from the rainfall-runoff model (HEC-HMS)

g- The design flow is based on a specified design return period, the design return period depends on the catchment area of the channel

- Channels having a catchment area < 50 km^2 are designed to accommodate a flow of 50-years return period and checked for the 100-year return period.
- Channels having a catchment area > 50 km^2 are designed in their structural section to accommodate a flow of 25-years return period. On the other hand, the system is designed

to accommodate the 100-year return period within both the channel (structural section) and the flood fringe (the non-structural section).

h- Concrete lining protection is proposed for channels such that:

- Channels having a catchment area < 25 km^2 are proposed to be completely lined (bed and side slopes protection), manning roughness coefficient is taken as 0.017.
- Channels having a catchment area > 25 km^2 are proposed to be partially lined (side slopes protection only), manning roughness coefficient is taken as 0.027.

1.2 Design of the Pilot System (Part 1 - Channels)

This section investigates the 1st part of the design methodology which is the channel design of the selected pilot system; System no. 32 (Egberi Stream). System 32 has a total length of 8.27km, the natural slope varies along the stream from 0.8% to 0.6%. The catchment area of this stream is around 19.9 km^2 with a 100-year flow of 171.9 m^3/s.

The stream passes through a dense urban area in Upper Omi West. The proposed channelization begins from station 1+454 where the catchment area of the stream reaches around 1km^2. Channelization of the stream ends at station no. 8+277 with a total length of around 6.8km and a catchment area of 19.9 km^2.

The channel is designed as a trapezoidal section with concrete lining protection in the bed and side slopes 2H:1V and with a Manning's roughness coefficient (n=0.017). The channel is designed to convey the total flow within its structural section.

The sizes of the channel vary from (bed width =3.5m x depth=1m) to (16m x 2m) respectively. The longitudinal slope is designed similar to the natural slope averaging from 0.8% to 0.6%.

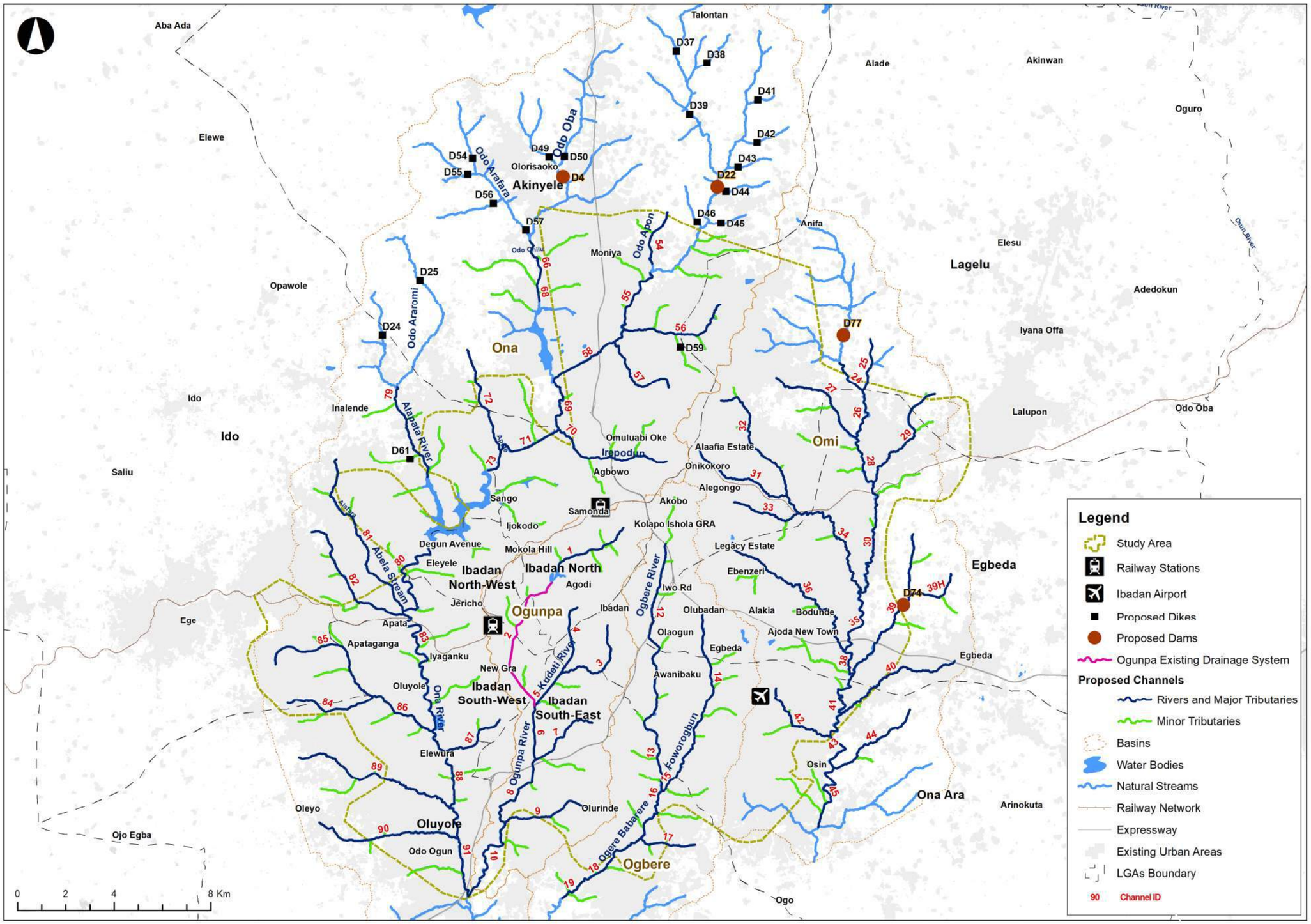

Figure 1.2: Drainage Masterplan (General Figure)

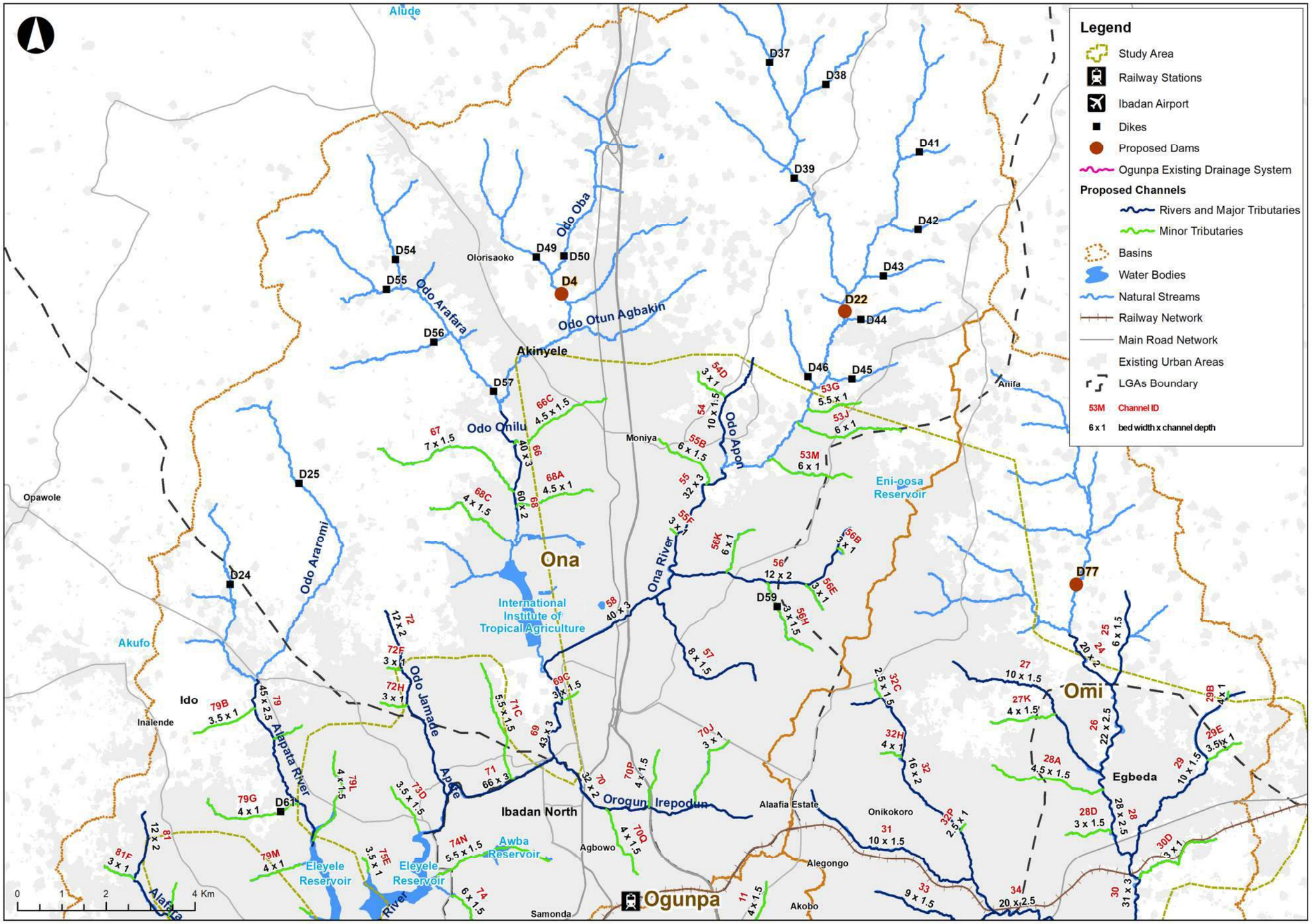

Figure 1.3: Drainage Masterplan – Northern Part Plan

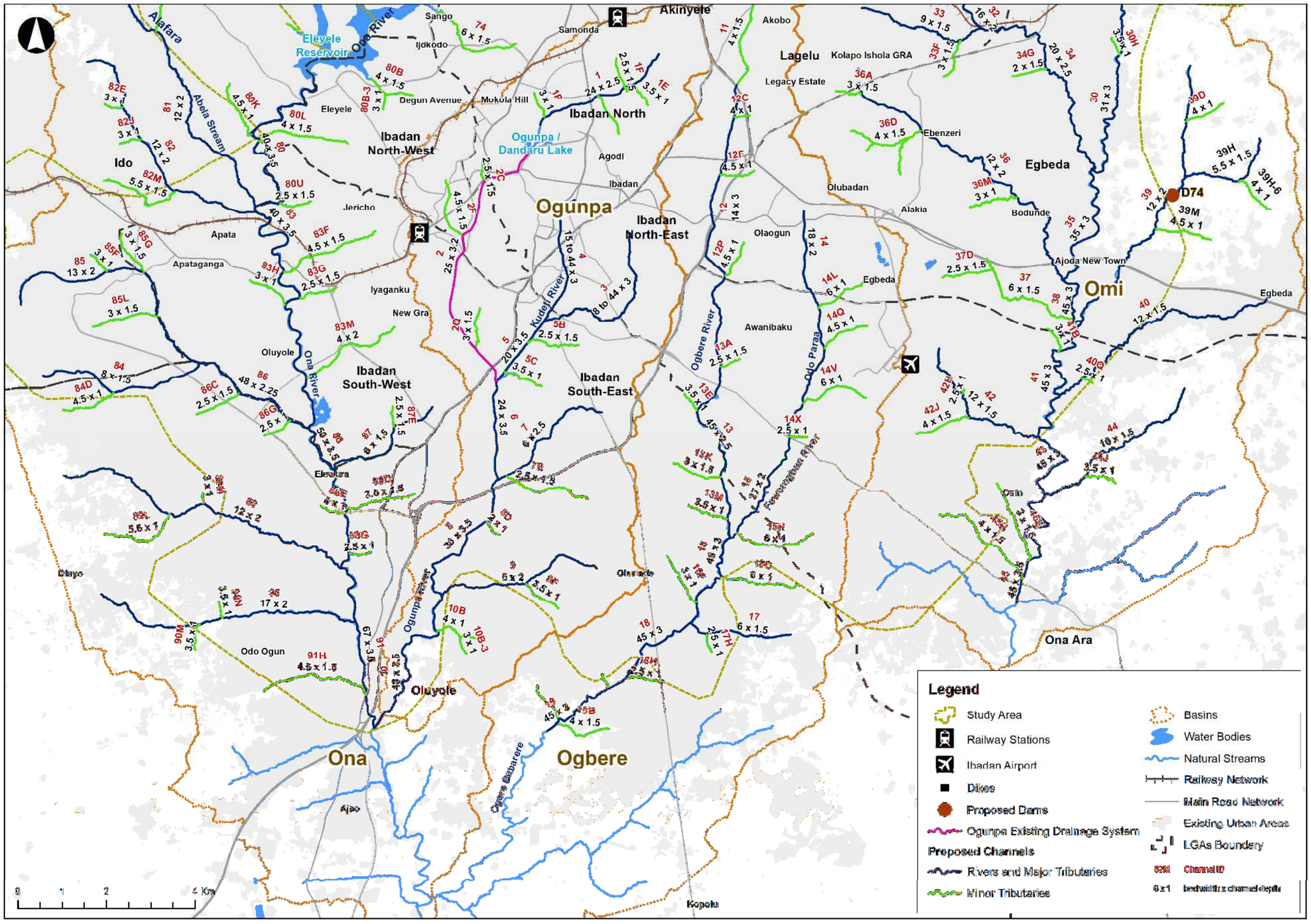

Figure 1.4: Drainage Masterplan - Southern Part Plan

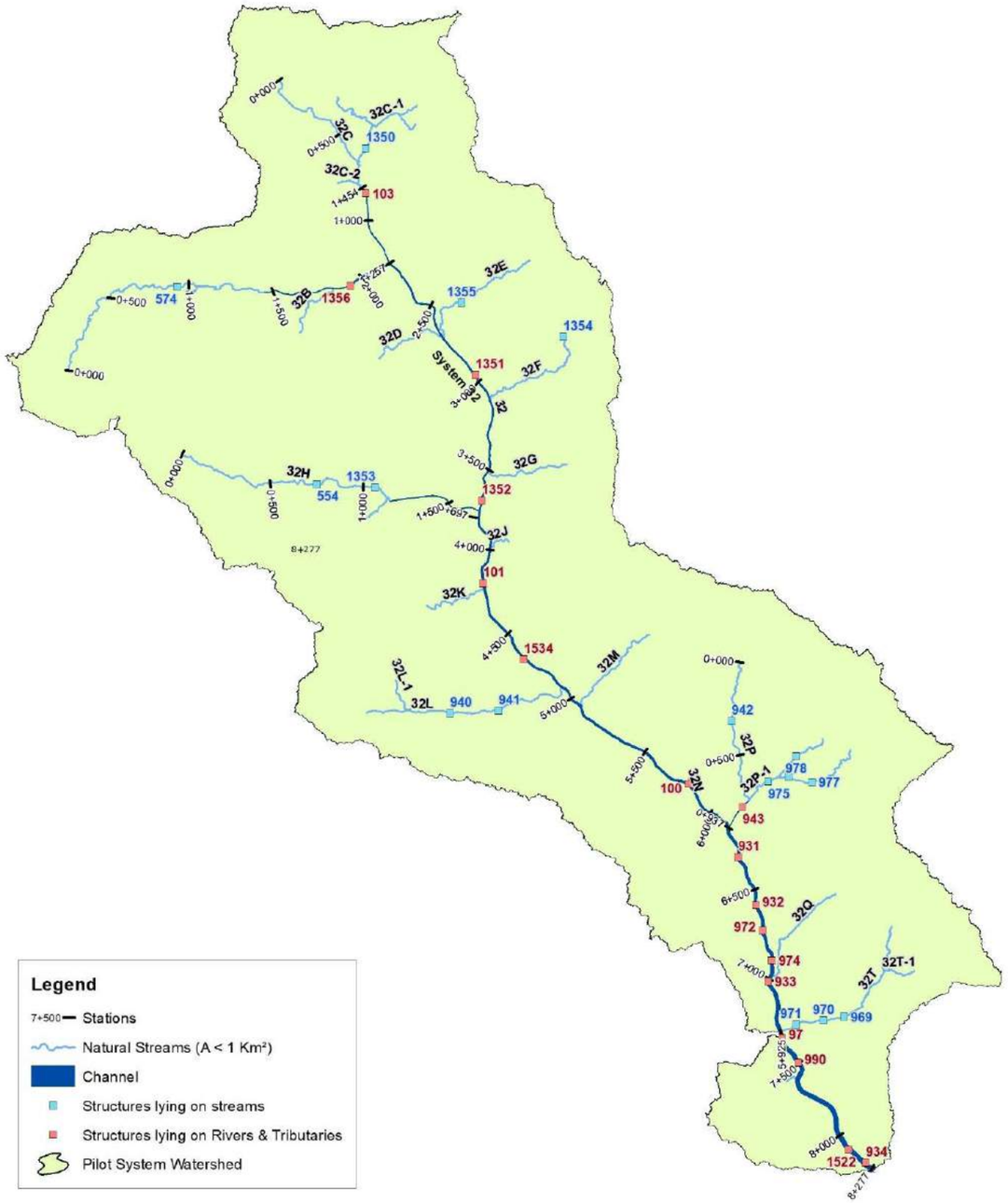

Figure 1.5: Proposed channelization of System 32

Table 1 presents a tabularized form of the data above. System 32 is divided into 20 reaches beginning from Reach 32-R1 and ending in Reach 32-R20. The table is sorted out from upstream to downstream and according to the catchment area of each reach.

Table 1 presents the following fields:

- Channel Id (System no.),
- Subbasin Id and Name
- Channel Length
- Reach Identity
- Start Station
- End Station
- Reach Length
- Catchment area
- 25-year flow
- 100-year flow
- Stream Slope
- Lining Protection
- Manning's Roughness Coefficient for the Channel
- Bed Width
- Design Depth
- Top Width

Figure 6 shows the output calculations for channel reach no. 32-R8 as checked by the FlowMaster Hydraulic Model. In the FlowMaster Model, the channel is designed as a concrete lined channel (bed and side slopes), manning's roughness coefficient = 0.017, the bed width is 9m width, the side slopes are 2H:1V, the normal depth of water is 1.42m corresponding to a 100-year flood event (81.8m3/s); thus the channel is designed with a 1.5m depth and a 15m top width, refer to the outlined border in Table 1.

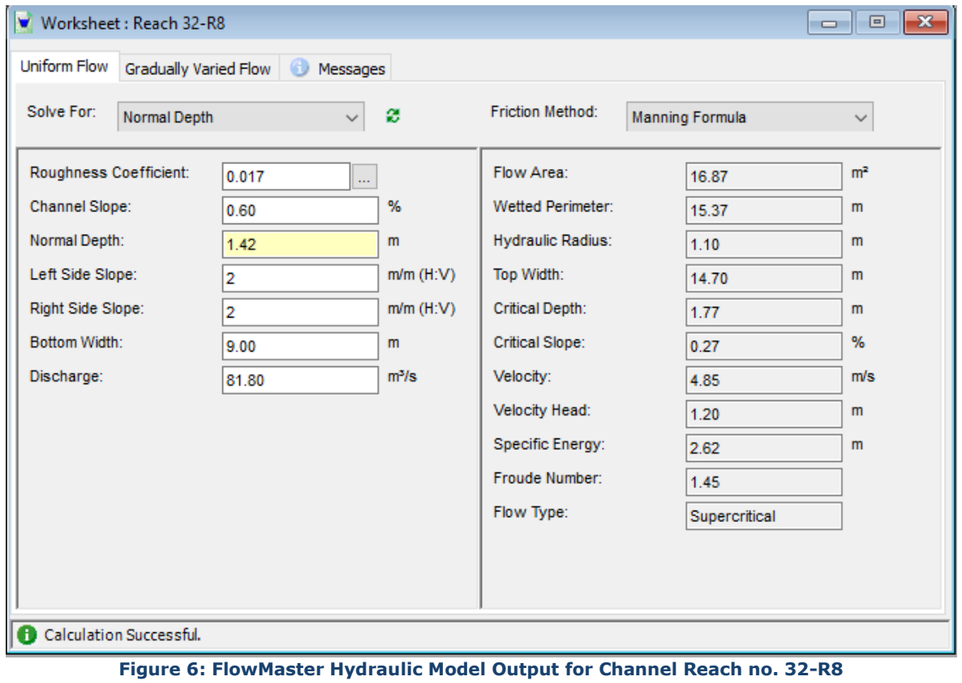

Figure 6: FlowMaster Hydraulic Model Output for Channel Reach no. 32-R8

Table 1: Channel Data and Design Dimensions of System 32 – Egberi Stream

Channel ID	Subbasin	Channel Length (m)	Reach ID	Start Station	End Station	Reach Length (m)	Catchment Area (km2)	25 Yrs Flow (m^3/s)	100 Yrs Flow (m^3/s)	Stream Slope (%)	Lining Material	Roughness Coeff. For Channel	Bed Width (m)	Design Depth (m)	Top Width (m)
32	OM3 Upper Omi West	6823	32-R1	1+454	1+926	472.0	1.4	14.0	18.6	0.81	Concrete	0.017	3.5	1	7.5
			32-R2	1+926	2+960	1,034.0	3.7	31.6	42.1	0.81	Concrete	0.017	5	1.5	11
			32-R3	2+960	3+680	720.0	4.7	39.3	52.4	0.81	Concrete	0.017	6	1.5	12
			32-R5	3+780	4+192	412.0	6.5	49.1	65.5	0.60	Concrete	0.017	8	1.5	14
			32-R6	4+192	4+665	473.0	7.0	52.0	69.3	0.60	Concrete	0.017	8	1.5	14
			32-R8	5+203	5+800	597.0	8.7	61.4	81.8	0.60	Concrete	0.017	9	1.5	15
			32-R9	5+800	6+301	501.0	10.3	79.0	105.4	0.60	Concrete	0.017	13	1.5	19
			32-R10	6+301	6+586	285.0	10.5	79.0	105.4	0.60	Concrete	0.017	13	1.5	19
			32-R12	6+634	6+727	93.0	10.6	79.0	105.4	0.60	Concrete	0.017	13	1.5	19
			32-R13	6+727	6+899	172.0	10.7	79.0	105.4	0.60	Concrete	0.017	13	1.5	19
			32-R14	6+899	7+016	117.0	11.1	79.0	105.4	0.60	Concrete	0.017	13	1.5	19
			32-R15	7+016	7+337	321.0	19.4	129.0	171.9	0.60	Concrete	0.017	13	1.5	19
			32-R16	7+337	7+496	159.0	19.4	129.0	171.9	0.60	Concrete	0.017	13	1.5	19
			32-R18	8+005	8+088	83.0	19.8	129.0	171.9	0.60	Concrete	0.017	16	2	24
			32-R19	8+088	8+204	116.0	19.9	129.0	171.9	0.60	Concrete	0.017	16	2	24
			32-R20	8204	8277	73	19.9	129.0	171.9	0.60	Concrete	0.017	16	2	24

2 Crossing Structures lying on Proposed Channels (1st Division)

This section present a summary of the design basis of the crossing structures lying on the proposed channels (1st Division). In addition, a pilot system is chosen to illustrate the methodology of this design.

There are around 657 crossing locations in Ibadan that are located on proposed channels. Based on the structure's assessment in Annex 8, there are around 544 crossing locations that needs to be rehabilitated. All these crossing locations are designed under the Masterplan such that they comprise of 53 Bridges and 491 Culverts.

2.1 Design Basis

Crossing structures lying on proposed channels are designed based on the following:

2.1.1. Culverts

a- Culverts are designed to convey a flow based on a 25-year return period or according to longer return periods in case of Main Road crossings or Expressway crossings.

b- Culverts are checked to convey a flow based on a 100-year return period such that the stormwater does not overtop the crossing road.

c- Culverts are sized according to the application of Manning's formula for open channels. The design is prepared using a hydraulic model (SAA model).

d- Crossing structures and their channels are designed altogether. The design basis of channels are illustrated in Section 1.1.

2.1.2. Bridges

a- Bridges are designed to convey a flow based on a 100-year return period and with a sufficient freeboard of not less than 0.75m

b- The span of the bridge is taken as the top width of the channel

c- The Bridge's deck is assumed 1.25m above the freeboard. i.e. 2m above the water level of the 100-year return period.

2.2 Design of the Pilot System (Part 2 – Crossing Works lying on Channels)

This section investigates the 2nd part of the design methodology which is the design of the crossing works lying on channels for the selected pilot system; System no. 32 (Egberi Stream). Based on the assessment provided in Annex 8, all structures along System 32 is necessary to be rehabilitated.

Based on the design flow data (calculated in Annex 8), all structures all designed according to the above-mentioned design basis. The 100-year flow in this system varies between 18.6 m^3/s to 171.9 m^3/s. i.e. no flow exceeded 250 m^3/s, thus all structures in this system are designed as box culverts (no bridges). The design dimensions of all structures lying on this system is presented in Table 2.1.

The following fields are presented:

- Channel Id (System no.),
- Subbasin name and Id,
- Crossing number (Structure no.)
- The Crossing Structure Station along the proposed channel
- The Address (Location)
- The Existing Crossing Structure Dimensions
- The Easting and Northing positions
- The contributing rainfall catchment area of each structure.
- The design flow
- The hydraulic adequacy of the structure
- The structural adequacy of the structure
- The necessity for a new structure

Moreover, Table 2.2 presents the structure design of these crossing structures, the following fields are presented:

- The Structure Status (To be left as existing or proposed for rehabilitation)
- The proposed crossing structure type (Box Culvert or Bridge)
- The design basis (based on a channelized stream or a natural stream)
- The stream slope (as extracted from the LiDAR DEM topographic survey)
- The Manning's roughness coefficient for the structure
- The Proposed Crossing Structure Dimensions
- The proposed vertical distance between the Road Level and the Proposed Culvert Invert Level
- The Consultant whom designed this Structure (Dar or Abfort or Pheman or Others)
- The objective of this design or its status (Masterplan or Pool of Works or Going for Bid or Under Construction)

For structure no. 100 lying on this system, the design is based on a structure lying on a channelized stream, the 25-year flow is 61.4 m^3/s (25-year return period), the proposed dimensions to convey this flow is 2 Box Culverts (4.5m x 2m). The proposed vertical distance between the Road Level and the Proposed Culvert Invert Level is 2.6m. This structure is designed by Dar in the Masterplan works.

Figure 2.1 shows the output calculations for structure number 100 as designed by the FlowMaster Hydraulic Model. In the FlowMaster Model, the flow 61.4 m^3/s is divided into 2 to convey a flow of 30.7 m^3/s for each cell, the bottom width is 4.5m, the manning's roughness coefficient for a concrete box culvert is taken as n = 0.017, the channel slope is 0.6%. The analysis reveal that the normal depth is 1.58m. Thus, the culvert's height is designed with a 2m height. The proposed dimensions for this structure is 2 Box Culverts (4.5m x 2m).

The Culvert is checked for a 100-year flow (81.8 m^3/s) using the SAA model to ensure that the water does not over top the crossing road.

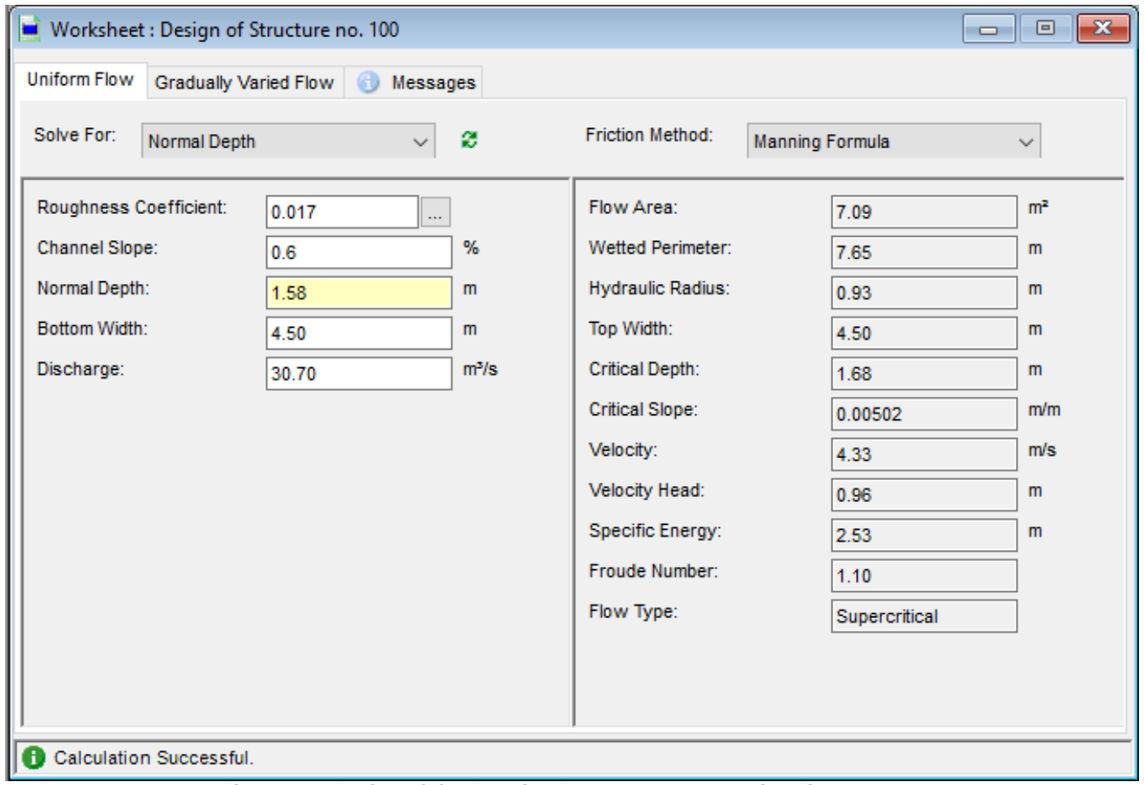

Figure 2.1: Design of the Crossing Structure No. 100 using Flow Master

Table 2.1: Structure Data of Crossing Works lying on System 32 – Egberi Stream

Channel ID	Subbasin	Structure No.	Structure Station	Location	Existing Crossing Structure Dimensions	Easting	Northing	Catchment Area (km2)	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Hydraulic Adequacy	Structural Adequacy	Necessity for a New structure
32	OM3 Upper Omi West	1356	1+926	Olorunda Abaa, Road 1,Ogooluwa Estate		606,591	826,139	1.4	14.0	18.6	Inadequate	Inadequate	Yes
		1351	2+960	Eleshinla Village, Eleshinla Road		607,291	825,674	3.7	31.6	42.1	Inadequate	Inadequate	Yes
		1352	3+680	Alapata Estate, Onireke Road	1 BC (1.85 x 0.74)	607,294	824,992	4.7	39.3	52.4	Inadequate	Inadequate	Yes
		101	4+192	TEMIDIER , SOKA ELEGA,	1 CC (0.8 dia)	607,270	824,546	6.5	49.1	65.5	Inadequate	Inadequate	Yes
		1534	4+665	Harmony Estate, Kumapayi		607,519	824,147	7.0	52.0	69.3	Inadequate	Inadequate	Yes
		100	5+800	AKOKA,	1 BC (1.97 x 1.44)	608,406	823,503	8.7	61.4	81.8	Inadequate	Inadequate	Yes
		931	6+301	Kute, Ibagun / Shokobi, Ibagun / Shokobi road	2 BC (1.2 x 1.7)	608,657	823,092	10.3	79.0	105.4	Inadequate	Inadequate	Yes
		932	6+586	Kute, Farinto, Farinto	1 BC (2.4 x 1.5)	608,756	822,837	10.5	79.0	105.4	Inadequate	Adequate	Yes
		972	6+727	Kute Area, Powerline, Powerline		608,787	822,694	10.6	79.0	105.4	Inadequate	Inadequate	Yes
		974	6+899	Kute Area, Sobaloju, Sobaloju		608,837	822,548	10.7	79.0	105.4	Inadequate	Inadequate	Yes
		933	7+016	Kute, Ifellodun zone 17, Ifelodun Zone 17	1 BC (2.6 x 1.62)	608,817	822,433	11.1	79.0	105.4	Inadequate	Adequate	Yes
		97	7+337	SIONI/OPEOLU,	2 CC (1.8 dia)	608,897	822,137	19.4	129.0	171.9	Inadequate	Inadequate	Yes
		990	7+496	Agbaja Olodo, Opeolu Layout, Behind Oremeji house		608,977	822,016	19.4	129.0	171.9	Inadequate	Inadequate	Yes
		1522	8+088	Olodo kumapayi, Opeolu Agbaja		609,242	821,545	19.8	129.0	171.9	Inadequate	Inadequate	Yes
		934	8+204	Arulogun Alaja, Along railway line, Railway line	Br (2 Span 6.45)	609,335	821,475	19.9	129.0	171.9	Adequate	Inadequate	Yes

Table 2.2: Structure Design of Crossing Works lying on System 32 – Egberi Stream

Channel ID	Structure No.	Location	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Manning for Structure	Channel Slope (%)	Proposed Crossing Structure Dimensions	Vertical Distance from Road Level to Proposed Culvert Invert	Designed by	Status
32	1356	Olorunda Abaa, Road 1,Ogooluwa Estate	14.0	18.6	Proposed	Box Culvert	Channelized Stream	0.017	0.81	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan
	1351	Eleshinla Village, Eleshinla Road	31.6	42.1	Proposed	Box Culvert	Channelized Stream	0.017	0.81	1 Cv (5 x 2)	2.6	Dar	Masterplan
	1352	Alapata Estate, Onireke Road	39.3	52.4	Proposed	Box Culvert	Channelized Stream	0.017	0.81	1 Cv (6 x 2)	2.6	Dar	Masterplan
	101	TEMIDIER , SOKA ELEGA,	49.1	65.5	Proposed	Box Culvert	Channelized Stream	0.017	0.60	2 Cv (4.5 x 2)	2.6	Dar	Masterplan
	1534	Harmony Estate, Kumapayi	52.0	69.3	Proposed	Box Culvert	Channelized Stream	0.017	0.60	2 Cv (4.5 x 2)	2.6	Dar	Masterplan
	100	AKOKA,	61.4	81.8	Proposed	Box Culvert	Channelized Stream	0.017	0.60	2 Cv (4.5 x 2)	2.6	Dar	Masterplan
	931	Kute, Ibagun / Shokobi, Ibagun / Shokobi road	79.0	105.4	Proposed	Box Culvert	Channelized Stream	0.017	0.60	2 Cv (4.5 x 2)	2.6	Dar	Masterplan
	932	Kute, Farinto, Farinto	79.0	105.4	Proposed	Box Culvert	Channelized Stream	0.017	0.60	2 Cv (4.5 x 2)	2.6	Dar	Masterplan
	972	Kute Area, Powerline, Powerline	79.0	105.4	Proposed	Box Culvert	Channelized Stream	0.017	0.60	2 Cv (6 x 2)	2.6	Dar	Masterplan
	974	Kute Area, Sobaloju, Sobaloju	79.0	105.4	Proposed	Box Culvert	Channelized Stream	0.017	0.60	2 Cv (6 x 2)	2.6	Dar	Masterplan
	933	Kute, Ifellodun zone 17, Ifelodun Zone 17	79.0	105.4	Proposed	Box Culvert	Channelized Stream	0.017	0.60	2 Cv (6 x 2)	2.6	Dar	Masterplan
	97	SIONI/OPEOLU,	129.0	171.9	Proposed	Box Culvert	Channelized Stream	0.017	0.60	2 Cv (6 x 2)	2.6	Dar	Masterplan
	990	Agbaja Olodo, Opeolu Layout, Behind Oremeji house	129.0	171.9	Proposed	Box Culvert	Channelized Stream	0.017	0.60	2 Cv (6 x 2)	2.6	Dar	Masterplan
	1522	Olodo kumapayi, Opeolu Agbaja	129.0	171.9	Proposed	Box Culvert	Channelized Stream	0.017	0.60	2 Cv (7.5 x 2.5)	3.25	Dar	Masterplan
	934	Arulogun Alaja, Along railway line, Railway line	129.0	171.9	Proposed	Box Culvert	Channelized Stream	0.017	0.60	2 Cv (7.5 x 2.5)	3.25	Dar	Masterplan

Channel Data						Structure Data								Design of Structures							Design of Channels					
Channel ID	Subbasin	Reach ID	Start Station	End Station	Reach Length (m)	Structure No.	Structure Station	Location	Existing Crossing Structure Dimensions	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Vertical Distance from Road L. to Prop. Culv. Inv.	Designed by	Status	Stream Slope (%)	Lining Protection	Roughness Coeff. For Channel	Bed Width (m)	Design Depth (m)	Top Width (m)
Channel_ID	Subbasin	Reach_ID	Start_St	End_St	Length_R_m			Location		Cat_A_Km2		Flow25CMS	Flow100CMS								Long_Slope	Lining	Manning	BedWidth_m	Depth_m	TopWidth_m
Channel_ID	Subbasin					Structu_No	StrStation	Address	Ext_St_Dim	Cat_A_Km2	X_RoadClas	Flow25CMS	Flow100CMS	Str_Status	Pr_X_StrTy	Dsn_Based	Pr_X_StDim	VD_RC_Prp	Designd_by	Status	Long_Slope					
11	Ob1 Ogbere Headwaters	11-R1	1+049	1+222	173	713	1+222	Akobo, Opposite Amazing investment filling station Olohunda road	2 CC (0.9 dia)	1.18	Main Road	14.7	19.6	Proposed	Box Culvert	Channelized Stream	1 Cv (2 x 2)	2.6	Dar	Masterplan	0.71	Concrete	0.017	2	1.5	8
		11-R2	1+222	1+937	715	115	1+937	BASHORUN , ESTATE AKOBO	1 BC (2.02 x 2.97)	2.27	Secondary Road	20.8	27.7	Proposed	Box Culvert	Channelized Stream	1 Cv (2 x 2)	2.6	Dar	Masterplan	0.71	Concrete	0.017	2	1.5	8
		11-R3	1+937	2+126	189	Size Change						20.8	27.7									Concrete	0.017	2	1.5	8
		11-R4	2+126	2+647	521	114	2+647	GENERAL GAS - NANA CHURCH ROAD	1 BC (3.2 x 2.05)	3.63	Secondary Road	42.6	56.8	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	0.71	Concrete	0.017	4	1.5	10
		11-R5	2+647	3+062	415	113	3+062	PAPA ELEWE-ODO	1 BC (2.48 x 1.84)	4.78	Tertiary Road	42.6	56.8	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	0.71	Concrete	0.017	4	1.5	10
		11-R6	3+062	3+270	208	Size Change				4.78												Concrete	0.017	4	1.5	10
12	Ob2 Upper Ogbere	12-R1		0+033	33	703	0+033	Elewi Odo, Elewi Odo, Ojo / Iwo road	1 BC (3.03 x 2.42)	4.96	Expressway	29.6	39.5	Existing							0.71	Concrete	0.017	4	1.5	10
		12-R2	0+033	0+220	187	Size Change						29.6	39.5									Concrete	0.017	4	1.5	10
		12-R3	0+220	0+395	175	Size Change						29.6	39.5									Concrete	0.017	4	1.75	11
		12-R4	0+395	0+506	111	704	0+506	Bashorun, Surulere, Surulere street off Iwo road	2 BC (3 x 1.92)	5.44	Tertiary Road	29.6	39.5	Existing							0.44	Concrete	0.017	7	2	15
		12-R5	0+506	0+653	147	814	0+653	ARIJE AREA/IWO RAOD, OGBERE AKERE RIVER, SURULERE STREET		5.48	Tertiary Road	51.0	68.0								0.44	Concrete	0.017	7	2	15
		12-R6	0+653	0+737	84	Size Change						66.8	89.0									Concrete	0.017	7	2	15
		12-R7	0+737	0+960	223	786	0+960	IWO ROAD, OGBERE RIVER, OLORUNBO STREET		7.50	Tertiary Road	83.3	111.1								0.44	Concrete	0.017	7	2.25	16
		12-R8	0+960	1+190	230	796	1+190	BASORUN/IWO ROAD, ABIMBOLA CHANNEL, ABIMBOLA STREET	3 BC (2.82 x 2.42)	7.63	Tertiary Road	83.3	111.1	Existing							0.44	Concrete	0.017	7	2.25	16
		12-R9	1+190	1+374	184	796B	1+374	Iwo road/Abayomi/Sule-manager, Ogbere S.C., Olagoke Akano/CAC		8.33	Tertiary Road	83.3	111.1								0.44	Concrete	0.017	7	2.25	16
		12-R10	1+374	1+778	404	787	1+778	IWO ROAD, IWO ROAD	3 BC (4.1 x 3)	8.76	Highway	83.3	111.1	Existing	Box Culvert	Channelized Stream	Add 1 Cv (3 x 2)		Dar	Lot1 (Going for Bid)	0.44	Concrete	0.017	10	2.25	19
		12-R11	1+778	2+150	372	Size Change						83.3	111.1									Concrete	0.017	10	2.25	19
		12-R12	2+150	2+269	119	788	2+269	BODE KUMAPAYI/IWO ROAD, OGBERE RIVER, AKINWUNMI/ODEWENWA STREET	2 BC (2.98 x 1.8)	10.68	Tertiary Road	83.3	111.1	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)		Dar	Lot1 (Going for Bid)	0.44	Concrete	0.017	10	2.5	20
		12-R13	2+269	2+974	705	304	2+974	Old Ife Road, Onipepeye/Ogbeere Stream, Abayomi Street		12.10	Tertiary Road	94.5	126.0	Existing							0.44	Concrete	0.017	14	2.5	24
		12-R14	2+974	3+103	129	87	3+103	ONIPEPEYE,	1 BC (4 x 3)	12.22	Highway	94.5	126.0	Proposed	Box Culvert	Channelized Stream	Add 2 Cv (4 x 2.5)		Dar	Lot1 (Going for Bid)	0.44	Concrete	0.017	14	2.5	24
		12-R15	3+103	3+290	187	304B	3+290	Onipepeye, Onipepeye Stream, Lagos-Ibadan Road	Br (3.6m)	12.27	Expressway	94.5	126.0	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)		Dar	Lot1 (Going for Bid)	0.44	Concrete	0.017	14	2.5	24
		12-R16	3+290	3+990	700	Size Change						94.5	126.0									Concrete	0.017	12	2.5	17
		12-R17	3+990	4+318	328	84	4+318	OGBERE MORADEYO,	2 BC (2.88 x 2.17)	14.04	Secondary Road	118.4	157.8	Proposed	Bridge	Channelized Stream	Br (15m)		Pheman	Going For Bid	0.44	Concrete	0.017	14	2.5	19
		12-R18	4+318	4+805	487	82	4+805	Oremeji, Babanla	Br (2 Span 13.83)	16.36	Main Road	130.9	174.5	Existing							0.44	Concrete	0.017	14	2.5	19
		12-R19	4+805	4+881	76	1562	4+881	Ogbere Idi Obi, Off Itamerin Road		16.42	Tertiary Road	130.9	174.5								0.44	Concrete	0.017	14	2.5	19
		12-R20	4+881	6+000	1119	Size Change						130.9	174.5									Concrete	0.017	14	2.5	19
		12-R21	6+000	6+350	350	Size Change						130.9	174.5									Concrete	0.017	14	2.75	25
		12-R22	6+350	6+474	124	425	6+474	Ogbere, Ogere Babarere, Seriki Market	3 BC (3.9 x 3.55)	18.29	Tertiary Road	154.3	205.8	Proposed	Box Culvert	Channelized Stream	Add 1 Cv (4 x 3)		Dar	Lot1 (Going for Bid)	0.44	Concrete	0.017	14	3	26
		12-R23	6+474	6+877	403	Size Change				18.29		165.9	221.3									Concrete	0.017	14	3	26
12C	Ob2 Upper Ogbere	12C-R1	0+776	0+856	80	797	0+856	IWO ROAD, AMUDA STREET	1 BC (1.84 x 1.53)	1.15	Expressway	12.4	16.5	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 1.5)	1.95	Dar	Masterplan	1.43	Concrete	0.017	4	1	8
		12C-R2	0+856	1+010	154	795	1+010	JONKU/IWO ROAD, ARIJE FAFUNLAYO STREET	1 BC (3.22 x 2.36)	1.23	Tertiary Road	13.0	17.3	Existing							1.43	Concrete	0.017	4	1	8
		12C-R3	1+010	1+127	117	Size Change				1.23		13.0	17.3									Concrete	0.017	4	1	8
12F	Ob2 Upper Ogbere	12F-R1	0+888	1+317	429	802	1+317	IWO ROAD, ALAREPE STREET	1 BC (2.46 x 1.9)	1.48	Expressway	14.9	19.8	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	0.94	Concrete	0.017	4	1	8
		12F-R2	1+317	1+432	115	801	1+432	ABAYOMI ATELE/IWO ROAD, ATELE/OLADAPO STREET	2 BC (1.42 x 2.62)	1.51	Tertiary Road	15.1	20.1	Existing							0.94	Concrete	0.017	4	1	8
		12F-R3	1+432	1+632	200	813	1+632	ABAYOMI/IWO ROAD, ABAYOMI IWO ROAD	2 BC (2.39 x 2)	1.56	Tertiary Road	15.5	20.6	Existing							0.94	Concrete	0.017	4.5	1	8.5
		12F-R4	1+632	1+698	66	Size Change				1.56		15.5	20.6									Concrete	0.017	4.5	1	8.5
12P	Ob2 Upper Ogbere	12P-R1	1+309	1+465	156	310	1+465	Oke Koto Sawmill, Old Army Barrack	1 BC (3.5 x 2.03)	1.06	Tertiary Road	11.7	15.6	Proposed	Box Culvert	Channelized Stream	1 Cv (2 x 2)	2.6	Dar	Masterplan	1.05	Concrete	0.017	4	1	8
		12P-R2	1+465	1+801	336	83	1+801	MAKU , OGBERE IDI-OSAN	2 BC (3.1 x 2.07)	1.62	Secondary Road	15.9	21.2	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.05	Concrete	0.017	4	1	8
		12P-R3	1+801	1+999	198	1561	1+999	Ogbere Idi Obi		1.72	Tertiary Road	16.7	22.2	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.05	Concrete	0.017	4.5	1	8.5
		12P-R4	1+999	2+239	240	Size Change				1.72		16.7	22.2									Concrete	0.017	4.5	1	8.5
13	Ob3 Middle Ogbere	13-R1		0+325	325	Size Change						217.0	289.3									Concrete Sides	0.027	18	2.5	28
		13-R2	0+325	0+475	150	Size Change						233.0	310.7									Concrete Sides	0.027	24	2.5	34
		13-R3	0+475	0+575	100	73	0+575	OGBERETIOYA,	1 BC (8 x 3.39)	21.32	Main Road	245.0	326.7	Proposed	Box Culvert	Channelized Stream	4 Cv (6 x 3)		Dar	Lot2 (Going for Bid)	0.63	Concrete Sides	0.027	24	2.5	34
		13-R4	0+575	1+325	750	Size Change						265.0	353.3									Concrete Sides	0.027	18	2.5	28
		13-R5	1+325	1+941	616	7M	1+941	Ogbere Aba Onde single span bridge				275.0	366.7	Proposed	Bridge	Channelized Stream	Br (15m)		Pheman	Going For Bid	0.63	Concrete Sides	0.027	25	2.5	35
		13-R6	1+941	2+839	898	Size Change						283.0	377.3									Concrete Sides	0.027	25	2.5	35
		13-R7	2+839	3+172	333	68	3+172	GBEGBA , OGBERE, Mosfala Road,	Br (2 Span 14.05)	25.70	Tertiary Road	297.2	396.3	Existing					Abfort	New	0.63	Concrete Sides	0.027	29	3	41
		13-R8	3+172	3+550	378	Size Change						318.0	424.0									Concrete Sides	0.027	29	3	41
		13-R9	3+550	4+300	750	28D	4+300	ZONE 2 AND 3- PAPA ELEYE COMMUNITY , OLOMI AREA, IBADAN 2		29.71	No Road	322.0	429.3	Proposed	Bridge	Channelized Stream	Br (55 x 10)	4	Dar	Masterplan	0.63	Concrete Sides	0.027	45	2.5	55
		13-R10	4+300	4+500	200	Size Change				29.71		331.0	441.3									Concrete Sides	0.027	45	2.5	55
13A	Ob3 Middle Ogbere	13A-R1	1+085	1+257	172	427	1+257	Ogbere, Transformer road	2 BC (2.78 x 2.04)	1.14	Tertiary Road	12.3	16.4	Existing							1.15	Concrete	0.017	2	1.5	8
		13A-R2	1+257	1+493	236	426	1+493	Ile eja bus stop Oritamrin road, Ifelodun street		1.24	Tertiary Road	13.1	17.4	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.15	Concrete	0.017	2.5	1.5	8.5
		13A-R3	1+493	1+561	68	Size Change				1.24		13.1	17.4									Concrete	0.017	2.5	1.5	8.5
13E	Ob3 Middle Ogbere	13E-R1	1+001	1+488	487	Size Change				1.50		15.0	20.0								1.20	Concrete	0.017	3.5	1	7.5
13K	Ob3 Middle Ogbere					909	0+982	MOSFALA, AMADIYA STREET		1.32	Tertiary Road	13.7	18.2	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.08	Concrete	0.017	2.5	1.5	8.5
		13K-R1	0+982	1+269	287	1513	1+269	off Mosfala Road		1.46	Tertiary Road	14.7	19.6	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.08	Concrete	0.017	2.5	1.5	8.5
		13K-R2	1+269	1+593	324	910	1+593	MOSFALA, ALATA STREET		1.69	Tertiary Road	16.4	21.9	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.08	Concrete	0.017	2.5	1.5	8.5
		13K-R3	1+593	1+730	137	911	1+730	MOSFALA, TEMIDIRE OGUNDEPEO STREET	1 BC (3 x 2.1)	1.76	Tertiary Road	17.0	22.6	Existing							1.08	Concrete	0.017	3	1.5	9
		13K-R4	1+730	2+033	303	67	2+033	ARAROMI OGUNDEPO	2 BC (2.42 x 1.83)	1.94	Tertiary Road	18.3	24.4	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 2)	2.6	Dar	Masterplan	1.08	Concrete	0.017	3	1.5	9
		13K-R5	2+033	2+158	125	Size Change				1.94		18.3	24.4									Concrete	0.017	3	1.5	9
13M	Ob3 Middle Ogbere	13M-R1	1+147	2+129	982	Size Change				1.50		15.0	20.0								1.20	Concrete	0.017	3.5	1	7.5

Channel Data						Structure Data								Design of Structures							Design of Channels					
Channel ID	Subbasin	Reach ID	Start Station	End Station	Reach Length (m)	Structure No.	Structure Station	Location	Existing Crossing Structure Dimensions	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Vertical Distance from Road L. to Prop. Culv. Inv.	Designed by	Status	Stream Slope (%)	Lining Protection	Roughness Coeff. For Channel	Bed Width (m)	Design Depth (m)	Top Width (m)
14	Ob4 Foworogbun	14-R1	0+892	1+087	195	344	1+087	Gbagi, Gbagi Market	1 BC (1.55 x 1.5)	1.27	Tertiary Road	13.3	17.7	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 2)	2.6	Dar	Masterplan	0.46	Concrete	0.017	3	1.5	9
		14-R2	1+087	1+942	855	342	1+942	Onideure, Alebiosu road	2 BC (3.1 x 2.1)	2.81	Secondary Road	24.8	33.1	Existing							0.46	Concrete	0.017	5	1.5	11
		14-R3	1+942	2+669	727	353	2+669	Gbaremu Area, Gbaremu Akinlade		4.33	Tertiary Road	36.2	48.3	Proposed	Box Culvert	Channelized Stream	2 Cv (4 x 2)	2.6	Dar	Masterplan	0.46	Concrete	0.017	8	1.5	14
		14-R4	2+669	2+825	156	81	2+825	GBAREMU OLOSUN	2 BC (1.77 x 1.87)	4.43	Main Road	37.0	49.3	Proposed	Box Culvert	Channelized Stream	2 Cv (4 x 2)	2.6	Dar	Masterplan	0.46	Concrete	0.017	8	1.5	14
		14-R5	2+825	3+222	397	Size Change						37.0	49.3									Concrete	0.017	8	1.5	14
		14-R6	3+222	3+581	359	327	3+581	Adenira Olosun, Adeniran/Olosun Stream, Adeniran/Olosun	Br (2 Span 2.5)	7.33	Secondary Road	84.8	113.0	Proposed	Box Culvert	Channelized Stream	2 Cv (4 x 2.5)	3.25	Dar	Masterplan	0.50	Concrete	0.017	8	2	16
		14-R7	3+581	4+281	700	437	4+281	Gangan -Paraa road, Odo Paraa, Paraa	4 CC (0.7 dia) + BC (2.2 x 2.47)	10.44	Secondary Road	84.8	113.0	Proposed	Box Culvert	Channelized Stream	2 Cv (4 x 2.5)	3.25	Dar	Masterplan	0.50	Concrete	0.017	8	2	16
		14-R8	4+281	5+272	991	445	5+272	Foworogun Area, Odo Foworogun, Foworogun	3 BC (0 x 2.9)	11.95	Tertiary Road	117.9	157.1	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.50	Concrete	0.017	12	2	20
		14-R9	5+272	6+128	856	Size Change				11.95		131.8	175.7									Concrete	0.017	16	2	24
		14-R10	6+128	6+510	382	Size Change				11.95		165.8	221.1									Concrete	0.017	18	2	26
14L	Ob4 Foworogbun	14L-R1	1+316	1+452	136	329	1+452	Temidayo-Ogungbile, Temidire		1.05	Tertiary Road	11.6	15.5	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	0.78	Concrete	0.017	3.5	1	7.5
		14L-R2	1+452	2+066	614	80	2+066	AROYE / ORISUNBARE	2 BC (1.55 x 1.57)	2.16	Main Road	20.0	26.6	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	0.78	Concrete	0.017	4.5	1	8.5
		14L-R3	2+066	2+337	271	328	2+337	Alagbayun, Oke ola/Alaba Road	2 BC (2.6 x 1.2)	2.32	Tertiary Road	21.2	28.2	Proposed	Box Culvert	Channelized Stream	2 Cv (3 x 1.5)	1.95	Dar	Masterplan	0.78	Concrete	0.017	6	1	10
		14L-R4	2+337	2+581	244	Size Change				2.32		21.2	28.2									Concrete	0.017	6	1	10
14Q	Ob4 Foworogbun	14Q-R1	1+502	1+568	66	79	1+568	AIMASIKO	3 BC (1.39 x 1.26)	1.63	Tertiary Road	16.0	21.3	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	0.86	Concrete	0.017	4	1	8
		14Q-R2	1+568	1+873	305	1524	1+873	Kate Idi Obi, Kate zone 1		1.79	Tertiary Road	17.2	22.9	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	0.86	Concrete	0.017	4	1	8
		14Q-R3	1+873	2+447	574	89	2+447	PAARA	2 BC (2.43 x 1.21)	2.09	Secondary Road	19.4	25.9	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	0.86	Concrete	0.017	4.5	1	8.5
		14Q-R4	2+447	2+659	212	Size Change				2.09		19.4	25.9									Concrete	0.017	4.5	1	8.5
14V	Ob4 Foworogbun	14V-R1	1+266	1+589	323	443	1+589	Aseyori-Alapafon, Alapafon Estate		1.22	Tertiary Road	12.9	17.2	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	0.90	Concrete	0.017	3	1	7
		14V-R2	1+589	1+928	339	442	1+928	Bamitale-Alapafon		1.78	Tertiary Road	17.1	22.8	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	0.90	Concrete	0.017	4	1	8
		14V-R3	1+928	2+199	271	78	2+199	MAKU , OGBERE IDI-OSAN		1.95	Tertiary Road	18.4	24.5	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	0.90	Concrete	0.017	4.5	1	8.5
		14V-R4	2+199	2+410	211	440	2+410	Olunloyo Area, Irepodun Alapafon		2.05	Tertiary Road	19.1	25.5	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	0.90	Concrete	0.017	4.5	1	8.5
		14V-R5	2+410	2+647	237	439	2+647	Alagbaa-Emilagbe, Oluwalogbon Church	1 BC (1.8 x 1.3)	2.45	2.45	2.5	2.5	Proposed	Box Culvert	Channelized Stream	2 Cv (3 x 1.5)	1.95	Dar	Masterplan	0.90	Concrete	0.017	6	1	10
		14V-R6	2+647	2+924	277	Size Change				2.45		22.1	29.5									Concrete	0.017	6	1	10
14X	Ob4 Foworogbun	14X-R1	1+318	1+569	251	401	1+569	Sogade, Ireakari Road	2 CC (0.8 dia)	1.09	Tertiary Road	11.9	15.9	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 1.5)	1.95	Dar	Masterplan	1.70	Concrete	0.017	2.5	1	6.5
		14X-R2	1+569	1+727	158	Size Change				1.09		11.9	15.9									Concrete	0.017	2.5	1	6.5
15	Ob4 Foworogbun	15-R1		0+015	15	76	0+015	OLUNLOYO IDIAGBON , ASOLO ROAD,	2 BC (3.15 x 3.93)	16.84	Main Road	181.9	242.5	Proposed	Box Culvert	Channelized Stream	6 Cv (6 x 2.5)		Dar	Lot2 (Going for Bid)	0.50	Concrete	0.017	18	2	26
		15-R2	0+015	0+887	872	20D	0+887	JOINT VIGILANTE GROUP, COMPRISES OF IFESEYI IDIAGBON, TEMIDIRE, OLUWAFIRANTI AND ISOKAN COMMUNTIY		18.05	No Road	165.8	221.1	Proposed	Box Culvert	Channelized Stream	3 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.50	Concrete	0.017	18	2	26
		15-R3	0+887	1+561	674	Size Change						165.8	221.1									Concrete	0.017	18	2	26
		15-R4	1+561	1+620	59	924	1+620	ALAAKA, ALAAKA/IDIOSAN		19.84		181.5	242.0	Proposed	Box Culvert	Channelized Stream	3 Cv (6.5 x 2.5)	3.25	Dar	Masterplan	0.33	Concrete	0.017	20	2	28
		15-R5	1+620	2+050	430	904	2+050	IDI OSAN, FOWOROGI, OGBERE/IDI OSAN	2 BC (1.87 x 1.34)	20.67		181.5	242.0	Proposed	Bridge	Channelized Stream	Br (15m)		Pheman	Going For Bid	0.33	Concrete	0.017	20	2	28
		15-R6	2+050	2+161	111	Size Change				20.67		181.5	242.0									Concrete	0.017	20	2	28
		15-R7	2+161	2+955	794	Size Change				20.67		192.4	256.5									Concrete	0.017	27	2	35
15H	Ob4 Foworogbun	15H-R1	1+521	2+354	833	70	2+354	ADEYE	1 BC (1.65 x 0.65)	1.87	Secondary Road	17.8	23.7	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 3.5)		Pheman	Going For Bid	0.80	Concrete	0.017	4	1	8
		15H-R2	2+354	2+770	416	926	2+770	BALOGUN/ADEYORI, ADEYORI STREET	1 BC (2.58 x 1.5)	2.13	Tertiary Road	19.7	26.3	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	0.80	Concrete	0.017	4.5	1	8.5
		15H-R3	2+770	3+147	377	1509	3+147	orisumbare akeyo, orisumbare Road	1 CC (1.28 dia)	2.44	Tertiary Road	22.1	29.4	Proposed	Box Culvert	Channelized Stream	2 Cv (3 x 1.5)	1.95	Dar	Masterplan	0.80	Concrete	0.017	6	1	10
		15H-R4	3+147	3+328	181	1510	3+328	Balogun 2		2.52	Tertiary Road	22.7	30.2	Proposed	Box Culvert	Channelized Stream	2 Cv (3 x 1.5)	1.95	Dar	Masterplan	0.80	Concrete	0.017	6	1	10
		15H-R5	3+328	3+487	159	Size Change				2.52												Concrete	0.017	6	1	10
16	Ob5 Lower Ogbere North	16-R1		0+200	200	74D	0+200	ORISUMBARE GENERAL COMMUNITY DEVELOPMENT ASSOCIATION		53.61	No Road	365.9	487.8	Proposed	Bridge	Channelized Stream	Br (55 x 10)	4	Dar	Masterplan	0.63	Concrete Sides	0.027	45	2.5	55
		16-R2	0+200	0+427	227	916	0+427	PAPA ELEYE, OGBERE RIVER, ZONE 4		53.76	Tertiary Road	365.9	487.8	Proposed	Bridge	Channelized Stream	Br (55 x 10)	4.5	Dar	Masterplan	0.38	Concrete Sides	0.027	45	2.5	55
		16-R3	0+427	1+163	736	1260	1+163	AKEYO-ODU, OGBERE, IDI-OSAN MUSLIM		54.75	Tertiary Road	365.9	487.8	Proposed	Bridge	Channelized Stream	Br (55 x 10)	4.5	Dar	Masterplan	0.38	Concrete Sides	0.027	45	2.5	55
		16-R4	1+163	1+510	347	43D	1+510	APABIELESIN LANDLORDS AND LANDLADIES ASSOCIATION ORELOPE ISALE ALFA ZONE 2 UNIT 2 OLUYOLE		57.41	No Road	365.9	487.8	Proposed	Bridge	Channelized Stream	Br (55 x 10)	4.5	Dar	Masterplan	0.38	Concrete Sides	0.027	45	2.5	55
		16-R5	1+510	2+300	790	Size Change						365.9	487.8									Concrete Sides	0.027	45	2.5	55
		16-R6	2+300	2+714	414	1270	2+714	ODO-DUDU, IRORUN OLUWA RD E, ODO-DUDU, OLOMI-OLUNDE AYEGUN		60.30	Tertiary Road	463.0	617.4	Proposed	Bridge	Channelized Stream	Br (60 x 10)	4.5	Dar	Masterplan	0.38	Concrete Sides	0.027	45	3	57
16D	Ob5 Lower Ogbere North	16D-R1	0+716	1+052	336	1255	1+052	TEMIDIRE, AYETORO, MUSLIM, EGBEDA-TUBA		1.22	Secondary Road	12.9	17.2	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	0.79	Concrete	0.017	3.5	1	7.5
		16D-R2	1+052	1+704	652	1514	1+704	ifesowapo iremide ajogbelede, ifesowopo zone D	1 CC (1.28 dia)	1.96	Tertiary Road	18.5	24.6	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	0.79	Concrete	0.017	4.5	1	8.5
		16D-R3	1+704	2+283	579	1256	2+283	OLOKOFEFE, IDI-IROKO, FATUNSI AREA,OLUNDE	2 CC (0.525 dia)	2.35	Tertiary Road	21.4	28.5	Proposed	Box Culvert	Channelized Stream	2 Cv (3 x 1.5)	1.95	Dar	Masterplan	0.79	Concrete	0.017	6	1	10
		16D-R4	2+283	2+611	328	Size Change				2.35												Concrete	0.017	6	1	10
16F	Ob5 Lower Ogbere North	16F-R1	0+850	1+147	297	1258	1+147	TEMIDIRE,OLOWU, FATOSA, OLUNDE		1.23	Tertiary Road	13.0	17.3	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	1.21	Concrete	0.017	3	1	7
		16F-R2	1+147	2+181	1034	Size Change				1.23												Concrete	0.017	3	1	7
17	Ob5 Lower Ogbere North	17-R1	1+117	1+766	649	1261	1+766	OBADA, OFF ISOKAN, AYEGUN RD, OLOMI	1 BC (1.2 x 0.87)	2.69	Secondary Road	23.9	31.9	Proposed	Box Culvert	Channelized Stream	2 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	0.71	Concrete	0.017	7	1	11
		17-R2	1+766	2+663	897	1511	2+663	irepodun gbako, irepodun gbako road a		3.78	Tertiary Road	32.1	42.8	Proposed	Box Culvert	Channelized Stream	2 Cv (4 x 1.5)	1.95	Dar	Masterplan	0.71	Concrete	0.017	8	1	12
		17-R3	2+663	3+085	422	Size Change						32.1	42.8									Concrete	0.017	8	1	12
		17-R4	3+085	3+290	205	1266	3+290	FATUNSI BRIDGE ODO-DUDU,ISOKAN, FATUNSI, ISOKAN, OLOMI-OLUNDE	2 BC (2.56 x 1.82)	5.25	Tertiary Road	46.3	61.7	Proposed	Box Culvert	Channelized Stream	1 Cv (6 x 2)	2.6	Dar	Masterplan	0.14	Concrete	0.017	6	1.5	12
		17-R5	3+290	3+418	128	1267	3+418	ODO-DUDU, IRORUN OLUWA ZONE 12, ODO-DUDU, ODO-DUDU OLOMI-OLUNDE		5.30	Tertiary Road	46.3	61.7	Proposed	Box Culvert	Channelized Stream	1 Cv (6 x 2)	2.6	Dar	Masterplan	0.14	Concrete	0.017	6	1.5	12
		17-R6	3+418	3+564	146	Size Change				5.30		46.3	61.7									Concrete	0.017	6	1.5	12
17H	Ob5 Lower Ogbere North	17H-R1	0+664	0+716	52	1263	0+716	ARANNSE OLUWA,IGBONNA, IGBONNA, OFF FATUSI	2 BC (1.25 x 0.62)	1.01	Tertiary Road	11.3	15.1	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 1.5)	1.95	Dar	Masterplan	1.33	Concrete	0.017	2.5	1	6.5
		17H-R2	0+716	0+834	118	1512	0+834	irepodun zone, Area 1	1 BC (4 x 0.88)	1.06	Tertiary Road	11.7	15.6	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 1.5)	1.95	Dar	Masterplan	1.33	Concrete	0.017	2.5	1	6.5
		17H-R3	0+834	1+020	186	1265	1+020	KAJOLA QUARTERS, FATUNSI AREA, MONDALA,OLOMI-OLUDE		1.16	Tertiary Road	12.5	16.6	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 1.5)	1.95	Dar	Masterplan	1.33	Concrete	0.017	2.5	1	6.5
		17H-R4	1+020	1+088	68	Size Change				1.16												Concrete	0.017	2.5	1	6.5
18	Ob5 Lower Ogbere North	18-R1		1+002	1002	65B	1+002	MAARUN, ARO FATUNSI, OGUNPA, MAARUN ARO, FATUNSI RD, NEW FELELE ACADEMY	Br (3 Span 14.5)	66.87	Main Road	463.0	617.4	Existing					N/A	New	0.35	Concrete Sides	0.027	45	3	57
		18-R2	1+002	3+552	2550	Size Change				66.87		463.0	617.4									Concrete Sides	0.027	45	3	57
18H	Ob5 Lower Ogbere North	18H-R1	0+951	1+003	52	1274	1+003	ARO OGO, IFESOWAPO, AYEGUN RD, OLOMI	2 CC (0.84 dia)	1.06	Main Road	11.7	15.6	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 1.5)	1.95	Dar	Masterplan	1.88	Concrete	0.017	2.5	1	6.5
		18H-R2	1+003	1+812	809	Size Change				1.06		11.7	15.6									Concrete	0.017	2.5	1	6.5
18K	Ob5 Lower Ogbere North	18K-R1	1+197	1+572	375	Size Change				1.50		15.0	20.0								1.44	Concrete	0.017	3	1	7

Channel Data						Structure Data								Design of Structures							Design of Channels					
Channel ID	Subbasin	Reach ID	Start Station	End Station	Reach Length (m)	Structure No.	Structure Station	Location	Existing Crossing Structure Dimensions	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Vertical Distance from Road L. to Prop. Culv. Inv.	Designed by	Status	Stream Slope (%)	Lining Protection	Roughness Coeff. For Channel	Bed Width (m)	Design Depth (m)	Top Width (m)
19	Ob5 Lower Ogbere North	19-R1		1+040	1040	Size Change				66.87		463.0	617.4								0.46	Concrete Sides	0.027	45	3	57
19A	Ob5 Lower Ogbere North	19A-R1	0+999	1+958	959	Size Change				1.50											1.10	Concrete	0.017	3.5	1	7.5
19B	Ob5 Lower Ogbere North	19B-R1	1+179	2+552	1373	Size Change				3.00		26.3	35.0								1.08	Concrete	0.017	4	1.5	10
1	Og1 Upper Ogunpa	1-R1	1+451	1+536	85	693	1+536	Ashi, Emiola Awe road	1 BC (3 x 2.09)	1.79	Tertiary Road	17.2	22.9	Existing							0.91	Concrete	0.017	3	1.5	9
		1-R2	1+536	1+729	193	692	1+729	Ashi, Ladosu Ladipo Close	2 BC (1.85 x 2.05)	1.85	Tertiary Road	17.6	23.5	Existing							0.91	Concrete	0.017	3	1.5	9
		1-R3	1+729	2+167	438	46	2+167	OLUGA STREET , SALAMI ESTATE	2 BC (2 x 0.87)	2.51	Tertiary Road	22.6	30.1	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 2)	2.6	Dar	Masterplan	0.91	Concrete	0.017	3.5	1.5	9.5
		1-R4	2+167	2+600	433	Size Change						22.6	30.1									Concrete	0.017	3.5	1.5	9.5
		1-R5	2+600	3+049	449	627	3+049	New Bodija, Ladoke Akintola Street Channel, Ladoke Akintola Street	2 BC (3 x 2.73)	5.76	Tertiary Road	76.9	102.5	Proposed	Box Culvert	Channelized Stream	2 Cv (4 x 2.5)		Dar	Lot1 (Going for Bid)	0.44	Concrete	0.017	5	2.5	15
		1-R6	3+049	3+508	459	44	3+508	Secretariat, Restoration Bridge, Secretariat Road	Br (2 Span 12.2)	7.90	Highway	82.5	110.0	Existing							0.44	Concrete	0.017	8	2.5	18
		1-R7	3+508	3+737	229	43	3+737	AWOLOWO AVENUE , OLUOKUN STREET,		8.16	Tertiary Road	90.0	120.0	Existing							0.44	Concrete	0.017	10	2.5	20
		1-R8	3+737	3+991	254	42	3+991	FRANCIS OKEDEJI STREET , DAVIES HOTEL,	2 BC (1.98 x 2.3)	8.72	Tertiary Road	95.0	126.7	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)		Dar	Lot1 (Going for Bid)	0.44	Concrete	0.017	10	2.5	20
		1-R9	3+991	4+421	430	41	4+421	ADEYI , OLD BODIJA,	2 BC (1.8 x 1.97)	8.97	Tertiary Road	95.0	126.7	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)		Dar	Lot1 (Going for Bid)	0.44	Concrete	0.017	12	2.5	22
		1-R10	4+421	4+791	370	40	4+791	ADEYI , OLD BODIJA,	1 BC (2.5 x 1.89)	10.61	Tertiary Road	95.0	126.7	Proposed	Box Culvert	Channelized Stream	4 Cv (6 x 2.5)		Dar	Lot1 (Going for Bid)	0.44	Concrete	0.017	Var.	2.5	Var.
		1-R11	4+791	4+839	48	Size Change				10.61		95.0	126.7									Concrete	0.017	24	2.5	34
1E	Og1 Upper Ogunpa	1E-R1	0+949	1+351	402	732	1+351	Salami Estate Bodija, Off Awele road		1.24	Tertiary Road	13.1	17.4	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	0.78	Concrete	0.017	3.5	1	7.5
		1E-R2	1+351	1+756	405	675	1+756	New Bodija,Salami Street	2 CC (0.5 dia)	1.35	Tertiary Road	13.9	18.5	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	0.78	Concrete	0.017	3.5	1	7.5
		1E-R3	1+756	1+868	112	Size Change				1.35		13.9	18.5									Concrete	0.017	3.5	1	7.5
1F	Og1 Upper Ogunpa	1F-R1	1+031	1+164	133	638	1+164	New Bodija, Oladunni Ayanndipe Street	2 BC (2.63 x 1.69)	1.09	Tertiary Road	11.9	15.9	Existing							1.00	Concrete	0.017	2.5	1.5	8.5
		1F-R2	1+164	1+252	88	639	1+252	New Bodija, Aretedo		1.17	Tertiary Road	12.5	16.7	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.00	Concrete	0.017	2.5	1.5	8.5
		1F-R3	1+252	1+647	395	45	1+647	KUNLE ABASS STREET , NEW BODIJA	1 CC (1.05 dia) + BC (2.05 x 1.25)	1.34	Tertiary Road	13.8	18.4	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.00	Concrete	0.017	2.5	1.5	8.5
		1F-R4	1+647	1+710	63	Size Change				1.34		13.8	18.4									Concrete	0.017	2.5	1.5	8.5
1H	Og1 Upper Ogunpa	1H-R1	0+935	1+461	526	1559	1+461	Oyeniyi Street Ikolaba GRA, Oyeniyi Str		1.34	Tertiary Road	13.8	18.4	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	1.10	Concrete	0.017	3	1	7
		1H-R2	1+461	1+577	116	641	1+577	Ikolaba,Fadaaya Street	1 BC (2.3 x 1.32)	1.37	Tertiary Road	14.0	18.7	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	1.10	Concrete	0.017	3	1	7
		1H-R3	1+577	1+830	253	640	1+830	Ikolaba, Olufemi Ilori Close	2 BC (1.6 x 1.32)	1.46	Tertiary Road	14.7	19.6	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	1.10	Concrete	0.017	3.5	1	7.5
		1H-R4	1+830	1+981	151	Size Change				1.46		14.7	19.6									Concrete	0.017	3.5	1	7.5
1P	Og1 Upper Ogunpa	1P-R1	1+343	1+438	95	642	1+438	Adeyi Estate, Beckley	1 BC (1.84 x 1.53)	1.12	Tertiary Road	12.2	16.2	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	1.08	Concrete	0.017	3	1	7
		1P-R2	1+438	1+989	551	Size Change				1.12		12.2	16.2									Concrete	0.017	3	1	7
2	Og2 Middle Ogunpa					247		Secretariat, Ogunpa(Dandaru), Paliament Road		12.93	Tertiary Road	123.2	164.2	Existing							0.45	Concrete	0.017	8	4.4	8
		2-R1		0+418	418	144B	0+418	DANDARU,	1 BC (6.5 x 3.83)	13.23	Highway	125.6	167.4	Proposed	Box Culvert	Channelized Stream	2 Cv (4.5 x 4)	5.2	Dar	Masterplan	0.45	Concrete	0.017	8	3.83	8
		2-R2	0+418	0+797	379	1552	0+797	Ireakari Area, Ogunpa, Queen Elizath Road		14.06	Secondary Road	132.2	176.2	Proposed	Box Culvert	Channelized Stream	2 Cv (5 x 4)	5.2	Dar	Masterplan	0.45	Concrete	0.017	10	3.55	10
		2-R3	0+797	1+179	382	246	1+179	Mokola, Ogunpa, Mokola	1 BC (13.2 x 4.33)	14.35	Secondary Road	134.5	179.3	Existing							0.45	Concrete	0.017	13	4.33	13
		2-R4	1+179	1+710	531	245	1+710	Mokola, Omitowoju Street	1 BC (20.7 x 4.1)	16.07	Secondary Road	148.1	197.5	Existing							0.45	Concrete	0.017	20	4.1	20
		2-R5	1+710	2+082	372	143B	2+082	Salvation Army, Ogunpa, Atewoda Street	Br (3 Span 5.36)	16.34	Secondary Road	150.3	200.3	Proposed	Box Culvert	Channelized Stream	Add 1 Cv (3 x 3)	3.9	Dar	Masterplan	0.45	Concrete	0.017	20	2.95	20
		2-R6	2+082	2+483	401	142B	2+483	Ogunpa, Ansarudeen Br., Anasrudeen	Br (3 Span 5.85)	17.29	Main Road	157.8	210.4	Proposed	Box Culvert	Channelized Stream	Add 1 Cv (5 x 3)	3.9	Dar	Masterplan	0.45	Concrete	0.017	20	2.5	20
		2-R7	2+483	2+696	213	244	2+696	Ogunpa, Ogunpa Stream, Ogunpa	Br (19m)	20.30	Tertiary Road	181.7	242.3	Existing							0.45	Concrete	0.017	20	3.1	20
		2-R8	2+696	3+001	305	243	3+001	Ogunpa Market, Ogunpa Stream, Lebanon Street	Br (20.2m)	20.43	Main Road	182.7	243.6	Existing							0.45	Concrete	0.017	20	4.2	20
		2-R9	3+001	3+082	81	242	3+082	Ogunpa Market, Ogunpa Stream, New Court Road	Br (20m)	20.99	Main Road	187.2	249.6	Existing							0.45	Concrete	0.017	20	4.1	20
		2-R10	3+082	3+417	335	241	3+417	Foko Area, Ogunpa, Agbokojo street	Br (25.6m)	21.70	Secondary Road	192.8	257.1	Existing							0.45	Concrete	0.017	25	3.7	25
		2-R11	3+417	3+852	435	141B	3+852	Foko Area, Ogunpa, Alubankudu street	Br (3 Span 6.05)	22.07	Tertiary Road	195.7	261.0	Existing							0.45	Concrete	0.017	25	3.22	25
		2-R12	3+852	4+264	412	235	4+264	Gege, Ogunpa, Gege road	Br (23.9m)	23.08	Secondary Road	203.8	271.7	Existing							0.45	Concrete	0.017	25	3.4	25
		2-R13	4+264	4+558	294	236	4+558	Isale Asake, Ogunpa, Asake	Br (2 Span 9)	23.11	Tertiary Road	204.0	272.0	Existing							0.45	Concrete	0.017	25	3.75	25
		2-R14	4+558	4+900	342	156B	4+900	Akuro, Ogunpa, Oredeyin	Br (3 Span 8.37)	23.84	Tertiary Road	209.8	279.7	Existing							0.45	Concrete	0.017	25	4.4	25
		2-R15	4+900	5+302	402	64	5+302	Poopo, Ogunpa, Poopo road	Br (3 Span 8.13)	24.12	Tertiary Road	212.0	282.7	Existing							0.45	Concrete	0.017	25	4.6	25
		2-R16	5+302	6+012	710	155B	6+012	OGUNPA,	3 BC (8.1 x 3.23)	26.72	Highway	226.5	302.0	Existing							0.45	Concrete	0.017	25	3.23	25
		2-R17	6+012	6+390	378	Size Change				26.72		226.5	302.0									Concrete	0.017	25	3.2	25
2C	Og2 Middle Ogunpa	2C-R1	1+104	1+304	200	38	1+304	Mokola, Sabo Road	2 BC (2.7 x 2.41)	1.17	Main Road	12.5	16.7	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	0.93	Concrete	0.017	2.5	1.5	8.5
		2C-R2	1+304	1+496	192	290	1+496	Mokola, Mokola Road	2 BC (2.9 x 2.41)	1.42	Highway	14.4	19.2	Existing							0.93	Concrete	0.017	2.5	1.5	8.5
		2C-R3	1+496	1+552	56	Size Change				1.42		14.4	19.2									Concrete	0.017	2.5	1.5	8.5
2F	Og2 Middle Ogunpa	2F-R1	1+158	1+279	121	37	1+279	ONIREKE ROAD	2 BC (3.75 x 3.2)	1.43	Main Road	14.5	19.3	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	0.67	Concrete	0.017	4	1	8
		2F-R2	1+279	1+548	269	34	1+548	ONIREKE	1 BC (1.65 x 1.13)	1.65	Tertiary Road	16.1	21.5	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	0.67	Concrete	0.017	4	1	8
		2F-R3	1+548	1+660	112	1549	1+660	Onireke		1.71	Tertiary Road	16.6	22.1	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	0.67	Concrete	0.017	4	1	8
		2F-R4	1+660	2+033	373	35	2+033	FAJUYI ROAD	2 BC (2.35 x 1.55)	2.47	Highway	22.3	29.7	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	0.67	Concrete	0.017	4	1.5	10
		2F-R5	2+033	2+279	246	33	2+279	DUGBE-ALAWO ROAD	1 BC (9.1 x 2)	2.85	Tertiary Road	25.1	33.5	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.67	Concrete	0.017	4.5	1.5	10.5
		2F-R6	2+279	2+646	367	Size Change				2.85												Concrete	0.017	4.5	1.5	10.5
2Q	Og2 Middle Ogunpa	2Q-R1	1+240	1+261	21	248	1+261	Titi Akala, Aladorin Isale Osi	2 BC (6.4 x 2.7)	1.01	Tertiary Road	11.3	15.1	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	0.73	Concrete	0.017	2.5	1.5	8.5
		2Q-R2	1+261	2+012	751	358	2+012	Popo Area, Popo Road	1 BC (6.5 x 2.44)	1.65	Tertiary Road	16.1	21.5	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 2)	2.6	Dar	Masterplan	0.73	Concrete	0.017	3	1.5	9
		2Q-R3	2+012	2+278	266	Size Change				1.65		16.1	21.5									Concrete	0.017	3	1.5	9

Channel Data						Structure Data								Design of Structures							Design of Channels					
Channel ID	Subbasin	Reach ID	Start Station	End Station	Reach Length (m)	Structure No.	Structure Station	Location	Existing Crossing Structure Dimensions	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Vertical Distance from Road L. to Prop. Culv. Inv.	Designed by	Status	Stream Slope (%)	Lining Protection	Roughness Coeff. For Channel	Bed Width (m)	Design Depth (m)	Top Width (m)
3	Og3 Kudeti	3-R1	1+489	1+555	66	279	1+555	Oluyoro, Oluyoro Road	2 BC (1.8 x 1.55)	1.06	Secondary Road	11.7	15.6	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	0.86	Concrete	0.017	3	1	7
		3-R2	1+555	1+714	159	278	1+714	Oluyoro, Oluyoro-Aladorin Road	2 BC (3.1 x 2.36)	1.12	Secondary Road	12.2	16.2	Existing							0.86	Concrete	0.017	3	1.5	9
		3-R3	1+714	2+023	309	96	2+023	ODE AYE ALALUBOSA	2 BC (1.98 x 1.62)	1.68	Secondary Road	16.4	21.8	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 2)	2.6	Dar	Masterplan	0.86	Concrete	0.017	3	1.5	9
		3-R4	2+023	2+356	333	277	2+356	Alabede, Alabede area	2 BC (3 x 2.12)	1.83	Tertiary Road	17.5	23.3	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 2)	2.6	Dar	Masterplan	0.86	Concrete	0.017	3	1.5	9
		3-R5	2+356	2+715	359	324	2+715	Aremo, Adekanbi Street		2.45	Tertiary Road	22.1	29.5	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 2)	2.6	Dar	Masterplan	0.86	Concrete	0.017	3.5	1.5	9.5
		3-R6	2+715	2+866	151	323	2+866	Ilupeju Agugu, Binukonu Area	3 BC (2.7 x 2.36)	2.49	Tertiary Road	22.4	29.9	Existing							0.86	Concrete	0.017	3.5	1.5	9.5
		3-R7	2+866	3+301	435	276	3+301	Aremo Adekile, Aremo grave yard	3 BC (2.79 x 2.33)	3.65	Tertiary Road	31.1	41.5	Proposed	Box Culvert	Channelized Stream	1 Cv (5 x 2)	2.6	Dar	Masterplan	0.86	Concrete	0.017	5	1.5	11
		3-R8	3+301	3+640	339	275	3+640	Aperin, Aperin Road	2 BC (3 x 2.87)	4.55	Main Road	57.1	76.1	Proposed	Box Culvert	Channelized Stream	1 Cv (7 x 2.5)		Dar	Lot1 (Going for Bid)	0.86	Concrete	0.017	7	2	15
		3-R9	3+640	4+364	724	297	4+364	Adelagun, Oluyoro Stream, Alamuyo Gbelekale		5.14	Tertiary Road	63.8	85.0	Proposed	Box Culvert	Channelized Stream	2 Cv (4 x 2)	2.6	Dar	Masterplan	0.93	Concrete	0.017	4	1.5	10
		3-R10	4+364	4+781	417	274	4+781	Kosodo Area, Oluyoro Stream, Kosodo-Labo	Br (31m)	5.52	Tertiary Road	67.5	90.0	Proposed	Box Culvert	Channelized Stream	2 Cv (4 x 2)	2.6	Dar	Masterplan	0.93	Concrete	0.017	4	1.5	10
		3-R11	4+781	5+103	322	Size Change						67.5	90.0									Concrete	0.017	8	1.5	14
		3-R12	5+103	5+212	109	273	5+212	Beere, Labo Stream, Beere road	3 BC (2.9 x 3.05)	5.67	Main Road	67.5	90.0	Proposed	Box Culvert	Channelized Stream	1 Cv (8 x 2.5)		Dar	Lot1 (Going for Bid)	0.93	Concrete	0.017	13	1.5to4	Var.
		3-R13	5+212	5+545	333	Size Change				5.67		67.5	90.0									Concrete	0.017	8	2.5	18
		3-R14	5+212	5+650	438	Size Change				5.67		67.5	90.0									Concrete	0.017	8 to 44	3	Var.
4	Og3 Kudeti	4-R1	1+136	1+612	476	51	1+612	Yemetu, Alawada Area	1 BC (8.7 x 2.4)	1.57	Main Road	15.5	20.7	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 2)	2.6	Dar	Masterplan	0.83	Concrete	0.017	3	1.5	9
		4-R2	1+612	1+930	318	1553	1+930	Yemetu Akabiako, Orogbangba Street		2.14	Tertiary Road	19.8	26.4	Existing							0.83	Concrete	0.017	3.5	1.5	9.5
		4-R3	1+930	2+039	109	265	2+039	Yemetu-Adeoyo, Ade oyo Street	2 BC (2.9 x 2.46)	2.18	Main Road	20.1	26.8	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 2)	2.6	Dar	Masterplan	0.83	Concrete	0.017	3.5	1.5	9.5
		4-R4	2+039	2+165	126	1554	2+165	Yemetu Akabiako, Orogbangba Street		2.22	Tertiary Road	20.4	27.2	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 2)	2.6	Dar	Masterplan	0.83	Concrete	0.017	3.5	1.5	9.5
		4-R5	2+165	2+379	214	266	2+379	Yemetu -Idi Ape Area, Traffic High way	2 BC (2.7 x 2.05)	2.31	Highway	21.1	28.1	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 2)	2.6	Dar	Masterplan	0.83	Concrete	0.017	3.5	1.5	9.5
		4-R6	2+379	2+474	95	1555	2+474	Oje Ibadan, Temidire		2.40	Tertiary Road	21.8	29.0	Existing							0.83	Concrete	0.017	3.5	1.5	9.5
		4-R7	2+474	2+620	146	267	2+620	Aderogba, Obasanjo Road	2 BC (2.9 x 1.97)	2.41	Secondary Road	21.8	29.1	Existing							0.83	Concrete	0.017	3.5	1.5	9.5
		4-R8	2+620	2+808	188	269	2+808	Alafara Bashorun, Oje Igosu	2 BC (3 x 2.65)	3.15	Main Road	27.4	36.5	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.83	Concrete	0.017	4.5	1.5	10.5
		4-R9	2+808	2+982	174	270	2+982	Abeni Ape	2 BC (4.7 x 3.11)	4.72	Main Road	39.2	52.2	Proposed	Box Culvert	Channelized Stream	3 Cv (5 x 3)	3.9	Dar	Masterplan	0.83	Concrete	0.017	4.5	2	12.5
		4-R10	2+982	3+987	1005	Size Change						39.2	52.2									Concrete	0.017	4.5	2	12.5
		4-R11	3+987	4+003	16	271	4+003	Beere, Orita Aperin Beere road	Br (14.8m)	5.78	Main Road	53.9	71.8	Existing							0.67	Concrete Sides	0.027	5	2	13
		4-R12	4+003	4+237	234	Size Change				5.78		53.9	71.8									Concrete Sides	0.027	15	2.5	25
		4-R13	4+237	4+335	98	Size Change				5.78		53.9	71.8									Concrete Sides	0.027	15 to 44	3	Var.
5	Og3 Kudeti	5-R1		0+059	59	272	0+059	Asanke Street, Okun Stream, Asanke Street	1 CC (0.9 dia) + BC (3.8 x 3.18)	11.94	Secondary Road	108.0	144.0	Existing							0.59	Concrete Sides	0.027	44	3	56
		5-R2	0+059	0+227	168	Size Change						108.0	144.0									Concrete Sides	0.027	44 to15	2.5	Var.
		5-R3	0+227	0+382	155	367	0+382	Agbongbon, Beside Agbogbon pry health centre	1 BC (12.3 x 5.16)	12.15	Secondary Road	108.0	144.0	Proposed							0.59	Concrete Sides	0.027	15	3	Var.
		5-R4	0+382	0+792	410	393	0+792	Idi Arere,	1 BC (36.5 x 5.9)	14.41	Secondary Road	122.8	163.7	Existing							0.59	Concrete Sides	0.027	15	3	27
		5-R5	0+792	1+176	384	Size Change						122.8	163.7									Concrete Sides	0.027	15	3.5	29
		5-R6	1+176	1+212	36	Size Change						122.8	163.7									Concrete Sides	0.027	15 to19.24	3.5	Var.
		5-R7	1+212	1+276	64	Size Change						122.8	163.7									Concrete Sides	0.027	19.24 to 15	3.5	Var.
		5-R8	1+276	1+451	175	Size Change						122.8	163.7									Concrete Sides	0.027	15	3.5	29
		5-R9	1+451	1+501	50	Size Change						140.1	186.8									Concrete Sides	0.027	15 to 20	3.5	Var.
		5-R10	1+451	1+702	251	363	1+702	Molete, Ogunpa, Yejide Avenue		16.24	Tertiary Road	140.1	186.8	Existing							0.59	Concrete Sides	0.027	20	3.5	34
5B	Og3 Kudeti	5B-R1	1+337	1+744	407	369	1+744	Eleta, Eleta Road	2 BC (3 x 1.73)	1.37	Main Road	14.0	18.7	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.08	Concrete	0.017	2.5	1.5	8.5
		5B-R2	1+744	2+001	257	365	2+001	Olunloyo, Tewogbade	1 BC (13.3 x 2.79)	1.62	Tertiary Road	15.9	21.2	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.08	Concrete	0.017	2.5	1.5	8.5
		5B-R3	2+001	2+181	180	366	2+181	Olunloyo, Tewogbade		1.66	Tertiary Road	16.2	21.6	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.08	Concrete	0.017	2.5	1.5	8.5
		5B-R4	2+181	2+323	142	368	2+323	Agbongbon, Olunloyo Street	3 BC (2.4 x 1.86)	1.72	Secondary Road	16.7	22.2	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.08	Concrete	0.017	2.5	1.5	8.5
		5B-R5	2+323	2+606	283	Size Change				1.72		16.7	22.2									Concrete	0.017	2.5	1.5	8.5
5C	Og3 Kudeti	5C-R1	1+144	1+165	21	39D1	1+165	ODE-KERREWU LANDLORDS AND TENANTS ASSOCIATION		1.07	No Road	11.8	15.7									Concrete	0.017	3.5	1	7.5
		5C-R2	1+165	1+318	153	39D3	1+318	ODE-KERREWU LANDLORDS AND TENANTS ASSOCIATION		1.14	No Road	12.3	16.4									Concrete	0.017	3.5	1	7.5
		5C-R3	1+318	1+995	677	63	1+995	YEJIDE , KUDETI ROAD	1 BC (3.4 x 1.28)	1.39		14.2	18.9	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	0.80	Concrete	0.017	3.5	1	7.5
		5C-R4	1+995	2+006	11	Size Change				1.39		14.2	18.9									Concrete	0.017	3.5	1	7.5
		5C-R5	2+006	2+122	116	Size Change				1.39		14.2	18.9									Concrete	0.017	3.5	1	7.5
6	Og4 Lower Ogunpa	6-R1		0+269	269	376	0+269	Molete, Ogunpa,	Br (37.2m)	43.30	Secondary Road	470.3	627.1	Existing							0.27	Concrete Sides	0.027	24	3.5	38
		6-R2	0+269	1+383	1114	866	1+383	FELELE, OGUNPA RIVER, GBANAMU AREA	Br (4 Span 11.4)	45.14	Tertiary Road	470.3	627.1	Existing							0.27	Concrete Sides	0.027	24	3.5	38
		6-R3	1+383	2+301	918	Size Change				45.14		470.3	627.1									Concrete Sides	0.027	24	3.5	38
7	Og4 Lower Ogunpa	7-R1	1+086	1+171	85	382	1+171	Owode Academy		1.11	Main Road	12.1	16.1	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.03	Concrete	0.017	2.5	1.5	8.5
		7-R2	1+171	1+581	410	383	1+581	Owode Academy, Adekola street	2 BC (2.1 x 2.92)	1.38	Tertiary Road	14.1	18.8	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.03	Concrete	0.017	2.5	1.5	8.5
		7-R3	1+581	2+053	472	384	2+053	Elere, Odo ile Tawa		1.69	Tertiary Road	16.4	21.9	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.03	Concrete	0.017	2.5	1.5	8.5
		7-R4	2+053	2+423	370	385	2+423	Elere, Odo oba elere	2 BC (2.6 x 1.76)	1.84	Secondary Road	17.6	23.4	Existing							1.03	Concrete	0.017	3	1.5	9
		7-R5	2+423	2+686	263	61	2+686	ODO OBA ELERE AREA	2 BC (2.85 x 2.31)	2.07	Tertiary Road	19.3	25.7	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 2)	2.6	Dar	Masterplan	1.03	Concrete	0.017	3	1.5	9
		7-R6	2+686	2+841	155	888	2+841	SANYO, SANYO STREET		2.83	Secondary Road	25.0	33.3	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	1.03	Concrete	0.017	4	1.5	10
		7-R7	2+841	3+202	361	889	3+202	SANYO, IREWUMI STREET		3.05	Tertiary Road	26.6	35.5	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	1.03	Concrete	0.017	4	1.5	10
		7-R8	3+202	3+629	427	880	3+629	SANYO, SANYO AREA		3.49	Tertiary Road	29.9	39.9	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	1.03	Concrete	0.017	4	1.5	10
		7-R9	3+629	4+182	553	Size Change						29.9	39.9								1.03	Concrete	0.017	4	1.5	10
		7-R10	4+182	4+441	259	55B	4+441	OGUNPA RCC RIVER	6 BC (3.72 x 3.41)	6.94	Highway	64.8	86.4	Existing							1.03	Concrete	0.017	6	2.5	16
7E	Og4 Lower Ogunpa	7E-R1	0+945	1+111	166	60	1+111	AKINFENWA	1 BC (1.67 x 1.6)	1.30	Tertiary Road	13.5	18.0	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.14	Concrete	0.017	2.5	1.5	8.5
		7E-R2	1+111	1+700	589	59	1+700	SANYO , BOLUWAJI	1 BC (2.9 x 1.42)	2.25	Tertiary Road	20.6	27.5	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 2)	2.6	Dar	Masterplan	1.14	Concrete	0.017	3	1.5	9
		7E-R3	1+700	2+003	303	891	2+003	SANYO, OKESUNA STREET		2.45	Tertiary Road	22.1	29.5	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 2)	2.6	Dar	Masterplan	1.14	Concrete	0.017	3.5	1.5	9.5
		7E-R4	2+003	2+217	214	58	2+217	AGBAMU , TEMIDRE DAMO RIVER	2 BC (3 x 2.18)	2.56	Tertiary Road	23.0	30.6	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 2)	2.6	Dar	Masterplan	1.14	Concrete	0.017	3.5	1.5	9.5
		7E-R5	2+217	2+476	259	57	2+476	TMIDIRE , DAMO RIVER	1 BC (3.2 x 1.75)	2.77	Tertiary Road	24.5	32.7	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 2)	2.6	Dar	Masterplan	1.14	Concrete	0.017	3.5	1.5	9.5
		7E-R6	2+476	2+834	358	56	2+834	Sanyo/Sooka, Lagos/Ibadan Express	1 BC (2.6 x 1.9)	3.01	Expressway	26.3	35.1	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	1.14	Concrete	0.017	4	1.5	10
		7E-R7	2+834	3+058	224	Size Change				3.01		26.3	35.1									Concrete	0.017	4	1.5	10
8	Og4 Lower Ogunpa	8-R1		0+269	269	54B	0+269	SOKA, SOKA	Br (3 Span 19.4)	53.36	Expressway	482.8	643.7	Existing							0.47	Concrete Sides	0.027	24	3.5	38
		8-R2	0+269	2+928	2659	1230	2+928	RED ROOF AREA, TOLL GATE, OGUNPA,TOLL GATE, LEAD CITY ,TOLL GATE		57.33	Tertiary Road	485.1	646.9	Proposed	Bridge	Channelized Stream	Br (45 x 10)	5	Dar	Masterplan	0.47	Concrete Sides	0.027	30	3.5	44
		8-R3	2+928	3+758	830	Size Change				57.33		485.1	646.9									Concrete Sides	0.027	30	3.5	44
8D	Og4 Lower Ogunpa	8D-R1	1+217	1+290	73	883	1+290	IDI MANGORO/SOKA, AANU OLUWAPO STREET		1.10	Tertiary Road	12.0	16.0	Proposed	Box Culvert	Channelized Stream	1 Cv (2 x 1.5)	1.95	Dar	Masterplan	2.67	Concrete	0.017	2	1	6
		8D-R2	1+290	1+466	176	882	1+466	SOKA/IDI MANGORO, ENGR BAYO STREET	2 BC (1.26 x 1.86)	1.22	Secondary Road	12.9	17.2	Existing							2.67	Concrete	0.017	2	1	6
		8D-R3	1+466	1+643	177	Size Change				1.22		12.9	17.2									Concrete	0.017	2	1	6

Channel Data						Structure Data								Design of Structures							Design of Channels					
Channel ID	Subbasin	Reach ID	Start Station	End Station	Reach Length (m)	Structure No.	Structure Station	Location	Existing Crossing Structure Dimensions	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Vertical Distance from Road L. to Prop. Culv. Inv.	Designed by	Status	Stream Slope (%)	Lining Protection	Roughness Coeff. For Channel	Bed Width (m)	Design Depth (m)	Top Width (m)
9	Og4 Lower Ogunpa	9-R1	0+794	1+287	493	71	1+287	ATAGBA	2 CC (0.9 dia) + BC (2.13 x 1.9)	1.30	Tertiary Road	13.5	18.0	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.10	Concrete	0.017	2.5	1.5	8.5
		9-R2	1+287	1+779	492	1221	1+779	OKE-ODE, AGBAMU, AGBAMU-SANYO	1 BC (2.8 x 2.62)	2.55	Tertiary Road	22.9	30.5	Existing							1.10	Concrete	0.017	3.5	1.5	9.5
		9-R3	1+779	2+702	923	1224	2+702	INUEWE STRAIGT AJOFEEBO, ABA,AJOFEEBO	2 CC (1.2 dia)	3.41	Tertiary Road	29.3	39.1	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 2)	2.6	Dar	Masterplan	1.10	Concrete	0.017	4.5	1.5	10.5
		9-R4	2+702	2+777	75	Size Change						29.3	39.1									Concrete	0.017	4.5	1.5	10.5
		9-R5	2+777	3+042	265	1234	3+042	IFESOWAPO, IDI-IROKO,OLUNDE, ODO AARIN MEJI INUEWE, INU EWE,OLUNDE	3 CC (0.9 dia)	5.34		63.7	84.9	Proposed	Box Culvert	Channelized Stream	1 Cv (6 x 2.5)	3.25	Dar	Masterplan		Concrete	0.017	6	2	14
		9-R6	3+042	3+552	510	1237	3+552	PEACE RD, MAJE, ODO MAJE, MAJE SOKA	4 CC (1.26 dia)	6.10		63.7	84.9	Proposed	Box Culvert	Channelized Stream	3 Cv (3 x 3.5)		Pheman	Going For Bid		Concrete	0.017	6	2	14
		9-R7	3+552	3+952	400	1239	3+952	IRORUN OLUWA RD 48, IRORUN OLUWA, GATE B, NEW FELELE, SOKA	2 CC (0.9 dia)	6.97		63.7	84.9	Proposed	Box Culvert	Channelized Stream	1 Cv (6 x 2.5)	3.25	Dar	Masterplan		Concrete	0.017	6	2	14
		9-R8	3+952	4+519	567	1226	4+519	SURULERE, Zone 19, SURULERE, NEW FELELE,SOKA	1 CC (1.83 dia) + BC (1 x 2.2)	7.36		63.7	84.9	Proposed	Box Culvert	Channelized Stream	1 Cv (6 x 2.5)	3.25	Dar	Masterplan		Concrete	0.017	6	2	14
		9-R9	4+519	4+923	404	Size Change				7.36		63.7	84.9									Concrete	0.017	6	2	14
9F	Og4 Lower Ogunpa	9F-R1	1+133	1+486	353	1231	1+486	FARIA, OFF SANYO, FARIA, OLUNDE	3 CC (0.716 dia)	1.55	Tertiary Road	15.4	20.5	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	1.16	Concrete	0.017	3.5	1	7.5
		9F-R2	1+486	1+738	252	1232	1+738	ABA AJOFEEBO, AGBAMU SANYO, ABA,AJOFEEBO	1 CC (1.5 dia)	1.68	Tertiary Road	16.4	21.8	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	1.16	Concrete	0.017	3.5	1	7.5
		9F-R3	1+738	1+945	207	1233	1+945	ABA AJOFEEBO,ZONE 7	1 CC (1.18 dia)	1.82	Tertiary Road	17.4	23.2	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	1.16	Concrete	0.017	3.5	1	7.5
		9F-R4	1+945	2+123	178	Size Change				1.82		17.4	23.2									Concrete	0.017	3.5	1	7.5
10	Og4 Lower Ogunpa					1240		SURULERE, OGUNPA,SURULERE, NEW FELELE,SOKA		65.20	Tertiary Road	508.7	678.3	Proposed	Bridge	Channelized Stream	Br (45 x 10)	6	Dar	Masterplan	0.25	Concrete Sides	0.027	30	3.5	44
		10-R1		2+318	2318	Size Change				65.20		508.7	678.3									Concrete Sides	0.027	30	3.5	44
		10-R2	2+318	4+279	1961	Size Change				65.20		510.2	680.3									Concrete Sides	0.027	48	3.5	62
10B	Og4 Lower Ogunpa	10B-R1	1+226	2+136	910	1246	2+136	BESIDE LENBOLA BLOCK,OLOJE SURULERE, NEW FELELE, SOKA		2.67	Tertiary Road	23.8	31.7	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	1.40	Concrete	0.017	4	1	8
		10B-R2	2+136	2+464	328	Size Change				2.67		23.8	31.7									Concrete	0.017	4	1	8
10B-3	Og4 Lower Ogunpa	10B-3-R1	1+010	1+419	409	Size Change				1.50		15.0	20.0								1.50	Concrete	0.017	3	1	7
24	OM2 Omi Headwaters	24-R1		1+252	1252	1369	1+252	Olodo-odan, Omi, Olujinle/Onimo	2 BC (1.35 x 1.8)	32.94	Tertiary Road	178.1	237.4	Proposed	Box Culvert	Channelized Stream	3 Cv (6.5 x 2.5)	3.25	Dar	Masterplan	0.42	Concrete	0.017	20	2	28
		24-R2	1+252	1+748	496	Size Change				32.94		178.1	237.4									Concrete	0.017	20	2	28
25	OM2 Omi Headwaters South	25-R1	1+352	2+910	1558	Size Change				1.75		16.9	22.5								1.08	Concrete	0.017	3.5	1	7.5
		25-R2	2+910	3+482	572	1363	3+482	Onigbinde, Kojaja, Kojaja		5.71	Tertiary Road	45.0	60.0	Proposed	Box Culvert	Channelized Stream	2 Cv (4 x 2)	2.6	Dar	Masterplan	0.65	Concrete	0.017	6	1.5	12
		25-R3	3+482	3+705	223	Size Change				5.71		45.0	60.0									Concrete	0.017	6	1.5	12
26	OM2 Omi Headwaters	26-R1		0+489	489	1370	0+489	Onigbinde, Omi, Oloko-Kete	1 BC (3.1 x 1.6)	40.12	Tertiary Road	217.7	290.3	Proposed	Bridge	Channelized Stream	Br (35 x 10)	4.5	Dar	Masterplan	0.38	Concrete	0.017	22	2.5	32
		26-R2	0+489	2+313	1824	Size Change				40.12		217.7	290.3									Concrete	0.017	22	2.5	32
27	OM2 Omi Headwaters South	27-R1	1+066	1+259	193	1342	1+259	Atobaba/Alafia community, Alagbada	1 CC (0.78 dia)	1.15		12.4	16.5	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	0.82	Concrete	0.017	3	1	7
		27-R2	1+259	1+552	293	1343	1+552	Olorunda Abaa, Abaa Igbagbo		1.86		17.7	23.6	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	0.82	Concrete	0.017	4	1	8
		27-R3	1+552	2+582	1030	1344	2+582	Kutaayii, Kutaayii/Lamona	1 CC (0.77 dia)	2.91		25.6	34.1	Proposed	Box Culvert	Channelized Stream	2 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	0.82	Concrete	0.017	7	1	11
		27-R4	2+582	3+937	1355	1345	3+937	Egba community zone 1, Road 14		3.90		33.0	44.0	Proposed	Box Culvert	Channelized Stream	2 Cv (4 x 1.5)	1.95	Dar	Masterplan	0.82	Concrete	0.017	8	1	12
		27-R5	3+937	4+100	163	1346	4+100	Egba community zone 1, Road 12		4.06		34.2	45.6	Proposed	Box Culvert	Channelized Stream	2 Cv (4 x 1.5)	1.95	Dar	Masterplan	0.82	Concrete	0.017	8	1	12
		27-R6	4+100	4+341	241	1535	4+341	Jenriyin, Egba Zone 1	1 CC (0.8 dia)	4.17		35.0	46.7	Proposed	Box Culvert	Channelized Stream	2 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	0.82	Concrete	0.017	9	1	13
		27-R7	4+341	4+560	219	1346 Prime	4+560	, Ahere 1, Olorunda	1 BC (2 x 1)	6.70	Secondary Road	50.5	67.3	Proposed	Box Culvert	Channelized Stream	2 Cv (5 x 2)	2.6	Dar	Masterplan	0.68	Concrete	0.017	10	1.5	16
		27-R8	4+560	5+231	671	1348	5+231	Odan-Elekan, Ahere 2, Akinlumo	1 BC (1.8 x 1)	7.70	Secondary Road	55.9	74.6	Proposed	Box Culvert	Channelized Stream	2 Cv (5 x 2)	2.6	Dar	Masterplan	0.68	Concrete	0.017	10	1.5	16
		27-R9	5+231	5+943	712	106	5+943	ASAJU , UNITY ESTATE,	2 CC (0.81 dia)	8.19	Tertiary Road	58.6	78.1	Proposed	Box Culvert	Channelized Stream	2 Cv (5 x 2)	2.6	Dar	Masterplan	0.68	Concrete	0.017	10	1.5	16
		27-R10	5+943	6+105	162	Size Change				8.19		46.3	61.8									Concrete	0.017	10	1.5	16
27K	OM2 Omi Headwaters South	27K-R1	1+218	2+815	1597	Size Change				3.00		26.3	35.0								0.88	Concrete	0.017	4	1.5	10
28	OM2 Omi Headwaters South	28-R1		0+961	961	1383	0+961	ASAJU-IFESOWAPO, ASAJU, ROAD 1		55.66	Tertiary Road	268.0	357.4	Proposed	Bridge	Channelized Stream	Br (35 x 10)	5	Dar	Masterplan	0.25	Concrete	0.017	23	2.5	33
		28-R2	0+961	1+834	873	1384	1+834	OGANLA, OMI, PAGUN	1 BC (9.1 x 2.46)	58.46	Tertiary Road	279.5	372.6	Proposed	Bridge	Channelized Stream	Br (40 x 10)	5	Dar	Masterplan	0.25	Concrete	0.017	28	2.5	38
		28-R3	1+834	1+877	43	105	1+877	OKE-OMI / OGA NLA,	2 BC (3.07 x 3.37)	58.54		279.5	372.6	Proposed	Bridge	Channelized Stream	Br (40 x 10)	5	Dar	Masterplan	0.25	Concrete	0.017	28	2.5	38
		28-R4	1+877	2+460	583	Size Change				58.54		279.5	372.6									Concrete	0.017	28	2.5	38
28A	OM2 Omi Headwaters South	28A-R1	1+242	1+746	504	973	1+746	Kore Estate-Olodo, Orita Odan road	2 BC (0.8 x 1.04)	1.38		14.1	18.8	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	0.91	Concrete	0.017	3.5	1	7.5
		28A-R2	1+746	1+924	178	979	1+924	Orita Odan Area-Jenriyin, Kute road	1 CC (0.73 dia)	1.42		14.4	19.2	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	0.91	Concrete	0.017	3.5	1	7.5
		28A-R3	1+924	3+061	1137	980	3+061	Olodo Area, Odan Road	2 BC (1.09 x 1.06)	2.55		22.9	30.5	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.91	Concrete	0.017	4.5	1.5	10.5
		28A-R4	3+061	3+741	680	981	3+741	Iranlowo Oluwa Estate, Area C	2 CC (0.75 dia)	3.32		28.7	38.2	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.91	Concrete	0.017	4.5	1.5	10.5
		28A-R5	3+741	4+140	399	1372	4+140	ASAJU CENTRAL ESTATE, MAIN ROAD 1	1 CC (0.85 dia)	3.49		29.9	39.9	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.91	Concrete	0.017	4.5	1.5	10.5
		28A-R6	4+140	4+276	136	Size Change				3.49		29.9	39.9									Concrete	0.017	4.5	1.5	10.5
28D	OM2 Omi Headwaters	28D-R1	1+307	2+267	960	1373	2+267	OGANLA, OMOLASO	1 BC (1.8 x 1.1)	2.05		19.1	25.5	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 2)	2.6	Dar	Masterplan	1.06	Concrete	0.017	3	1.5	9
		28D-R2	2+267	2+504	237	Size Change				2.05		19.1	25.5									Concrete	0.017	3	1.5	9
31	OM3 Upper Omi West	31-R1	1+184	1+659	475	719	1+659	Akobo-Ojurin, Yawiri Road	2 CC (0.9 dia)	1.85	Secondary Road	17.6	23.5	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	0.93	Concrete	0.017	4	1	8
		31-R2	1+659	2+283	624	98	2+283	PAPA ATU	1 BC (1.37 x 1.02)	3.37	Tertiary Road	29.0	38.7	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.93	Concrete	0.017	4.5	1.5	10.5
		31-R3	2+283	3+358	1075	Size Change						29.0	38.7									Concrete	0.017	4.5	1.5	10.5
		31-R4	3+358	4+459	1101	939	4+459	Kute-Orisunbare zone 11, Shonekan, Shonekan road	2 CC (0.6 dia)	6.36	Tertiary Road	48.6	64.9	Proposed	Box Culvert	Channelized Stream	2 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.67	Concrete	0.017	7	1.5	13
		31-R5	4+459	4+733	274	Size Change						48.6	64.9									Concrete	0.017	7	1.5	13
		31-R6	4+733	5+403	670	119	5+403	GBO-ADURA-OJU IRIN,	2 BC (1.67 x 1.56)	7.38	Secondary Road	54.2	72.3	Proposed	Box Culvert	Channelized Stream	2 Cv (5 x 2)	2.6	Dar	Masterplan	0.67	Concrete	0.017	10	1.5	16
		31-R7	5+403	5+928	525	Size Change				7.38		54.2	72.3									Concrete	0.017	10	1.5	16

Channel Data						Structure Data								Design of Structures							Design of Channels					
Channel ID	Subbasin	Reach ID	Start Station	End Station	Reach Length (m)	Structure No.	Structure Station	Location	Existing Crossing Structure Dimensions	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Vertical Distance from Road L. to Prop. Culv. Inv.	Designed by	Status	Stream Slope (%)	Lining Protection	Roughness Coeff. For Channel	Bed Width (m)	Design Depth (m)	Top Width (m)
32	OM3 Upper Omi West	32-R1	1+454	1+926	472	1356	1+926	Olorunda Abaa, Road 1,Ogooluwa Estate		1.36		14.0	18.6	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	0.81	Concrete	0.017	3.5	1	7.5
		32-R2	1+926	2+960	1034	1351	2+960	Eleshinla Village, Eleshinla Road		3.71	Tertiary Road	31.6	42.1	Proposed	Box Culvert	Channelized Stream	1 Cv (5 x 2)	2.6	Dar	Masterplan	0.81	Concrete	0.017	5	1.5	11
		32-R3	2+960	3+680	720	1352	3+680	Alapata Estate, Onireke Road	1 BC (1.85 x 0.74)	4.74	Secondary Road	39.3	52.4	Proposed	Box Culvert	Channelized Stream	1 Cv (6 x 2)	2.6	Dar	Masterplan	0.81	Concrete	0.017	6	1.5	12
		32-R4	3+680	3+780	100	Size Change						39.3	52.4									Concrete	0.017	6	1.5	12
		32-R5	3+780	4+192	412	101	4+192	TEMIDIER , SOKA ELEGA,	1 CC (0.8 dia)	6.45	Tertiary Road	49.1	65.5	Proposed	Box Culvert	Channelized Stream	2 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.60	Concrete	0.017	8	1.5	14
		32-R6	4+192	4+665	473	1534	4+665	Harmony Estate, Kumapayi		6.97	Tertiary Road	52.0	69.3	Proposed	Box Culvert	Channelized Stream	2 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.60	Concrete	0.017	8	1.5	14
		32-R7	4+665	5+203	538	Size Change						52.0	69.3									Concrete	0.017	8	1.5	14
		32-R8	5+203	5+800	597	100	5+800	AKOKA,	1 BC (1.97 x 1.44)	8.70	Secondary Road	61.4	81.8	Proposed	Box Culvert	Channelized Stream	2 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.60	Concrete	0.017	9	1.5	15
		32-R9	5+800	6+301	501	931	6+301	Kute, Ibagun / Shokobi, Ibagun / Shokobi road	2 BC (1.2 x 1.7)	10.28	Tertiary Road	79.0	105.4	Proposed	Box Culvert	Channelized Stream	2 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.60	Concrete	0.017	9	1.5	15
		32-R10	6+301	6+586	285	932	6+586	Kute, Farinto, Farinto	1 BC (2.4 x 1.5)	10.50	Tertiary Road	79.0	105.4	Proposed	Box Culvert	Channelized Stream	2 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.60	Concrete	0.017	13	1.5	19
		32-R11	6+586	6+634	48	Size Change						79.0	105.4									Concrete	0.017	13	1.5	19
		32-R12	6+634	6+727	93	972	6+727	Kute Area, Powerline, Powerline		10.64	Tertiary Road	79.0	105.4	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2)	2.6	Dar	Masterplan	0.60	Concrete	0.017	13	1.5	19
		32-R13	6+727	6+899	172	974	6+899	Kute Area, Sobaloju, Sobaloju		10.74	Tertiary Road	79.0	105.4	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2)	2.6	Dar	Masterplan	0.60	Concrete	0.017	13	1.5	19
		32-R14	6+899	7+016	117	933	7+016	Kute, Ifellodun zone 17, Ifelodun Zone 17	1 BC (2.6 x 1.62)	11.09	Tertiary Road	79.0	105.4	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2)	2.6	Dar	Masterplan	0.60	Concrete	0.017	13	1.5	19
		32-R15	7+016	7+337	321	97	7+337	SIONI/OPEOLU,	2 CC (1.8 dia)	19.36	Tertiary Road	129.0	171.9	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2)	2.6	Dar	Masterplan	0.60	Concrete	0.017	13	1.5	19
		32-R16	7+337	7+496	159	990	7+496	Agbaja Olodo, Opeolu Layout, Behind Oremeji house		19.40	Tertiary Road	129.0	171.9	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2)	2.6	Dar	Masterplan	0.60	Concrete	0.017	13	1.5	19
		32-R17	7+496	8+005	509	Size Change						129.0	171.9									Concrete	0.017	14	2	22
		32-R18	8+005	8+088	83	1522	8+088	Olodo kumapayi, Opeolu Agbaja		19.83	Tertiary Road	129.0	171.9	Proposed	Box Culvert	Channelized Stream	2 Cv (7.5 x 2.5)	3.25	Dar	Masterplan	0.60	Concrete	0.017	16	2	24
		32-R19	8+088	8+204	116	934	8+204	Arulogun Alaja, Along railway line, Railway line	Br (2 Span 6.45)	19.87	Tertiary Road	129.0	171.9	Proposed	Box Culvert	Channelized Stream	2 Cv (7.5 x 2.5)	3.25	Dar	Masterplan	0.60	Concrete	0.017	16	2	24
		32-R20	8+204	8+277	73	Size Change				19.87		129.0	171.9									Concrete	0.017	16	2	24
32C	OM3 Upper Omi West	32C-R1	0+816	0+851	35	103	0+851	AJARA	1 BC (1.87 x 1.62)	1.06	Main Road	11.7	15.6	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	0.80	Concrete	0.017	2.5	1.5	8.5
		32C-R2	0+851	1+252	401	Size Change				1.06												Concrete	0.017	2.5	1.5	8.5
32H	OM3 Upper Omi West	32H-R1	1+173	1+697	524	Size Change		Oloko Stream		2.00		18.8	25.0									Concrete	0.017	4	1	8
32P	OM3 Upper Omi West	32P-R1	0+751	0+803	52	943	0+803	Unity Estate- Akoka, Road 4	1 CC (0.75 dia)	1.10	Tertiary Road	12.0	16.0	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 1.5)	1.95	Dar	Masterplan	1.67	Concrete	0.017	2.5	1	6.5
		32P-R2	0+803	0+934	131	Size Change				1.10												Concrete	0.017	2.5	1	6.5
33	OM3 Upper Omi West	33-R1	1+230	1+579	349	1527	1+579	Akobo, Iyana Church Road	1 BC (2.86 x 1.7)	1.29	Tertiary Road	13.4	17.9	Existing							0.92	Concrete	0.017	4	1.5	10
		33-R2	1+579	2+339	760	118	2+339	OKE-IBADAN ESTATE	1 BC (1.8 x 1.96)	2.52	Tertiary Road	22.7	30.2	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	0.92	Concrete	0.017	4	1.5	10
		33-R3	2+339	2+932	593	1526	2+932	Iyana Church, Iyana Church Road	1 BC (1.8 x 1.62)	3.02	Tertiary Road	26.4	35.2	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	0.92	Concrete	0.017	4	1.5	10
		33-R4	2+932	3+729	797	957	3+729	Wofun, Kute road	2 BC (3.3 x 2.9)	3.54	Secondary Road	30.3	40.4	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.92	Concrete	0.017	4.5	1.5	10.5
		33-R5	3+729	3+906	177	Size Change						30.3	40.4					2.6				Concrete	0.017	4.5	1.5	10.5
		33-R6	3+906	3+926	20	935	3+926	Wofun, ARCEDEM, ARCEDEM	1 BC (2.5 x 2.01)	5.71	Tertiary Road	45.1	60.1	Proposed	Box Culvert	Channelized Stream	2 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.67	Concrete	0.017	9	1.5	15
		33-R7	3+926	4+483	557	Size Change				5.71		45.1	60.1									Concrete	0.017	9	1.5	15
33F	OM3 Upper Omi West	33F-R1	1+347	1+471	124	116	1+471	WAKAJAIYE	1 BC (3 x 1.96)	1.16	Tertiary Road	12.5	16.6	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.00	Concrete	0.017	2.5	1.5	8.5
		33F-R2	1+471	1+902	431	117	1+902	IWDFUN , IWO EXPRESS WAY	1 BC (3.12 x 1.87)	1.64	Highway	16.1	21.4	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 2)	2.6	Dar	Masterplan	1.00	Concrete	0.017	3	1.5	9
		33F-R3	1+902	2+009	107	956	2+009	Wofun, Kute road	1 BC (3 x 1.55)	2.02	Secondary Road	18.9	25.2	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 2)	2.6	Dar	Masterplan	1.00	Concrete	0.017	3	1.5	9
		33F-R4	2+009	2+367	358	Size Change				2.02												Concrete	0.017	3	1.5	9
34	OM3 Upper Omi West	34-R1		0+199	199	936	0+199	Arulogun Alaja, By Ona-Iwa Mimo C& S Church, Railway line		26.26	Tertiary Road	169.8	226.4	Proposed	Box Culvert	Channelized Stream	2 Cv (7.5 x 2.5)	3.25	Dar	Masterplan	0.46	Concrete	0.017	16	2	24
		34-R2	0+199	0+354	155	Size Change						169.8	226.4									Concrete	0.017	16	2	24
		34-R3	0+354	0+855	501	937	0+855	Olodo, Ogberi, Galili	1 BC (7.2 x 2.87)	26.84	Secondary Road	169.8	226.4	Proposed	Box Culvert	Channelized Stream	3 Cv (6 x 3)	3.9	Dar	Masterplan	0.46	Concrete	0.017	18	2.5	28
		34-R4	0+855	1+207	352	955	1+207	Olodo Area, Behind The Jewels Nursery & Pry School, Aba Baale		27.39	Tertiary Road	169.8	226.4	Proposed	Box Culvert	Channelized Stream	3 Cv (6 x 3)	3.9	Dar	Masterplan	0.46	Concrete	0.017	18	2.5	28
		34-R5	1+207	1+477	270	992	1+477	Olodo Nla, Egberi, Olodo way		27.44		169.8	226.4	Proposed	Box Culvert	Channelized Stream	3 Cv (6 x 3)	3.9	Dar	Masterplan	0.46	Concrete	0.017	18	2.5	28
		34-R6	1+477	1+705	228	104	1+705	Olodo Nla, Egberi, Olodo way	1 BC (3 x 3.6)	27.72	Highway	169.8	226.4	Proposed	Box Culvert	Channelized Stream	3 Cv (6 x 3)	3.9	Dar	Masterplan	0.46	Concrete	0.017	18	2.5	28
		34-R7	1+705	2+828	1123	991	2+828	Custom Area-Oki, Imorole, Imorole		29.99	Tertiary Road	169.8	226.4	Proposed	Box Culvert	Channelized Stream	3 Cv (6 x 3)	3.9	Dar	Masterplan	0.46	Concrete	0.017	18	2.5	28
		34-R8	2+828	3+147	319	938	3+147	Isale Custom-Oki, Idera, Idera Street		30.16	Tertiary Road	169.8	226.4	Proposed	Box Culvert	Channelized Stream	3 Cv (6 x 3)	3.9	Dar	Masterplan	0.46	Concrete	0.017	18	2.5	28
		34-R9	3+147	5+595	2448	1403	5+595	Majue, Egberi, Egberi	Br (11.6m)	33.85	Tertiary Road	176.6	235.4	Proposed	Box Culvert	Channelized Stream	3 Cv (6.5 x 3)	3.9	Dar	Masterplan	0.46	Concrete	0.017	18	2.5	28
		34-R10	5+595	5+787	192	Size Change						176.6	235.4									Concrete	0.017	18	2.5	28
		34-R11	5+787	5+940	153	34D2	5+940	PEACE ESTATE (ZONE 9) RESIDENTS ASSOCIATION OGUNGBADE, OFF NEW IFE ROAD EGBEDA LG, IBADAN		33.93	No Road	176.6	235.4	Proposed	Bridge	Channelized Stream	Br (30 x 10)	4.5	Dar	Masterplan	0.46	Concrete	0.017	20	2.5	30
		34-R12	5+940	5+964	24	Size Change				33.93		176.6	235.4									Concrete	0.017	20	2.5	30
34G	OM3 Upper Omi West	34G-R1	0+926	1+075	149	952	1+075	Oki, Olodo way	1 BC (1.19 x 2)	1.12	Secondary Road	12.2	16.2	Proposed	Box Culvert	Channelized Stream	1 Cv (2 x 2)	2.6	Dar	Masterplan	2.55	Concrete	0.017	2	1.5	8
		34G-R2	1+075	1+405	330	1523	1+405	Olodo, Sooto Street		1.30	Tertiary Road	13.5	18.0	Proposed	Box Culvert	Channelized Stream	1 Cv (2 x 2)	2.6	Dar	Masterplan	2.55	Concrete	0.017	2	1.5	8
		34G-R3	1+405	1+712	307	Size Change				1.30												Concrete	0.017	2	1.5	8
29	OM4 Upper Omi East	29-R1	1+359	2+687	1328	1361	2+687	Baale-Ajinti, Keshinjo Road		3.58		30.6	40.8	Proposed	Box Culvert	Channelized Stream	1 Cv (5 x 2)	2.6	Dar	Masterplan	0.68	Concrete	0.017	5	1.5	11
		29-R2	2+687	3+557	870	Size Change						30.6	40.8									Concrete	0.017	5	1.5	11
		29-R3	3+557	3+653	96	1360	3+653	Adeleye-Fatumo, Oloro, Oloro	1 CC (0.85 dia)	5.93	Tertiary Road	46.3	61.7	Proposed	Box Culvert	Channelized Stream	2 Cv (4 x 2)	2.6	Dar	Masterplan	0.73	Concrete	0.017	6	1.5	12
		29-R4	3+653	3+832	179	Size Change						46.3	61.7									Concrete	0.017	6	1.5	12
		29-R5	3+832	4+148	316	1537	4+148	Erunmu, Adewumi Olosunde		6.90	Tertiary Road	53.7	71.7	Proposed	Box Culvert	Channelized Stream	2 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.73	Concrete	0.017	8	1.5	14
		29-R6	4+148	4+479	331	1536	4+479	Olodo, Erunmu		7.21	Tertiary Road	53.7	71.7	Proposed	Box Culvert	Channelized Stream	2 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.73	Concrete	0.017	8	1.5	14
		29-R7	4+479	4+914	435	1393	4+914	OKE-OMI, ODO-OKOKO, ALAAKA	1 CC (0.85 dia)	7.41	Tertiary Road	54.4	72.5	Proposed	Box Culvert	Channelized Stream	2 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.73	Concrete	0.017	8	1.5	14
		29-R8	4+914	5+236	322	Size Change						53.7	71.7									Concrete	0.017	8	1.5	14
		29-R9	5+236	6+107	871	1394	6+107	OKE-OMI, ESE-ONA, ESE-ONA/OLD ROAD		9.23	Tertiary Road	66.4	88.5	Proposed	Box Culvert	Channelized Stream	2 Cv (5 x 2)	2.6	Dar	Masterplan	0.73	Concrete	0.017	10	1.5	16
		29-R10	6+107	6+215	108	1395	6+215	OKE-OMI, OMI, IWO-ROAD EXPRESS	1 BC (2.96 x 2.5)	9.27	Highway	66.4	88.5	Proposed	Box Culvert	Channelized Stream	2 Cv (5 x 2)	2.6	Dar	Masterplan	0.73	Concrete	0.017	10	1.5	16
		29-R11	6+215	6+787	572	Size Change				9.27		66.4	88.5									Concrete	0.017	10	1.5	16
29B	OM4 Upper Omi East	29B-R1	1+300	1+438	138	Size Change				1.50		15.0	20.0									Concrete	0.017	4	1	8
29E	OM4 Upper Omi East	29E-R1	0+934	1+421	487	1359	1+421	Baale-Ajinti, Ifelodun Road	1 CC (1 dia)	1.53		15.2	20.3	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	1.00	Concrete	0.017	3.5	1	7.5
		29E-R2	1+421	1+820	399	Size Change				1.53												Concrete	0.017	3.5	1	7.5
30	OM4 Upper Omi East	30-R1		0+399	399	1385	0+399	KOKOKO ESTATE, OMI, ARUBIEWE/OJUIRIN	Br (m)	69.86	Tertiary Road	284.6	379.4	Proposed	Bridge	Channelized Stream	Br (40 x 10)	5	Dar	Masterplan	0.22	Concrete Sides	0.027	28	3	40
		30-R2	0+399	0+980	581	110	0+980	OGODU,	2 BC (2.83 x 3.04)	73.79	Secondary Road	296.4	395.2	Proposed	Bridge	Channelized Stream	Br (40 x 10)	5	Dar	Masterplan	0.22	Concrete Sides	0.027	28	3	40
		30-R3	0+980	1+845	865	Size Change						296.4	395.2									Concrete Sides	0.027	28	3	40
		30-R4	1+845	2+963	1118	1386	2+963	IKUMAPAYI-OLODO, OMI, IDI-OSAN/AREKE		79.10	Secondary Road	312.3	416.4	Proposed	Bridge	Channelized Stream	Br (30 x 10)	6	Dar	Masterplan	0.22	Concrete	0.017	14	3	26
		30-R5	2+963	3+752	789	111	3+752	OKU OSEJU,	2 BC (1.86 x 1.88)	80.30	Tertiary Road	315.9	421.2	Proposed	Bridge	Channelized Stream	Br (30 x 10)	6	Dar	Masterplan	0.22	Concrete	0.017	14	3	26
		30-R6	3+752	4+700	948	1400	4+700	Oke-omi/Ogundipe, Omi, Koojo		80.99	Tertiary Road	318.0	424.0	Proposed	Bridge	Channelized Stream	Br (30 x 10)	6	Dar	Masterplan	0.22	Concrete	0.017	14	3	26
		30-R7	4+700	4+870	170	Size Change				80.99		321.1	428.1									Concrete	0.017	14	3	26
		30-R8	4+870	5+628	758	Size Change				99.00		393.0	524.0									Concrete Sides	0.027	31	3	43
30D	OM4 Upper Omi East	30D-R1	1+002	1+141	139	1538	1+141	Kumapayi, Kumapayi Road		1.46		14.7	19.6	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	1.28	Concrete	0.017	3	1	7
		30D-R2	1+141	3+338	2197	Size Change				1.46												Concrete	0.017	3	1	7
30H	OM4 Upper Omi East	30H-R1	1+418	1+772	354	1378	1+772	AHOYAYA VILLAGE, ROAD 1		1.16		12.5	16.6	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	0.71	Concrete	0.017	3.5	1	7.5
		30H-R2	1+772	1+857	85	Size Change				1.16												Concrete	0.017	3.5	1	7.5

Channel Data						Structure Data								Design of Structures							Design of Channels					
Channel ID	Subbasin	Reach ID	Start Station	End Station	Reach Length (m)	Structure No.	Structure Station	Location	Existing Crossing Structure Dimensions	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Vertical Distance from Road L. to Prop. Culv. Inv.	Designed by	Status	Stream Slope (%)	Lining Protection	Roughness Coeff. For Channel	Bed Width (m)	Design Depth (m)	Top Width (m)
35	OM4 Upper Omi East	35-R1		0+156	156	34D1	0+156	PEACE ESTATE (ZONE 9) RESIDENTS ASSOCIATION OGUNGBADE, OFF NEW IFE ROAD EGBEDA LG, IBADAN		116.05	No Road	393.0	524.0	Proposed	Bridge	Channelized Stream	Br (45 x 10)	5.5	Dar	Masterplan	0.25	Concrete Sides	0.027	31	3	43
		35-R2	0+156	0+729	573	1401	0+729	Ogungbade, Omi, Agbede/Adesoji Road.A		116.70	Tertiary Road	393.0	524.0	Proposed	Bridge	Channelized Stream	Br (45 x 10)	5.5	Dar	Masterplan	0.25	Concrete Sides	0.027	31	3	43
		35-R3	0+729	2+569	1840	1025	2+569	Ikumoda, Oloro, Iso ege	2 BC (2.42 x 2.44)	118.85	Secondary Road	393.0	524.0	Proposed	Bridge	Channelized Stream	Br (45 x 10)	5.5	Dar	Masterplan	0.25	Concrete Sides	0.027	31	3	43
		35-R4	2+569	2+820	251	93	2+820	Ikumoda, By Buso rock hotel, Old Ife road	Br (14.7m)	119.01	Expressway	393.0	524.0	Existing							0.25	Concrete Sides	0.027	31	3	43
		35-R5	2+820	3+026	206	Size Change				119.01		393.0	524.0									Concrete Sides	0.027	31	3	43
		35-R6	3+026	3+511	485	Size Change				119.01		393.0	524.0									Concrete Sides	0.027	35	3	47
39	OM5 Middle Omi East	39-R1	0+914	3+662	2748	Size Change				4.00		33.8	45.0									Concrete	0.017	4.5	1.5	10.5
		39-R2	3+662	5+155	1493	Size Change						76.6	102.1									Concrete	0.017	11	1.5	17
		39-R3	5+155	5+523	368	1413	5+523	Alapata, Alapata, Egbeda	3 CC (0.9 dia)	14.91	Secondary Road	95.3	127.1	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.73	Concrete	0.017	12	2	20
		39-R4	5+523	6+268	745	1414	6+268	Ajoda, Ajoda, Road.3	1 BC (0.9 x 1.5)	15.72	Tertiary Road	99.5	132.7	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.73	Concrete	0.017	12	2	20
		39-R5	6+268	6+430	162	94	6+430	AJODA-NEW TOWN IFE-IBADAN EXPRESS ROAD,	2 BC (1.85 x 1.57)	16.00	Expressway	101.1	134.8	Proposed	Box Culvert	Channelized Stream	2 Cv (7 x 2.5)	3.25	Dar	Masterplan	0.52	Concrete	0.017	12	2	20
		39-R6	6+430	6+846	416	1415	6+846	Ifeoluwatedo, Zone 2		16.62	Tertiary Road	104.4	139.2	Proposed	Box Culvert	Channelized Stream	2 Cv (7 x 2.5)	3.25	Dar	Masterplan	0.52	Concrete	0.017	12	2	20
		39-R7	6+846	7+239	393	1416	7+239	Ifeoluwatedo Estate, Ifeoluwatedo, Road.14	1 BC (2.4 x 1.22)	17.01	Tertiary Road	106.6	142.1	Proposed	Box Culvert	Channelized Stream	2 Cv (7 x 2.5)	3.25	Dar	Masterplan	0.52	Concrete	0.017	12	2	20
		39-R8	7+239	7+468	229	52D1	7+468	PROGBESSIVE LANDLORDS/LANDLADIES ASSOCIATION OFF AKINBODE ROAD, OLUWO AREA EGBEDA LGA.	1 BC (2.4 x 1.22)	17.25	Tertiary	107.9	143.8	Proposed	Box Culvert	Channelized Stream	2 Cv (7 x 2.5)	3.25	Dar	Masterplan	0.52	Concrete	0.017	12	2	20
		39-R9	7+468	8+270	802	Size Change				17.25		107.9	143.8									Concrete	0.017	12	2	20
39D	OM5 Middle Omi East	39D-R1	0+663	1+722	1059	Size Change				2.00		18.8	25.0									Concrete	0.017	4	1	8
39H	OM5 Middle Omi East	39H-R1	0+949	2+875	1926	Size Change				2.00		18.8	25.0									Concrete	0.017	4.5	1	8.5
		39H-R2	2+875	3+532	657	Size Change				5.00		41.3	55.0									Concrete	0.017	5.5	1.5	11.5
39H-6	OM5 Middle Omi East	39H-6-R1	0+864	1+990	1126	Size Change				1.50		15.0	20.0									Concrete	0.017	4	1	8
39M	OM5 Middle Omi East	39M-R1	1+294	2+801	1507	Size Change				2.50		22.5	30.0									Concrete	0.017	4.5	1	8.5
36	OM6 Middle Omi West	36-R1	1+893	1+984	91	960	1+984	Onibuore, Iwo road	1 CC (0.93 dia)	1.13	Highway	12.2	16.3	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	0.80	Concrete	0.017	3.5	1	7.5
		36-R2	1+984	2+334	350	962	2+334	Onibuore, Arowolo		2.92	Tertiary Road	25.7	34.2	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	0.80	Concrete	0.017	4	1.5	10
		36-R3	2+334	3+468	1134	1031	3+468	Ebenesary Area, Jinarere	2 CC (0.85 dia)	3.72	Tertiary Road	31.7	42.2	Proposed	Box Culvert	Channelized Stream	1 Cv (5 x 2)	2.6	Dar	Masterplan	0.80	Concrete	0.017	5	1.5	11
		36-R4	3+468	3+552	84	1032	3+552	Ebenesary Area, Adogba Road	2 BC (1.3 x 1.34)	3.84	Tertiary Road	32.6	43.4	Proposed	Box Culvert	Channelized Stream	1 Cv (5 x 2)	2.6	Dar	Masterplan	0.80	Concrete	0.017	5	1.5	11
		36-R5	3+552	3+638	86	1034	3+638	Ebenesary Area 3, Road A	2 CC (0.9 dia) + BC (1.8 x 1.56)	3.99	Tertiary Road	33.7	44.9	Proposed	Box Culvert	Channelized Stream	1 Cv (5 x 2)	2.6	Dar	Masterplan	0.80	Concrete	0.017	5	1.5	11
		36-R6	3+638	3+910	272	Size Change																Concrete	0.017	5	1.5	11
		36-R7	3+910	3+953	43	1035	3+953	Alakia, Isabo, Isabo		9.18	Main Road	87.6	116.8	Proposed	Bridge	Channelized Stream	Br (15 x 37)		Pheman	Going For Bid	0.39	Concrete	0.017	8	2	16
		36-R8	3+953	4+931	978	1036	4+931	Seke, Comfort Memorial School, Comfort Memorial School		10.38	Tertiary Road	87.6	116.8	Proposed	Box Culvert	Channelized Stream	2 Cv (4 x 2.5)	3.25	Dar	Masterplan	0.39	Concrete	0.017	8	2	16
		36-R9	4+931	5+180	249	1055	5+180	Seke Apomu, Lekan Hussein, Lekan Hussein Street		10.55	Tertiary Road	87.6	116.8	Proposed	Box Culvert	Channelized Stream	2 Cv (4 x 2.5)	3.25	Dar	Masterplan	3.50	Concrete	0.017	8	2	16
		36-R10	5+180	5+895	715	1033	5+895	Oke- Odo Alapata, Eternity Nursery & Primary School, Eternity Nursery & Primary School Road		11.70	Tertiary Road	87.6	116.8	Proposed	Box Culvert	Channelized Stream	2 Cv (4 x 2.5)	3.25	Dar	Masterplan	3.50	Concrete	0.017	8	2	16
		36-R11	5+895	6+345	450	1049	6+345	Oke- Odo Alapata, Fimiiti Oluwa, Fimiiti Oluwa		12.16	Tertiary Road	87.6	116.8	Proposed	Box Culvert	Channelized Stream	2 Cv (4 x 2.5)	3.25	Dar	Masterplan	3.50	Concrete	0.017	8	2	16
		36-R12	6+345	6+536	191	1037	6+536	Oke- Odo Alapata, Olosan, Olosan	3 BC (2.25 x 2.76)	12.23	Tertiary Road	87.6	116.8	Existing							3.50	Concrete	0.017	8	2	16
		36-R13	6+536	6+835	299	1038	6+835	Alakia, Oluwatedo Quarters, Oluwatedo Quarters	2 BC (3.73 x 2.16)	12.35	Tertiary Road	87.6	116.8	Proposed	Box Culvert	Channelized Stream	2 Cv (4 x 2.5)	3.25	Dar	Masterplan	0.56	Concrete	0.017	8	2	16
		36-R14	6+835	7+260	425	Size Change						87.6	116.8									Concrete	0.017	8	2	16
		36-R15	7+260	8+924	1664	1021	8+924	Adegbayi, Oloro, Abatiti Olode	3 BC (2.99 x 1.91)	16.99	Secondary Road	113.1	150.8	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.56	Concrete	0.017	12	2	20
		36-R16	8+924	9+385	461	92	9+385	Celica, Oloro, Oloro	1 BC (2.4 x 1.85)	17.79	Expressway	113.1	150.8	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.56	Concrete	0.017	12	2	20
		36-R17	9+385	9+925	540	Size Change				17.79		113.1	150.8									Concrete	0.017	12	2	20
36A	OM6 Middle Omi West	36A-R1	1+131	1+396	265	729	1+396	Agric, Iwo road	1 BC (3.7 x 1.75)	1.37		14.0	18.7	Existing							0.86	Concrete	0.017	2.5	1.5	8.5
		36A-R2	1+396	1+538	142	728	1+538	Agric bus stop, Gospel mission faith church road	1 BC (1.8 x 1.48)	1.57		15.5	20.7	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 2)	2.6	Dar	Masterplan	0.86	Concrete	0.017	3	1.5	9
		36A-R3	1+538	1+811	273	961	1+811	Onibuore, Odo eran	1 BC (1.5 x 1.14)	1.69	Tertiary Road	16.4	21.9	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 2)	2.6	Dar	Masterplan	0.86	Concrete	0.017	3	1.5	9
36D	OM6 Middle Omi West	36D-R1	1+080	1+105	25	812	1+105	AGORO/ MANATAN, AGORO STREET	2 BC (1.23 x 1.68)	1.06	Tertiary Road	11.7	15.6	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	0.72	Concrete	0.017	3.5	1	7.5
		36D-R2	1+105	1+310	205	1039	1+310	Aroko- Agoro, Zone 4		1.16	Tertiary Road	12.5	16.6	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	0.72	Concrete	0.017	3.5	1	7.5
		36D-R3	1+310	1+463	153	1040	1+463	Agoro, Adesina Street		1.32	Tertiary Road	13.7	18.2	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	0.72	Concrete	0.017	3.5	1	7.5
		36D-R4	1+463	1+780	317	1520	1+780	Adogba		2.53	Tertiary Road	22.7	30.3	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	0.72	Concrete	0.017	4	1.5	10
		36D-R5	1+780	2+030	250	1043	2+030	Alalubosa, Ago Irapada		2.61	Tertiary Road	23.3	31.1	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	0.72	Concrete	0.017	4	1.5	10
		36D-R6	2+030	2+914	884	Size Change				2.61												Concrete	0.017	4	1.5	10
36D-5	OM6 Middle Omi West	36D-5-R1	1+046	1+070	24	1521	1+070	Adogba		1.04	Tertiary Road	11.6	15.4	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 1.5)	1.95	Dar	Masterplan	1.20	Concrete	0.017	2.5	1	6.5
		36D-5-R2	1+070	1+286	216	Size Change				1.04												Concrete	0.017	2.5	1	6.5
36D-7	OM6 Middle Omi West	36D-7-R1	1+128	1+554	426	1045	1+554	Alalubosa, Mojawe	1 BC (2.6 x 2)	1.64	Tertiary Road	16.1	21.4	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 2)	2.6	Dar	Masterplan	0.73	Concrete	0.017	3	1.5	9
		36D-7-R2	1+554	2+182	628	Size Change				1.64												Concrete	0.017	3	1.5	9
36M	OM6 Middle Omi West	36M-R1	1+166	2+288	1122	1028	2+288	Alakia Area, Amuro Onilu Temidire Zone D		1.85	Tertiary Road	17.6	23.5	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	1.92	Concrete	0.017	3	1	7
		36M-R2	2+288	2+435	147	1027	2+435	Alakia Area, Amuro Onilu Temidire Zone D		1.86	Tertiary Road	17.7	23.6	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	1.92	Concrete	0.017	3	1	7
		36M-R3	2+435	2+493	58	Size Change				1.86												Concrete	0.017	3	1	7
37	OM6 Middle Omi West	37-R1	1+788	1+823	35	998	1+823	Iyana Agbala, Old Ife road	2 CC (0.9 dia)	1.12	Expressway	12.2	16.2	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 1.5)	1.95	Dar	Masterplan	1.35	Concrete	0.017	2.5	1	6.5
		37-R2	1+823	2+403	580	997	2+403	Iyana Agbala, Kuelu	1 BC (2.3 x 1.75)	3.56	Tertiary Road	30.5	40.6	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	1.35	Concrete	0.017	4	1.5	10
		37-R3	2+403	2+767	364	996	2+767	Kuelu Area, Zone D	2 BC (1.55 x 1.62)	3.72	Tertiary Road	31.7	42.2	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	1.35	Concrete	0.017	4	1.5	10
		37-R4	2+767	2+876	109	995	2+876	Omiri, Adekola road	2 CC (1.2 dia) + BC (2.35 x 2.11)	4.42	Secondary Road	36.9	49.2	Proposed	Box Culvert	Channelized Stream	3 Cv (3 x 3.5)		Pheman	Going For Bid	1.35	Concrete	0.017	4.5	1.5	10.5
		37-R5	2+876	3+267	391	994	3+267	Ogo Oluwa Community Zone B, Morning Star International School	2 BC (2.4 x 1.74)	4.59	Tertiary Road	38.2	50.9	Existing							2.63	Concrete	0.017	4.5	1.5	10.5
		37-R6	3+267	4+159	892	Size Change				4.59		38.2	50.9									Concrete	0.017	4.5	1.5	10.5
		37-R7	4+159	4+830	671	Size Change				4.59		38.7	51.6								1.00	Concrete	0.017	6	1.5	12
37D	OM6 Middle Omi West	37D-R1	0+806	0+915	109	1010	0+915	Adegbayi, Ikuogbolekun	2 BC (1.53 x 1.89)	1.39	Tertiary Road	14.2	18.9	Existing							1.25	Concrete	0.017	2.5	1.5	8.5
		37D-R2	0+915	1+003	88	1008	1+003	Adegbayi, Off Ikuogbolekun		1.41	Tertiary Road	14.3	19.1	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.25	Concrete	0.017	2.5	1.5	8.5
		37D-R3	1+003	1+215	212	1007	1+215	Adegbayi, Akomolafe-Road C		1.67	Tertiary Road	16.3	21.7	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.25	Concrete	0.017	2.5	1.5	8.5
		37D-R4	1+215	1+407	192	1006	1+407	Adegbayi, Aba Odan	2 BC (1.95 x 1.15)	1.76	Tertiary Road	17.0	22.6	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.25	Concrete	0.017	2.5	1.5	8.5
		37D-R5	1+407	1+731	324	1005	1+731	Adegbayi, Ajia road		1.96	Tertiary Road	18.5	24.6	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.25	Concrete	0.017	2.5	1.5	8.5
		37D-R6	1+731	1+785	54	1004	1+785	Adegbayi, Kuelu	1 BC (2.3 x 1.4)	1.99	Secondary Road	18.7	24.9	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.25	Concrete	0.017	2.5	1.5	8.5
		37D-R7	1+785	2+023	238	Size Change				1.99												Concrete	0.017	2.5	1.5	8.5
38	OM6 Middle Omi West	38-R1		0+647	647	Size Change						419.6	559.5									Concrete Sides	0.027	40	3	52
		38-R2	0+647	1+461	814	Size Change				82.00		430.0	573.4									Concrete Sides	0.027	45	3	57

Channel Data						Structure Data								Design of Structures							Design of Channels					
Channel ID	Subbasin	Reach ID	Start Station	End Station	Reach Length (m)	Structure No.	Structure Station	Location	Existing Crossing Structure Dimensions	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Vertical Distance from Road L. to Prop. Culv. Inv.	Designed by	Status	Stream Slope (%)	Lining Protection	Roughness Coeff. For Channel	Bed Width (m)	Design Depth (m)	Top Width (m)
40	OM7 Middle Omi South	40-R1	1+199	1+281	82	1422	1+281	Egbeda/Iyana-Ajia, Ife/Ibadan Express Way	1 CC (0.78 dia)	1.44	Expressway	14.6	19.4	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	0.88	Concrete	0.017	3.5	1	7.5
		40-R2	1+281	1+542	261	1423	1+542	Egbeda, Jekaoyinfa Road	1 BC (3.16 x 1.9)	1.75	Tertiary Road	16.9	22.5	Existing							0.88	Concrete	0.017	4	1	8
		40-R3	1+542	1+837	295	1424	1+837	Bethel Estate, Celestial Village	1 BC (1.64 x 0)	1.96	Tertiary Road	18.5	24.6	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	0.88	Concrete	0.017	4	1	8
		40-R4	1+837	2+279	442	1425	2+279	Oke-odo, Agudu Road	3 CC (0.67 dia)	2.67	Tertiary Road	23.8	31.7	Proposed	Box Culvert	Channelized Stream	1 Cv (5 x 1.5)	1.95	Dar	Masterplan	0.88	Concrete	0.017	5	1	9
		40-R5	2+279	2+646	367	1426	2+646	Moleke-Agudu, Road.5		2.87	Tertiary Road	25.3	33.7	Proposed	Box Culvert	Channelized Stream	1 Cv (5.5 x 1.5)	1.95	Dar	Masterplan	0.88	Concrete	0.017	5.5	1	9.5
		40-R6	2+646	3+259	613	1427	3+259	Wisdom estate, Edun villa	2 CC (0.79 dia) + BC (2.02 x 0.94)	4.10	Tertiary Road	34.5	46.0	Proposed	Box Culvert	Channelized Stream	2 Cv (4 x 1.5)	1.95	Dar	Masterplan	0.88	Concrete	0.017	8	1	12
		40-R7	3+259	3+589	330	1428	3+589	Olorunsogo, Akinjole Zone 2		4.44	Tertiary Road	37.1	49.4	Proposed	Box Culvert	Channelized Stream	2 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	0.88	Concrete	0.017	9	1	13
		40-R8	3+589	3+786	197	1429	3+786	Akinjole/Omoloju, Akinjole Zone 2		4.64	Tertiary Road	38.6	51.4	Proposed	Box Culvert	Channelized Stream	1 Cv (5.5 x 2)	2.6	Dar	Masterplan	0.88	Concrete	0.017	5.5	1.5	11.5
		40-R9	3+786	3+965	179	Size Change						38.6	51.4									Concrete	0.017	5.5	1.5	11.5
		40-R10	3+965	4+156	191	1517	4+156	Logun, Odo Loogun, Road 3		5.61	Tertiary Road	44.7	59.6	Proposed	Box Culvert	Channelized Stream	2 Cv (3.5 x 2)	2.6	Dar	Masterplan	0.80	Concrete	0.017	6	1.5	12
		40-R11	4+156	4+899	743	1430	4+899	Olode/Ajamaro, Olode, Okewusi Road 1.A	2 BC (2.17 x 1.55)	6.15	Tertiary Road	47.5	63.3	Proposed	Box Culvert	Channelized Stream	2 Cv (4 x 2)	2.6	Dar	Masterplan	0.80	Concrete	0.017	6	1.5	12
		40-R12	4+899	5+187	288	Size Change						47.5	63.3									Concrete	0.017	6	1.5	12
		40-R13	5+187	5+299	112	1516	5+299	Masopa estate, Road C, Lane 1		7.12	Tertiary Road	71.8	95.7	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2)	2.6	Dar	Masterplan	0.80	Concrete	0.017	12	1.5	18
		40-R14	5+299	6+274	975	1441	6+274	Areokuta, Omi S.C., Wemimo		7.97	Tertiary Road	71.8	95.7	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2)	2.6	Dar	Masterplan	0.80	Concrete	0.017	12	1.5	18
		40-R15	6+274	6+732	458	1515	6+732	Oke Anu Alaro Ibadan, Ire Akari Str.		8.16	Tertiary Road	71.8	95.7	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2)	2.6	Dar	Masterplan	0.80	Concrete	0.017	12	1.5	18
		40-R16	6+732	7+138	406	1142	7+138	Komolafe Estate, Komolafe, Off Ajia Road		9.77	Tertiary Road	71.8	95.7	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2)	2.6	Dar	Masterplan	0.80	Concrete	0.017	12	1.5	18
		40-R17	7+138	7+501	363	Size Change				9.77		71.8	95.7									Concrete	0.017	12	1.5	18
40Q	OM7 Middle Omi South	40Q-R1	1+254	1+299	45	1437	1+299	Arinokuta, Wemimo/Alaro Estate	1 CC (0.8 dia)	1.00	Tertiary Road	11.3	15.0	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 1.5)	1.95	Dar	Masterplan	1.56	Concrete	0.017	2.5	1	6.5
		40Q-R2	1+299	1+557	258	Size Change				1.00												Concrete	0.017	2.5	1	6.5
41	OM7 Middle Omi South	41-R1		0+370	370	1173	0+370	Araba Redeem, Oomi River, Redeem		161.51	Tertiary Road	432.7	576.9	Proposed	Bridge	Channelized Stream	Br (60 x 10)	5	Dar	Masterplan	0.19	Concrete Sides	0.027	45	3	57
		41-R2	0+370	2+965	2595	1141	2+965	Ejikeye Alaro, Oomi River, Ajia Road	Br (3 Span 5.6)	174.43	Secondary Road	444.8	593.0	Proposed	Bridge	Channelized Stream	Br (60 x 10)	5.5	Dar	Masterplan	0.19	Concrete Sides	0.027	45	3	57
		41-R3	2+965	4+230	1265	Size Change				174.43		444.8	593.0									Concrete Sides	0.027	45	3	57
41B	OM7 Middle Omi South	41B-R1	1+221	1+902	681	Size Change				1.50		15.0	20.0								1.64	Concrete	0.017	3	1	7
42	OM7 Middle Omi South	42-R1	0+598	0+810	212	1170 Prime	0+810	Aiport, Perimeter fence road	1 BC (1.3 x 1.05)	1.27	Tertiary Road	13.3	17.7	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 1.5)	1.95	Dar	Masterplan	2.24	Concrete	0.017	2.5	1	6.5
		42-R2	0+810	0+872	62	1170	0+872	Aiport, Off Perimeter fence road		1.40	Tertiary Road	14.3	19.0	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 1.5)	1.95	Dar	Masterplan	2.24	Concrete	0.017	2.5	1	6.5
		42-R3	0+872	1+560	688	1130	1+560	Oke Ibukun, Road 1		1.97	Tertiary Road	18.5	24.7	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	2.24	Concrete	0.017	3	1	7
		42-R4	1+560	2+425	865	1132	2+425	Kobiowu Akintunde, Kobiowu Akintunde		3.52	Tertiary Road	30.2	40.2	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	2.24	Concrete	0.017	4.5	1	8.5
		42-R5	2+425	2+626	201	1133	2+626	Kobiowu Akintunde,	2 BC (1.5 x 1.39)	3.57	Secondary Road	30.5	40.7	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	2.24	Concrete	0.017	4.5	1	8.5
		42-R6	2+626	2+717	91	Size Change						30.5	40.7									Concrete	0.017	4.5	1	8.5
		42-R7	2+717	3+492	775	Size Change						68.9	91.9									Concrete	0.017	8	1.5	14
		42-R8	3+492	4+244	752	Size Change						68.9	91.9									Concrete	0.017	10	1.5	16
		42-R9	4+244	4+546	302	Size Change				10.00		68.9	91.9								1.10	Concrete	0.017	12	1.5	18
42H	OM7 Middle Omi South	42H-R1	1+094	1+207	113	Size Change				1.50		15.0	20.0								2.17	Concrete	0.017	2.5	1	6.5
42J	OM7 Middle Omi South	42J-R1	1+077	1+730	653	1139	1+730	Lato, Soobu Merin Street		3.07	Tertiary Road	26.8	35.7	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	4.80	Concrete	0.017	3	1	7
		42J-R2	1+730	2+347	617	90	2+347	AKINTUNDE	2 BC (2.5 x 2.2)	3.53	Secondary Road	30.2	40.3	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	1.18	Concrete	0.017	4	1.5	10
		42J-R3	2+347	2+437	90	Size Change				3.53		30.2	40.3									Concrete	0.017	4	1.5	10
43	OM7 Middle Omi South	43-R1		1+193	1193	1174	1+193	Igbaotun, Oomi River, Aba Oloosa		185.99	Tertiary Road	455.6	607.5	Proposed	Bridge	Channelized Stream	Br (60 x 10)	5	Dar	Masterplan	0.30	Concrete Sides	0.027	45	3	57
		43-R2	1+193	2+050	857	Size Change				185.99		455.6	607.5									Concrete Sides	0.027	45	3	57
44	OM7 Middle Omi South	44-R1	1+301	3+743	2442	Size Change				5.00		41.3	55.0								1.04	Concrete	0.017	9	1	13
		44-R2	3+743	4+868	1125	Size Change						47.1	62.7									Concrete	0.017	8	1.5	14
		44-R3	4+868	5+973	1105	Size Change				9.00		62.7	83.7								1.04	Concrete	0.017	10	1.5	16
44J	OM7 Middle Omi South	44J-R1	0+842	1+692	850	Size Change				1.50		15.0	20.0								1.14	Concrete	0.017	3.5	1	7.5
45	OM7 Middle Omi South	45-R1		2+570	2570	Size Change						375.9	501.2									Concrete Sides	0.027	45	3	57
		45-R2	2+570	3+235	665	1445	3+235	Ona-ara, Omi Br., Akanran	Br (3 Span 4.2)	203.10	Main Road	471.7	628.9	Proposed	Bridge	Channelized Stream	Br (60 x 20)	5	Dar	Masterplan	0.24	Concrete Sides	0.027	45	3.5	59
		45-R3	3+235	3+687	452	Size Change				203.10		471.7	628.9									Concrete Sides	0.027	45	3.5	59
45E	OM7 Middle Omi South	45E-R1	1+219	1+278	59	1164	1+278	Akindele Atea, Irepodun Estate	1 BC (1.95 x 1.09)	1.02	Tertiary Road	11.4	15.2	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	1.10	Concrete	0.017	3	1	7
		45E-R2	1+278	1+682	404	1161	1+682	Aba Epo, Ayetuntun	2 CC (0.75 dia) + BC (1.5 x)	1.37	Tertiary Road	14.0	18.7	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	1.10	Concrete	0.017	3	1	7
		45E-R3	1+682	2+235	553	1160	2+235	Aba Epo, Akanran	1 BC (1.9 x 1.1)	1.83	Tertiary Road	17.5	23.3	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	1.10	Concrete	0.017	3.5	1	7.5
		45E-R4	2+235	2+718	483	1530	2+718	Oluwalogbon Community, Zone 1		2.06	Tertiary Road	19.2	25.6	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	1.10	Concrete	0.017	4	1	8
		45E-R5	2+718	2+860	142	1159	2+860	Ogo Oluwa Estate, Zone G		2.09	Tertiary Road	19.4	25.9	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 2)	2.6	Dar	Masterplan	1.10	Concrete	0.017	3	1.5	9
		45E-R6	2+860	2+995	135	1158	2+995	Ogo Oluwa Estate, Road 2		2.12	Tertiary Road	19.7	26.2	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 2)	2.6	Dar	Masterplan	1.10	Concrete	0.017	3	1.5	9
		45E-R7	2+995	3+114	119	1442	3+114	Idi-ose, Ogo-oluwa Estate zone.6	2 BC (0.83 x 1.24)	2.16	Tertiary Road	20.0	26.6	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 2)	2.6	Dar	Masterplan	1.10	Concrete	0.017	3	1.5	9
		45E-R8	3+114	3+347	233	Size Change				2.16		20.0	26.6									Concrete	0.017	3	1.5	9
45H	OM7 Middle Omi South	45H-R1	1+038	1+451	413	1150	1+451	Oloya Area, Akaran	1 BC (1.95 x 1.43)	1.14	Tertiary Road	12.3	16.4	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	1.29	Concrete	0.017	3	1	7
		45H-R2	1+451	1+922	471	1154	1+922	Araromi, Oke-Odo	3 CC (0.75 dia) + BC (2.15 x 1.85)	2.12	Tertiary Road	19.7	26.2	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	1.29	Concrete	0.017	4	1	8
		45H-R3	1+922	2+557	635	1155	2+557	Ab a Eku, Irewole	1 BC (2.8 x 1.6)	2.82	Tertiary Road	24.9	33.2	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 2)	2.6	Dar	Masterplan	1.29	Concrete	0.017	3.5	1.5	9.5
		45H-R4	2+557	3+300	743	1443	3+300	Idi-ose off Akanran Road, Ifelagba zone.5	2 BC (1.8 x 2.25)	3.47	Tertiary Road	29.8	39.7	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	1.29	Concrete	0.017	4	1.5	10
		45H-R5	3+300	3+435	135	1444	3+435	Idi-ose, Irewole		3.56	Tertiary Road	30.5	40.6	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	1.29	Concrete	0.017	4	1.5	10
		45H-R6	3+435	3+909	474	Size Change				3.56		30.5	40.6									Concrete	0.017	4	1.5	10
66	ON6 Upper Ona West	66-R1		0+230	230	167	0+230	Onikankan-Onilu, Odo Onilu, Iyana Apete Road	1 BC (6.2 x 1.6)	66.84	Secondary Road	376.3	501.7	Proposed	Bridge	Channelized Stream	Br (55 x 10)	5	Dar	Masterplan	0.25	Concrete Sides	0.027	40	3	52
		66-R2	0+230	0+783	553	186	0+783	Aba Onilu, Odo Onilu, Aba Onilu	Br (14.18m)	67.22	Tertiary Road	376.3	501.7	Proposed	Bridge	Channelized Stream	Br (55 x 10)	5	Dar	Masterplan	0.25	Concrete Sides	0.027	40	3	52
		66-R3	0+783	2+110	1327	Size Change				67.22		376.3	501.7									Concrete Sides	0.027	40	3	52
66C	ON6 Upper Ona West	66C-R1	0+692	0+715	23	178	0+715	Moniya, Old Oyo Road	1 BC (3.1 x 2)	1.44	Highway	14.6	19.4	Existing							0.85	Concrete	0.017	2.5	1.5	8.5
		66C-R2	0+715	0+942	227	1578	0+942	Monya, Moniya Market		1.50	Tertiary Road	15.0	20.0	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	0.85	Concrete	0.017	2.5	1.5	8.5
		66C-R3	0+942	1+296	354	184	1+296	Ayobomi Abiola (Moniya), Iseyin-Ibadan Road	1 BC (2.6 x 1.8)	2.01	Main Road	18.8	25.1	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 2)	2.6	Dar	Masterplan	0.85	Concrete	0.017	3	1.5	9
		66C-R4	1+296	1+601	305	123B	1+601	Moniya, Isale-odo,Balogun Lane.3	2 BC (2.42 x 1.48)	2.63	Tertiary Road	23.5	31.3	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 2)	2.6	Dar	Masterplan	0.85	Concrete	0.017	3.5	1.5	9.5
		66C-R5	1+601	1+796	195	166	1+796	Balogun		2.70	Tertiary Road	24.0	32.0	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	0.85	Concrete	0.017	4	1.5	10
		66C-R6	1+796	1+947	151	165	1+947	Balogun		3.00	Tertiary Road	26.3	35.0	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.85	Concrete	0.017	4.5	1.5	10.5
		66C-R7	1+947	2+692	745	164	2+692	Onilu		3.36	Tertiary Road	29.0	38.6	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.85	Concrete	0.017	4.5	1.5	10.5
		66C-R8	2+692	2+989	297	35D3	2+989	ONILU LANDLORDS ASSOCIATION, MONIYA,IBADAN		3.49	No Road	29.9	39.9	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.85	Concrete	0.017	4.5	1.5	10.5
		66C-R9	2+989	3+297	308	Size Change				3.49		29.9	39.9									Concrete	0.017	4.5	1.5	10.5
67	ON6 Upper Ona West	67-R1	1+120	3+781	2661	Size Change				4.50		37.5	50.0								0.85	Concrete	0.017	5.5	1.5	11.5
		67-R2	3+781	4+958	1177	Size Change				4.50		55.6	74.2								0.92	Concrete	0.017	7	1.5	13
68	ON6 Upper Ona West	68-R1		0+655	655	187	0+655	Guuwin - Lagbe, Odo Guumin, Guumin Road	3 BC (2 x 1.3)	81.45	Tertiary Road	402.9	537.2	Proposed	Bridge	Channelized Stream	Br (70 x 10)	5	Dar	Masterplan	0.15	Concrete Sides	0.027	60	2	68
		68-R2	0+655	0+661	6	Size Change				81.45		402.9	537.2									Concrete Sides	0.027	60	2	68

Channel Data						Structure Data								Design of Structures							Design of Channels					
Channel ID	Subbasin	Reach ID	Start Station	End Station	Reach Length (m)	Structure No.	Structure Station	Location	Existing Crossing Structure Dimensions	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Vertical Distance from Road L. to Prop. Culv. Inv.	Designed by	Status	Stream Slope (%)	Lining Protection	Roughness Coeff. For Channel	Bed Width (m)	Design Depth (m)	Top Width (m)
68A	ON6 Upper Ona West	68A-R1	1+935	1+939	4	173	1+939	Akingbile	1 BC (2.2 x 1.77)	1.01	Tertiary Road	11.3	15.1	Existing							1.15	Concrete	0.017	2.5	1	6.5
		68A-R2	1+939	2+373	434	172	2+373	Fatokun		1.79	Tertiary Road	17.2	22.9	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	1.15	Concrete	0.017	3.5	1	7.5
		68A-R3	2+373	2+513	140	171	2+513	Fatokun		1.95	Tertiary Road	18.4	24.5	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	1.15	Concrete	0.017	4	1	8
		68A-R4	2+513	2+861	348	192	2+861	Ogunsinde		2.27	Tertiary Road	20.8	27.7	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	1.15	Concrete	0.017	4	1	8
		68A-R5	2+861	3+419	558	191	3+419	Idiamu Akingbile	1 CC (0.6 dia)	2.66	Tertiary Road	23.7	31.6	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	1.15	Concrete	0.017	4.5	1	8.5
		68A-R6	3+419	3+787	368	Size Change				2.66		23.7	31.6									Concrete	0.017	4.5	1	8.5
68C	ON6 Upper Ona West	68C-R1	0+896	2+920	2024	189	2+920	Agbe, Agbe Road	2 BC (1.4 x 0.71)	3.07	Tertiary Road	26.8	35.7	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	1.05	Concrete	0.017	4	1.5	10
		68C-R2	2+920	2+971	51	Size Change				3.07		26.8	35.7									Concrete	0.017	4	1.5	10
53G	ON7 Upper Ona East	53G-R1	2+057	2+197	140	1581	2+197	Arulogun, Arulogun Road	1 CC (0.8 dia)	1.08	Main Road	11.9	15.8	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 1.5)	1.95	Dar	Masterplan	1.31	Concrete	0.017	3	1	7
		53G-R2	2+197	2+389	192	219	2+389	Ifesowapo community, Kole zone F		1.16	Tertiary Road	12.5	16.6	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 1.5)	1.95	Dar	Masterplan	1.31	Concrete	0.017	4	1	8
		53G-R3	2+389	2+971	582	218	2+971	Kole Aroro, Kole road 6	1 BC (1.47 x 0.73)	1.44	Tertiary Road	14.6	19.4	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	1.31	Concrete	0.017	4	1	8
		53G-R4	2+971	3+271	300	217	3+271	Kole		1.55	Tertiary Road	15.4	20.5	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	1.31	Concrete	0.017	5.5	1	9.5
		53G-R5	3+271	3+364	93	Size Change				1.55		15.4	20.5									Concrete	0.017	5.5	1	9.5
53J	ON7 Upper Ona East	53J-R1	1+295	2+925	1630	121B	2+925	KOLE OSHE , ARULOGUN ROAD	1 CC (1 dia)	4.09	Main Road	34.4	45.9	Proposed	Box Culvert	Channelized Stream	2 Cv (4 x 1.5)	1.95	Dar	Masterplan	0.81	Concrete	0.017	4	1	8
		53J-R2	2+925	3+672	747	214	3+672	Agrifamily Estate	1 BC (1.35 x 1)	4.48	Tertiary Road	37.4	49.8	Proposed	Box Culvert	Channelized Stream	2 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	0.81	Concrete	0.017	6	1	10
		53J-R3	3+672	3+882	210	Size Change				4.48		37.4	49.8									Concrete	0.017	6	1	10
53M	ON7 Upper Ona East	53M-R1	1+433	1+688	255	212	1+688	Oke funfun 2, Oke funfun Road	1 CC (0.73 dia)	1.10	Tertiary Road	12.0	16.0	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	1.00	Concrete	0.017	4	1	8
		53M-R2	1+688	2+018	330	211	2+018	Arulogun, Arulogun road	1 CC (0.7 dia)	1.37	Main Road	14.0	18.7	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	1.00	Concrete	0.017	6	1	10
		53M-R3	2+018	3+662	1644	Size Change				1.37		14.0	18.7									Concrete	0.017	6	1	10
54	ON7 Upper Ona East	54-R1	1+058	1+351	293	222	1+351	Aiku, Aiku road		1.24	Main Road	13.1	17.4	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	0.94	Concrete	0.017	3	1	7
		54-R2	1+351	2+858	1507	Size Change						13.1	17.4									Concrete	0.017	3	1	7
		54-R3	2+858	3+308	450	220	3+308	Bagadaje-Baale, Odo Apon, Ogo oluwa		5.70		58.9	78.6	Proposed	Box Culvert	Channelized Stream	2 Cv (5 x 2)	2.6	Dar	Masterplan	0.67	Concrete	0.017	10	1.5	16
		54-R4	3+308	3+698	390	Size Change				5.70		58.9	78.6									Concrete	0.017	10	1.5	16
54D	ON7 Upper Ona East	54D-R1	0+894	1+749	855	221	1+749	Orieni, Orieni road		2.24	Main Road	20.6	27.4	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	1.00	Concrete	0.017	3	1	7
		54D-R2	1+749	1+929	180	Size Change				2.24		20.6	27.4									Concrete	0.017	3	1	7
55	ON7 Upper Ona East	55-R1		0+309	309	204	0+309	Ajoda (Peace avenue), Ajoda		78.66	Tertiary Road	331.6	442.2	Proposed	Bridge	Channelized Stream	Br (45 x 10)	5	Dar	Masterplan	0.32	Concrete Sides	0.027	30	3	42
		55-R2	0+309	0+664	355	203	0+664	Aroro Makinde, Makinde		78.79	Tertiary Road	331.6	442.2	Proposed	Bridge	Channelized Stream	Br (45 x 10)	5	Dar	Masterplan	0.32	Concrete Sides	0.027	30	3	42
		55-R3	0+664	0+689	25	37D	0+689	AKINRINOLA, EWE INA, DIVINE FAVOUR WITH ARORO MAKINDE, ARULOGUN AREA TO IBADAN-ILORIN EXPRESSROAD AT IDI-OSE.		81.10	No Road	331.6	442.2	Proposed	Bridge	Channelized Stream	Br (45 x 10)	5	Dar	Masterplan	0.32	Concrete Sides	0.027	30	3	42
		55-R4	0+689	1+402	713	Size Change						331.6	442.2									Concrete Sides	0.027	30	3	42
		55-R5	1+402	1+612	210	47D	1+612	AKINRINOLA COMMUNITY DEVELOPMENT ASSOCIATION OFF IDI-OSE OYO ROAD AKINYELE LGA		82.56	No Road	335.4	447.2	Proposed	Bridge	Channelized Stream	Br (45 x 10)	5	Dar	Masterplan	0.32	Concrete Sides	0.027	32	3	44
		55-R6	1+612	1+728	116	205	1+728	Akinrinola Village, Odo Ona, Akinrinola		82.61	Tertiary Road	335.4	447.2	Proposed	Bridge	Channelized Stream	Br (45 x 10)	5	Dar	Masterplan	0.32	Concrete Sides	0.027	32	3	44
		55-R7	1+728	3+222	1494	Size Change				82.61		335.4	447.2									Concrete Sides	0.027	32	3	44
55B	ON7 Upper Ona East	55B-R1	0+807	1+091	284	200	1+091	Apapa, Akuro-Apapa road	2 BC (2.88 x 2.14)	1.12	Main Road	12.2	16.2	Existing							1.33	Concrete	0.017	4	1.5	10
		55B-R2	1+091	1+322	231	201	1+322	Apapa		1.65	Tertiary Road	16.1	21.5	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.33	Concrete	0.017	6	1.5	12
		55B-R3	1+322	1+915	593	85D1	1+915	DAUDA ZONE COMMUNITY, BAGADAJE/OLOBI AREA. ARORO MAKINDE MONIYA ROAD		1.99	No Road	18.7	24.9	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.33	Concrete	0.017	6	1.5	12
		55B-R4	1+915	2+433	518	202	2+433	Bagadaje		2.27	Tertiary Road	20.8	27.7	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 2)	2.6	Dar	Masterplan	1.33	Concrete	0.017	6	1.5	12
		55B-R5	2+433	2+559	126	Size Change				2.27		20.8	27.7									Concrete	0.017	6	1.5	12
55F	ON7 Upper Ona East	55F-R1	1+290	1+311	21	206	1+311			1.01	Tertiary Road	11.3	15.1	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 1.5)	1.95	Dar	Masterplan	1.84	Concrete	0.017	3	1	7
		55F-R2	1+311	1+492	181	Size Change				1.01		11.3	15.1									Concrete	0.017	3	1	7
56	ON8 Upper Ona South	56-R1	1+220	1+616	396	210	1+616	Model City		1.53	Tertiary Road	15.2	20.3	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	0.87	Concrete	0.017	3	1	7
		56-R2	1+616	1+869	253	209	1+869	Model City	2 BC (0.73 x 0.95)	1.15	Tertiary Road	12.4	16.5	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	0.87	Concrete	0.017	4	1	8
		56-R3	1+869	2+544	675	560	2+544	Holiness Estate, Higher ground Road	1 CC (0.5 dia)	3.55	Tertiary Road	30.4	40.5	Proposed	Box Culvert	Channelized Stream	1 Cv (5 x 2)	2.6	Dar	Masterplan	0.87	Concrete	0.017	4	1.5	10
		56-R4	2+544	2+835	291	561	2+835	Omilabu, Omilabu-Olorunda Road	1 BC (1 x 1.26)	3.88	Secondary Road	32.9	43.8	Proposed	Box Culvert	Channelized Stream	1 Cv (5 x 2)	2.6	Dar	Masterplan	0.87	Concrete	0.017	5.5	1.5	11.5
		56-R5	2+835	2+996	161	Size Change						32.9	43.8									Concrete	0.017	5.5	1.5	11.5
		56-R6	2+996	3+796	800	Size Change						51.3	68.5									Concrete	0.017	10	1.5	16
		56-R7	3+796	4+105	309	1582	4+105	Ojoo, Alapata Street		9.60	Tertiary Road	101.2	134.9	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.58	Concrete	0.017	12	2	20
		56-R8	4+105	4+668	563	123A	4+668	ARULOGUN ROAD,	1 BC (4.1 x 2.03)	10.71	Main Road	101.2	134.9	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.58	Concrete	0.017	12	2	20
		56-R9	4+668	5+170	502	124A	5+170	ARORO , MAKINDE,	1 BC (2.18 x 1.29)	13.28	Tertiary Road	101.2	134.9	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.58	Concrete	0.017	12	2	20
		56-R10	5+170	6+120	950	Size Change				13.28		101.2	134.9									Concrete	0.017	12	2	20
56B	ON8 Upper Ona South	56B-R1	0+962	1+175	213	Size Change				1.00		11.3	15.0									Concrete	0.017	3	1	7
56E	ON8 Upper Ona South	56E-R1	0+963	1+661	698	Size Change				2.00		18.8	25.0									Concrete	0.017	3	1	7
56H	ON8 Upper Ona South	56H-R1	0+871	2+703	1832	555	2+703	Abutu		2.75	Secondary Road	24.4	32.5	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	0.82	Concrete	0.017	3	1.5	9
		56H-R2	2+703	2+927	224	Size Change				2.75		24.4	32.5									Concrete	0.017	3	1.5	9
56K	ON8 Upper Ona South	56K-R1	1+099	1+215	116	122A	1+215	ADELOLA ESTATE , ARULOGUN	1 BC (1.84 x 1.03)	1.13	Tertiary Road	12.2	16.3	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	0.93	Concrete	0.017	4	1	8
		56K-R2	1+215	1+999	784	536	1+999	Alapata, Alaafia road	2 CC (0.93 dia)	1.79	Tertiary Road	17.2	22.9	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	0.93	Concrete	0.017	6	1	10
		56K-R3	1+999	2+262	263	537	2+262	Arulogun		1.96	Tertiary Road	18.5	24.6	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	0.93	Concrete	0.017	6	1	10
		56K-R4	2+262	2+415	153	Size Change				1.96		18.5	24.6									Concrete	0.017	6	1	10
58	ON8 Upper Ona South	58-R1		1+501	1501	511	1+501	Akingbile, New Road		106.73	Tertiary Road	373.2	497.6	Proposed	Bridge	Channelized Stream	Br (55 x 10)	5	Dar	Masterplan	0.26	Concrete Sides	0.027	43	3	55
		58-R2	1+501	1+576	75	Size Change						373.2	497.6									Concrete Sides	0.027	43	3	55
		58-R3	1+576	1+596	20	126A	1+596	Akingbile, New Road	Br (2 Span 24)	107.63	Tertiary Road	387.2	516.2	Existing							0.26	Concrete Sides	0.027	40	3	52
		58-R4	1+596	1+883	287	127	1+883	IITA IDI DSE,	1 BC (6.4 x 3.01)	107.80	Highway	387.2	516.2	Proposed	Bridge	Channelized Stream	Br (55 x 20)	5	Dar	Masterplan	0.26	Concrete Sides	0.027	40	3	52
		58-R5	1+883	3+102	1219	Size Change				107.80		387.2	516.2									Concrete Sides	0.027	40	3	52
		58-R6	3+102	3+900	798	Size Change				107.80		391.1	521.4									Concrete Sides	0.027	40	3	52
57	ON8 Upper Ona South	57-R1	1+127	1+876	749	551	1+876	Barack, Off Range road before cemetery	2 CC (0.9 dia)	1.81	Tertiary Road	17.3	23.1	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	0.84	Concrete	0.017	4.5	1	8.5
		57-R2	1+876	2+431	555	550	2+431	Barack, KTJ Minimah	1 BC (1.8 x 1.9)	2.47	Tertiary Road	22.3	29.7	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	0.84	Concrete	0.017	4	1.5	10
		57-R3	2+431	3+209	778	549	3+209	Barack, Range Road	1 BC (1.8 x 1.85)	3.82	Tertiary Road	32.4	43.2	Proposed	Box Culvert	Channelized Stream	1 Cv (5 x 2)	2.6	Dar	Masterplan	0.84	Concrete	0.017	5	1.5	11
		57-R4	3+209	3+668	459	Size Change						32.4	43.2									Concrete	0.017	5	1.5	11
		57-R5	3+668	3+842	174	578	3+842	Ojoo, Jerusalem Cv., Arulogun/jerusalem junction	2 CC (0.9 dia)	5.32		52.1	69.4	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2)		Dar	Lot2 (Going for Bid)	0.84	Concrete	0.017	8	1.5	14
		57-R6	3+842	4+035	193	547	4+035	Ilupeju Community, Off Arulogun Road		5.50		52.1	69.4	Proposed	Box Culvert	Channelized Stream	2 Cv (4 x 2)	2.6	Dar	Masterplan	0.84	Concrete	0.017	8	1.5	14
		57-R7	4+035	4+073	38	546	4+073	Ilupeju Community, Off Arulogun Road		5.52		52.1	69.4	Proposed	Box Culvert	Channelized Stream	2 Cv (4 x 2)	2.6	Dar	Masterplan	0.84	Concrete	0.017	8	1.5	14
		57-R8	4+073	4+317	244	545	4+317	Goodness Estate Ojoo, Jerusalem		6.03		52.1	69.4	Proposed	Box Culvert	Channelized Stream	2 Cv (4 x 2)	2.6	Dar	Masterplan	0.84	Concrete	0.017	8	1.5	14
		57-R9	4+317	4+664	347	544	4+664	Aba Eko Ojoo, L.A. Adisa-Aba eko road	1 BC (2.4 x 1.94)	6.31		52.1	69.4	Proposed	Box Culvert	Channelized Stream	2 Cv (4 x 2)	2.6	Dar	Masterplan	0.84	Concrete	0.017	8	1.5	14
		57-R10	4+664	5+148	484	Size Change				6.31		52.1	69.4									Concrete	0.017	8	1.5	14

Channel Data						Structure Data								Design of Structures							Design of Channels					
Channel ID	Subbasin	Reach ID	Start Station	End Station	Reach Length (m)	Structure No.	Structure Station	Location	Existing Crossing Structure Dimensions	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Vertical Distance from Road L. to Prop. Culv. Inv.	Designed by	Status	Stream Slope (%)	Lining Protection	Roughness Coeff. For Channel	Bed Width (m)	Design Depth (m)	Top Width (m)
70	ON9 Orogun	70-R1	0+842	1+692	850	567	1+692	Barack, Adekunle Fajuyi Central Mosque road	2 CC (0.9 dia)	2.71	Tertiary Road	24.1	32.1	Existing							1.00	Concrete	0.017	3.5	1.5	9.5
		70-R2	1+692	2+267	575	Size Change						24.1	32.1									Concrete	0.017	3.5	1.5	9.5
		70-R3	2+267	2+796	529	565	2+794	Barack, Commandant house road, Commandant house road	1 BC (1.8 x 1.9)	7.55		48.8	65.0	Proposed	Box Culvert	Channelized Stream	2 Cv (4 x 2)		Dar	Lot1 (Going for Bid)		Concrete	0.017	6	2	14
		70-R4	2+796	3+230	434	678	3+230	Agbowo Express, Irepodun, Irepodun Street	1 BC (2.3 x 1.83)	8.71		48.8	65.0	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2)		Dar	Lot1 (Going for Bid)		Concrete	0.017	6	2	14
		70-R5	3+230	3+369	139	677	3+369	Irepodun Ojo road, Police Station, Police Station road	1 BC (3.6 x 2.85)	8.79		59.9	79.9	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2)		Dar	Lot1 (Going for Bid)		Concrete	0.017	12	2	20
		70-R6	3+369	3+838	469	634	3+838	Agbowo, Orogun River, Oriolowo street Junction		11.66		82.5	110.0	Proposed	Box Culvert	Channelized Stream	3 Cv (5 x 2)		Dar	Lot1 (Going for Bid)		Concrete	0.017	12	2	20
		70-R7	3+838	4+263	425	633	4+263	Agbowo, Orogun Bridge Agbowo, Aba Apata Kekere street	2 BC (2.58 x 2.2)	12.04		82.5	110.0	Proposed	Box Culvert	Channelized Stream	3 Cv (6 x 2)		Dar	Lot1 (Going for Bid)		Concrete	0.017	15	2	23
		70-R8	4+263	5+087	824	122B	5+087	OROGUN,	2 BC (2.7 x 2.68)	15.88		164.0	218.7	Proposed	Box Culvert	Channelized Stream	5 Cv (6 x 2)		Dar	Lot1 (Going for Bid)		Concrete Sides	0.027	32	2	40
		70-R9	5+087	6+308	1221	Size Change				15.88		164.0	218.7													
70J	ON9 Orogun	70J-R1	1+026	1+045	19	553	1+045	Barack, Command day secondary school road	1 BC (1.9 x 1.3)	1.15	Main Road	12.4	16.5	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	1.00	Concrete	0.017	3	1	7
		70J-R2	1+045	2+866	1821	Size Change				1.15		12.4	16.5									Concrete	0.017	3	1	7
70P	ON9 Orogun	70P-R1	0+863	1+193	330	552	1+193	Orogun Express		1.42	Tertiary Road	14.4	19.2	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	0.97	Concrete	0.017	3.5	1	7.5
		70P-R2	1+193	1+531	338	681	1+531	Kajorepo Ojo, Kajorepo Secondary school road	1 BC (1.82 x 1.42)	1.56	Tertiary Road	15.5	20.6	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	0.97	Concrete	0.017	3.5	1	7.5
		70P-R3	1+531	1+662	131	680	1+662	Kajola, Temidire Street	1 BC (2.95 x 1.27)	2.00	Tertiary Road	18.8	25.0	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	0.97	Concrete	0.017	4	1	8
		70P-R4	1+662	1+876	214	679	1+876	Kajola, Iwo road	1 BC (2.4 x 1.81)	2.35	Expressway	21.4	28.5	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	0.97	Concrete	0.017	4	1.5	10
		70P-R5	1+876	2+166	290	1548	2+166	Agbowo, Fijabi Bus Stop	1 BC (3.1 x 2.72)	2.51	Tertiary Road	22.6	30.1	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	0.97	Concrete	0.017	4	1.5	10
		70P-R6	2+166	2+292	126	Size Change				2.51		22.6	30.1									Concrete	0.017	4	1.5	10
70Q	ON9 Orogun	70Q-R1	1+091	1+250	159	636	1+250	Farayola Bodija, Farayola Street	1 BC (4.6 x 1.63)	1.18	Tertiary Road	12.6	16.8	Existing							1.00	Concrete	0.017	3	1	7
		70Q-R2	1+250	1+493	243	128	1+493	MAJEOBAJE AGBOWO	1 BC (3.16 x 2.21)	1.26	Tertiary Road	13.2	17.6	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	1.00	Concrete	0.017	3	1	7
		70Q-R3	1+493	1+809	316	125B	1+809	OMOTARA , AGBOWO	2 BC (1.73 x 1.4)	2.25	Tertiary Road	20.6	27.5	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	1.00	Concrete	0.017	4.5	1	8.5
		70Q-R4	1+809	1+884	75	668	1+884	Agbowo, Adewumi Street		2.29	Tertiary Road	20.9	27.9	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	1.00	Concrete	0.017	4.5	1	8.5
		70Q-R5	1+884	1+945	61	1547	1+945	Agbowo, Adewunmi Street		2.29	Tertiary Road	20.9	27.9	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	1.00	Concrete	0.017	4.5	1	8.5
		70Q-R6	1+945	2+360	415	667	2+360	Agbowo, Adeoye Off Carpenter Street	1 BC (3.5 x 2.56)	2.59	Tertiary Road	23.2	30.9	Existing							1.00	Concrete	0.017	4	1.5	10
		70Q-R7	2+360	2+705	345	126B	2+705	Agbowo-Barika, Adegbite Estate/Majeroku street		2.80	Tertiary Road	24.8	33.0	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	1.00	Concrete	0.017	4	1.5	10
		70Q-R8	2+705	2+917	212	Size Change				2.80		24.8	33.0									Concrete	0.017	4	1.5	10
69	ON10 Middle Ona North	69-R1		2+555	2555	490	2+555	University of Ibadan, Ajibode Road	1 BC (29.2 x 4.1)	210.83	Main Road	435.2	580.3	Existing							0.21	Concrete Sides	0.027	43	3	55
		69-R2	2+555	2+576	21	Size Change				210.83		435.2	580.3									Concrete Sides	0.027	43	3	55
69C	ON10 Middle Ona North	69C-R1	1+409	1+685	276	502	1+685	University of Ibadan, Ajibode Road	2 CC (0.9 dia) + BC (2.9 x 1.94)	1.57		15.5	20.7	Existing							0.89	Concrete	0.017	3	1.5	9
		69C-R2	1+685	1+848	163	Size Change				1.57		15.5	20.7									Concrete	0.017	3	1.5	9
71	ON10 Middle Ona North	71-R1		0+287	287	489	0+287	University of Ibadan, Ajibode Road	1 BC (43.9 x 5.8)	229.57	Main Road	435.2	580.3	Existing							0.16	Concrete Sides	0.027	43	3	55
		71-R2	0+287	0+952	665	628	0+952	Ajibode, Aho River, Odo Ona way		230.17	Tertiary Road	435.2	580.3	Proposed	Bridge	Channelized Stream	Br (55 x 10)	5.5	Dar	Masterplan	0.16	Concrete Sides	0.027	43	3	55
		71-R3	0+952	2+906	1954	Size Change				242.00		508.6	678.1									Concrete Sides	0.027	66	3	78
71C	ON10 Middle Ona North	71C-R1	0+982	1+054	72	481	1+054	Laniba	1 BC (6.7 x 0)	1.33	Tertiary Road	13.7	18.3	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	0.73	Concrete	0.017	3.5	1	7.5
		71C-R2	1+054	1+272	218	482	1+272	Ajibode, Ajibode Road	1 CC (0.8 dia)	1.42	Tertiary Road	14.4	19.2	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	0.73	Concrete	0.017	3.5	1	7.5
		71C-R3	1+272	3+048	1776	484	3+048	Area 3		3.79	Tertiary Road	32.2	42.9	Proposed	Box Culvert	Channelized Stream	1 Cv (5 x 2)	2.6	Dar	Masterplan	0.73	Concrete	0.017	5	1.5	11
		71C-R4	3+048	3+348	300	485	3+348	Ajibode (Lakoto), Lakoto Apete Road	1 BC (1.56 x 1.56)	4.02	Main Road	33.9	45.2	Proposed	Box Culvert	Channelized Stream	1 Cv (5.5 x 2)	2.6	Dar	Masterplan	0.73	Concrete	0.017	5.5	1.5	11.5
		71C-R5	3+348	3+698	350	486	3+698	Ajibode, Ajibode Road	1 CC (0.8 dia)	4.19	4.19	35.2	46.9	Proposed	Box Culvert	Channelized Stream	1 Cv (5.5 x 2)	2.6	Dar	Masterplan	0.73	Concrete	0.017	5.5	1.5	11.5
		71C-R6	3+698	3+979	281	Size Change				4.19		35.2	46.9									Concrete	0.017	5.5	1.5	11.5
72	ON10 Middle Ona North	72-R1	0+516	2+240	1724	475	2+240	Balogun, Balogun Road		4.17	Tertiary Road	35.0	46.7	Proposed	Box Culvert	Channelized Stream	2 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	0.82	Concrete	0.017	9	1	13
		72-R2	2+240	2+780	540	Size Change						35.0	46.7									Concrete	0.017	9	1	13
		72-R3	2+780	3+501	721	474	3+501	Jamade, Odo Jamade, Jamade Road		6.79	Tertiary Road	85.0	113.4	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2)	2.6	Dar	Masterplan	0.69	Concrete	0.017	12	1.5	18
		72-R4	3+501	3+824	323	487	3+824	Jamade,	2 BC (1.4 x 1.5)	7.54	Tertiary Road	85.0	113.4	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2)	2.6	Dar	Masterplan	0.69	Concrete	0.017	12	1.5	18
		72-R5	3+824	4+584	760	488	4+584	Osajin, odo ola-adua,		8.83	Tertiary Road	85.0	113.4	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2)	2.6	Dar	Masterplan	0.69	Concrete	0.017	12	1.5	18
		72-R6	4+584	4+894	310	625B	4+894	Ojoo-Ajibode, Laniba Cv., Laniba	2 BC (3 x 2)	9.45	Tertiary Road	85.0	113.4	Proposed	Box Culvert	Channelized Stream	Add 4 Cv (3 x 2)		Abfort	Addition by Dar	0.69	Concrete	0.017	12	1.5	18
		72-R7	4+894	5+057	163	625	5+057	Onigbodogi, Sasa River, Ajibode Raod	1 BC (2.2 x 2.48)	9.45	Main Road	85.0	113.4	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2)	2.6	Dar	Masterplan	0.69	Concrete	0.017	12	1.5	18
		72-R8	5+057	5+129	72	Size Change						85.0	113.4									Concrete	0.017	12	1.5	18
		72-R9	5+129	5+379	250	626	5+379	Onigbodogi, Apete River, Ola Adura Road	3 BC (3 x 2)	9.53	Tertiary Road	85.0	113.4	Proposed	Box Culvert	Channelized Stream	Add 3 Cv (3 x 2)		Abfort	Addition by Dar	0.69	Concrete	0.017	12	2	20
		72-R10	5+379	5+439	60	Size Change				9.53		85.0	113.4									Concrete	0.017	12	2	20
72F	ON10 Middle Ona North	72F-R1	0+993	1+305	312	Size Change				1.50		15.0	20.0								1.33	Concrete	0.017	3	1	7
72H	ON10 Middle Ona North	72H-R1	1+094	1+355	261	468	1+355	Onikoko		1.17	Tertiary Road	12.5	16.7	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	1.20	Concrete	0.017	3	1	7
		72H-R2	1+355	1+579	224	470	1+579	Ilupeju		1.34	Tertiary Road	13.8	18.4	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	1.20	Concrete	0.017	3	1	7
		72H-R3	1+579	1+812	233	Size Change				1.34												Concrete	0.017	3	1	7
73	ON10 Middle Ona North	73-R1		1+005	1005	133	1+005	Apete, Apete Birdge, Apete	Br (3 Span 19.77)	247.99	Main Road	508.6	678.1	Existing						New	0.20	Concrete Sides	0.027	80	3	92
		73-R2	1+005	1+166	161	Size Change				247.99		508.6	678.1									Concrete Sides	0.027	80	3	92
73D	ON10 Middle Ona North	73D-R1	1+132	1+374	242	623	1+374	Oloya Apete, Jeje road		1.13	Tertiary Road	12.2	16.3	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	0.75	Concrete	0.017	3.5	1	7.5
		73D-R2	1+374	2+076	702	132	2+076	APETE , AWTAN ROAD	1 BC (2.2 x 1.39)	1.84	Main Road	17.5	23.3	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)		Dar	Lot2 (Going for Bid)	0.75	Concrete	0.017	4.5	1	8.5
		73D-R3	2+076	2+260	184	599	2+260	Iyanamorubo Apete, Iyanamorubo	1 CC (2.8 dia) + BC (2.53 x 1.82)	1.97	Tertiary Road	18.5	24.7	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 2)	2.6	Dar	Masterplan	0.75	Concrete	0.017	3.5	1.5	9.5
		73D-R4	2+260	2+367	107	Size Change				1.97		18.5	24.7									Concrete	0.017	3.5	1.5	9.5
74	ON10 Middle Ona North	74-R1	0+983	1+081	98	659	1+081	Sango, Polytechnic road	1 BC (2.45 x 2.48)	1.21	Main Road	12.8	17.1	Existing							0.72	Concrete	0.017	2.5	1.5	8.5
		74-R2	1+081	1+345	264	676	1+345	Sango, Odugbemi Road		1.63	Tertiary Road	16.0	21.3	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 2)	2.6	Dar	Masterplan	0.72	Concrete	0.017	3	1.5	9
		74-R3	1+345	1+485	140	657	1+485	Sango, Alenuloke Street	2 BC (2.08 x 2.02)	1.71	Tertiary Road	16.6	22.1	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 2)	2.6	Dar	Masterplan	0.72	Concrete	0.017	3	1.5	9
		74-R4	1+485	1+556	71	1544	1+556	Eleyele, Elewure		1.73	Tertiary Road	16.7	22.3	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 2)	2.6	Dar	Masterplan	0.72	Concrete	0.017	3	1.5	9
		74-R5	1+556	1+669	113	656	1+669	Sango, Idito road	2 BC (2.47 x 2.05)	1.81	Tertiary Road	17.3	23.1	Existing							0.72	Concrete	0.017	3	1.5	9
		74-R6	1+669	1+909	240	647	1+909	Alaro, Alaro road	4 BC (1.54 x 1.9)	2.20	Tertiary Road	20.3	27.0	Existing							0.72	Concrete	0.017	3.5	1.5	9.5
		74-R7	1+909	2+349	440	137	2+349	Sango-Eleyele road, Eleyele road,Ijokodo	1 BC (2.45 x 2.45)	3.77	Main Road	32.0	42.7	Proposed	Bridge	Channelized Stream	Br (10m)		Pheman	Going For Bid	0.72	Concrete	0.017	5.5	1.5	11.5
		74-R8	2+349	3+153	804	651	3+153	Polytechnic Ibadan, Ijokodo Estate Road, Ibadan Poly	2 BC (1.68 x 2.2)	4.50	Tertiary Road	37.5	50.0	Proposed	Box Culvert	Channelized Stream	1 Cv (6 x 2)	2.6	Dar	Masterplan	0.72	Concrete	0.017	6	1.5	12
		74-R9	3+153	3+383	230	Size Change				4.50		37.5	50.0									Concrete	0.017	6	1.5	12

Channel Data						Structure Data								Design of Structures							Design of Channels					
Channel ID	Subbasin	Reach ID	Start Station	End Station	Reach Length (m)	Structure No.	Structure Station	Location	Existing Crossing Structure Dimensions	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Vertical Distance from Road L. to Prop. Culv. Inv.	Designed by	Status	Stream Slope (%)	Lining Protection	Roughness Coeff. For Channel	Bed Width (m)	Design Depth (m)	Top Width (m)
74N	ON10 Middle Ona North	74N-R1	1+367	1+540	173	654	1+540	UI, Zik Road	2 BC (1.88 x 1.24)	1.53	Tertiary Road	15.2	20.3	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 2)	2.6	Dar	Masterplan	0.80	Concrete	0.017	3	1.5	9
		74N-R2	1+540	2+009	469	1545	2+009	UI, Zoo	1 BC (4 x 2)	1.77	Tertiary Road	17.0	22.7	Existing							0.80	Concrete	0.017	3	1.5	9
		74N-R3	2+009	2+064	55	1546	2+064	UI, Zoo	1 BC (4 x 2)	1.86	Tertiary Road	17.7	23.6	Existing							0.80	Concrete	0.017	3	1.5	9
		74N-R4	2+064	3+123	1059	653	3+123	UI, Tech Road	2 BC (3.88 x 1.86)	1.91	Tertiary Road	18.1	24.1	Existing							0.80	Concrete	0.017	3	1.5	9
		74N-R5	3+123	3+657	534	652	3+657	Polytechnic Ibadan, Bookshop Road	5 CC (1.25 dia)	4.03	Tertiary Road	34.0	45.3	Proposed	Box Culvert	Channelized Stream	1 Cv (5.5 x 2)	2.6	Dar	Masterplan	0.80	Concrete	0.017	5.5	1.5	11.5
		74N-R6	3+657	3+902	245	135	3+902	IJOKODO , APETE ROAD	1 BC (2.97 x 1.66)	4.21	Main Road	35.3	47.1	Proposed	Box Culvert	Channelized Stream	Add 1 Cv (4 x 2)		Others	Addition by Dar	0.80	Concrete	0.017	5.5	1.5	11.5
		74N-R7	3+902	4+436	534	Size Change				4.21		35.3	47.1									Concrete	0.017	5.5	1.5	11.5
75E	ON10 Middle Ona North	75E-R1	0+714	1+069	355	611	1+069	Alakuta Idimango, Alakuta/Papa Ajisafe road	2 CC (0.75 dia)	1.21	Tertiary Road	12.8	17.1	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	0.78	Concrete	0.017	3.5	1	7.5
		75E-R2	1+069	1+114	45	Size Change				1.21		12.8	17.1									Concrete	0.017	3.5	1	7.5
79	ON11 Alapata South	79-R1		0+413	413	458	0+413	Peace Estate, Peace Estate	1 BC (3.25 x 1.89)	28.16	Tertiary Road	207.5	276.7	Proposed	Bridge	Channelized Stream	Br (30 x 10)	4	Dar	Masterplan	0.70	Concrete	0.017	18	2	26
		79-R2	0+413	0+579	166	459	0+579	Peace Estate, Peace Estate		28.21	Tertiary Road	207.5	276.7	Proposed	Bridge	Channelized Stream	Br (30 x 10)	4	Dar	Masterplan	0.70	Concrete	0.017	18	2	26
		79-R3	0+579	0+804	225	460	0+804	Alapata, Alapa		30.60	Tertiary Road	207.5	276.7	Proposed	Bridge	Channelized Stream	Br (30 x 10)	4	Dar	Masterplan	0.70	Concrete	0.017	18	2	26
		79-R4	0+804	1+652	848	476	1+652	Akowo Idi Osan, Odo Oteru, Akowo	2 CC (0.7 dia) + BC (2.2 x 1.26)	32.63	Tertiary Road	207.5	276.7	Proposed	Bridge	Channelized Stream	Br (30 x 10)	4	Dar	Masterplan	0.70	Concrete	0.017	18	2	26
		79-R5	1+652	1+973	321	1507	1+973	Akowojo -Ijokodo, Akowojo, Lane H	2 BC (2.78 x 1.78)	33.69	Tertiary Road	207.5	276.7	Proposed	Bridge	Channelized Stream	Br (30 x 10)	4	Dar	Masterplan	0.70	Concrete	0.017	18	2	26
		79-R6	1+973	2+224	251	472	2+224	Akowo Idi Osan, Odo Oteru, Akowo Idi Osan		33.88	Tertiary Road	207.5	276.7	Proposed	Bridge	Channelized Stream	Br (30 x 10)	4	Dar	Masterplan	0.70	Concrete	0.017	18	2	26
		79-R7	2+224	2+408	184	473	2+408	Akufo, Odo Oteru, Akufo Road		34.02	Tertiary Road	207.5	276.7	Proposed	Bridge	Channelized Stream	Br (30 x 10)	4	Dar	Masterplan	0.70	Concrete	0.017	18	2	26
		79-R8	2+408	2+599	191	Size Change						207.5	276.7									Concrete	0.017	18	2	26
		79-R9	2+599	2+979	380	594	2+979	Oke Odo Balogun Area, Oteru Stream, Akufo road	1 BC (2.8 x 1.5)	34.54	Secondary Road	207.5	276.7	Proposed	Bridge	Channelized Stream	Br (30 x 10)	4	Dar	Masterplan	0.70	Concrete	0.017	22	2	30
		79-R10	2+979	3+243	264	Size Change						207.5	276.7									Concrete	0.017	22	2	30
		79-R11	3+243	3+930	687	598	3+930	Adeosun, Oteru Stream, Unity road	1 CC (0.8 dia) + BC (1.2 x 1.2)	39.59	Secondary Road	235.1	313.5	Proposed	Bridge	Channelized Stream	Br (35 x 10)	4	Dar	Masterplan	0.70	Concrete	0.017	22	2.5	32
		79-R12	3+930	4+461	531	Size Change				53.00		235.1	313.5									Concrete	0.017	45	2.5	55
79B	ON11 Alapata South	79B-R1	0+817	2+352	1535	Size Change				2.00		18.8	25.0								1.38	Concrete	0.017	3.5	1	7.5
79D	ON11 Alapata South	79D-R1	1+064	1+579	515	461	1+579	Alapata, Akufo Road	1 BC (1.8 x 1.21)	1.33	Main Road	13.7	18.3	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	1.09	Concrete	0.017	3	1	7
		79D-R2	1+579	1+798	219	Size Change				1.33												Concrete	0.017	3	1	7
79G	ON11 Alapata South	79G-R1	0+863	1+230	367	604	1+230	Alatare Zone C, Olonde Estate road		1.71	Tertiary Road	16.6	22.1	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	0.88	Concrete	0.017	4	1	8
		79G-R2	1+230	3+262	2032	Size Change				1.71												Concrete	0.017	4	1	8
79L	ON11 Alapata South	79L-R1	0+804	0+887	83	463	0+887	Adaba Co-operative	1 BC (1.1 x 1.3)	1.13	Tertiary Road	12.2	16.3	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	0.88	Concrete	0.017	3	1	7
		79L-R2	0+887	1+125	238	1539	1+125	Happy people Community, Road 11	2 CC (0.8 dia)	1.27	Tertiary Road	13.3	17.7	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	0.88	Concrete	0.017	3	1	7
		79L-R3	1+125	1+412	287	609	1+412	Jeje Powerline, Unity Quarters Street		1.56	Tertiary Road	15.5	20.6	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	0.88	Concrete	0.017	3.5	1	7.5
		79L-R4	1+412	2+200	788	130	2+200	LIFEORTR ROAD	1 BC (1.7 x 1.02)	2.31	Main Road	21.1	28.1	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 2)	2.6	Dar	Masterplan	0.88	Concrete	0.017	3.5	1.5	9.5
		79L-R5	2+200	2+700	500	131	2+700	LIFE FORTE		2.98	Tertiary Road	26.1	34.8	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	0.88	Concrete	0.017	4	1.5	10
		79L-R6	2+700	3+183	483	Size Change				2.98												Concrete	0.017	4	1.5	10
79M	ON11 Alapata South	79M-R1	0+969	2+175	1206	Size Change				2.00		18.8	25.0			Channelized Stream					1.00	Concrete	0.017	4	1	8
81	ON12 Middle Ona West	81-R1	1+071	1+577	506	593	1+577	Harmony Gold Estate Olounde, Lorikem College	2 BC (1.8 x 1.4)	1.71	Tertiary Road	16.6	22.1	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	0.83	Concrete	0.017	4	1	8
		81-R2	1+577	1+965	388	592	1+965	Aba Agbopa Ologuneru, Ogunremi Road		2.19	Tertiary Road	20.2	26.9	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 2)	2.6	Dar	Masterplan	0.83	Concrete	0.017	4	1	8
		81-R3	1+965	2+262	297	591	2+262	Ogunremi, Ogunremi Road		2.30	Tertiary Road	21.0	28.0	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 2)	2.6	Dar	Masterplan	0.83	Concrete	0.017	4.5	1	8.5
		81-R4	2+262	2+927	665	Size Change						21.0	28.0									Concrete	0.017	4.5	1	8.5
		81-R5	2+927	3+907	980	579	3+907	Alafara, Zone 2 Ayedade		5.95	Tertiary Road	48.9	65.2	Proposed	Box Culvert	Channelized Stream	2 Cv (4 x 2)	2.6	Dar	Masterplan	0.67	Concrete	0.017	8	1.5	14
		81-R6	3+907	3+976	69	Size Change						48.9	65.2									Concrete	0.017	8	1.5	14
		81-R7	3+976	4+495	519	580	4+495	Alafara, Alafara, Elenusonso Ido Road	1 BC (2.5 x 1.8)	8.01	Secondary Road	71.7	95.6	Proposed	Box Culvert	Channelized Stream	2 Cv (5 x 2)	2.6	Dar	Masterplan	0.67	Concrete	0.017	10	1.5	16
		81-R8	4+495	4+883	388	581	4+883	Alafara, Alafara, Off Elenusonso road		8.46	Tertiary Road	71.7	95.6	Proposed	Box Culvert	Channelized Stream	2 Cv (5 x 2)	2.6	Dar	Masterplan	0.67	Concrete	0.017	10	1.5	16
		81-R9	4+883	5+426	543	Size Change						71.7	95.6									Concrete	0.017	10	1.5	16
		81-R10	5+426	5+909	483	621	5+909	Abela near Shallom Christian College, Abela Stream, Agbofi Eti road	2 CC (0.6 dia) + BC (0.8 x 1.35)	10.36	Tertiary Road	149.9	199.9	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.67	Concrete	0.017	12	2	20
		81-R11	5+909	6+888	979	741	6+888	Aba Asa- Iddo, Allahu Lateef, Aba Asa / Allahu Lateef road	3 CC (0.76 dia)	11.34	Tertiary Road	149.9	199.9	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.67	Concrete	0.017	12	2	20
		81-R12	6+888	7+149	261	742	7+149	Ifelodun Community, Odo Ona, Road 12		11.51	Tertiary Road	149.9	199.9	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.67	Concrete	0.017	12	2	20
		81-R13	7+149	8+199	1050	743	8+199	Lasokun Araromi, Bokusoro, Lasokun Araromi	2 BC (1.88 x 1.66)	12.17	Tertiary Road	149.9	199.9	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.67	Concrete	0.017	12	2	20
		81-R14	8+199	8+614	415	1	8+614	LASOKUN OLUBODE , OFF GBEKUBA,	2 BC (3.05 x 1.54)	12.47	Tertiary Road	149.9	199.9	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.67	Concrete	0.017	12	2	20
		81-R15	8+614	8+837	223	744	8+837	Lasokun Gbakuba Apata, Ile omo olugbade, Ile omo olugbade street	2 BC (1.43 x 0.9)	12.58	Tertiary Road	149.9	199.9	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.67	Concrete	0.017	12	2	20
		81-R16	8+837	9+043	206	2	9+043	OLUGBODE ESTATE , ALAFARA STREAM,	2 CC (0.8 dia)	12.65	Tertiary Road	149.9	199.9	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.67	Concrete	0.017	12	2	20
		81-R17	9+043	9+151	108	Size Change				12.65		149.9	199.9									Concrete	0.017	12	2	20
81F	ON12 Middle Ona West	81F-R1	0+715	1+239	524	1541	1+239	Ifesowapo Area		2.29	Tertiary Road	20.9	27.9	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 2)	2.6	Dar	Masterplan	0.75	Concrete	0.017	3	1	7
		81F-R2	1+239	1+475	236	Size Change				2.29		20.9	27.9									Concrete	0.017	3	1	7
81J	ON12 Middle Ona West	81J-R1	0+861	0+975	114	584	0+975	Itesiwaju estate-Ologuneru	3 CC (0.77 dia)	1.05	Tertiary Road	11.6	15.5	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	1.13	Concrete	0.017	4	1	8
		81J-R2	0+975	1+173	198	583	1+173	Itesiwaju estate-Ologuneru, Alagutan road	3 CC (0.77 dia)	1.13	Tertiary Road	12.2	16.3	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	1.13	Concrete	0.017	4	1	8
		81J-R3	1+173	1+601	428	Size Change				1.13		12.2	16.3									Concrete	0.017	4	1	8
82	ON12 Middle Ona West	82-R1	0+923	2+924	2001	1117	2+924	Apata, All saint college road	1 BC (1.5 x 1.43)	4.47	Tertiary Road	37.3	49.7	Proposed	Box Culvert	Channelized Stream	1 Cv (5.5 x 2)	2.6	Dar	Masterplan	0.85	Concrete	0.017	3	1	7
		82-R2	2+924	3+476	552	Size Change						37.3	49.7									Concrete	0.017	3	1	7
		82-R3	3+476	4+055	579	1060	4+055	Apata, Behind NNPC, Behind NNPC	2 BC (2.09 x 1.2)	6.39	Tertiary Road	63.8	85.1	Proposed	Box Culvert	Channelized Stream	2 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.56	Concrete	0.017	9	1.5	15
		82-R4	4+055	4+538	483	1061	4+538	Apata, Ekun odebe, Ekun odebe		7.24	Tertiary Road	63.8	85.1	Proposed	Box Culvert	Channelized Stream	2 Cv (5.5 x 2)	2.6	Dar	Masterplan	0.56	Concrete	0.017	11	1.5	17
		82-R5	4+538	4+971	433	Size Change						63.8	85.1									Concrete	0.017	11	1.5	17
		82-R6	4+971	5+201	230	6	5+201	OLADELE NEW TOWN , GBEKUBA,	2 BC (2.8 x 2.14)	10.40	Tertiary Road	70.6	94.2	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2)	2.6	Dar	Masterplan	0.56	Concrete	0.017	12	1.5	18
		82-R7	5+201	5+486	285	5	5+486	OLADELE NEW TOWN , GBEKUBA,		10.94	Tertiary Road	73.5	98.1	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.56	Concrete	0.017	12	2	20
		82-R8	5+486	5+795	309	4	5+795	OLADELE NEW IOWN , GBEKUBA APATA,		11.01	Tertiary Road	83.0	110.6	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.56	Concrete	0.017	12	2	20
		82-R9	5+795	6+255	460	3	6+255	ABA-ALFA GBEKUBA,	1 BC (2.9 x 1.45)	11.33	Tertiary Road	83.0	110.6	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.56	Concrete	0.017	12	2	20
		82-R10	6+255	6+351	96	Size Change						83.0	110.6									Concrete	0.017	12	2	20
		82-R11	6+351	6+701	350	745	6+701	Gbekuba Apata, Bello Tade Layout, Bello Tade Layout	2 BC (2.39 x 1.5)	12.16	Tertiary Road	90.0	120.0	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.56	Concrete	0.017	12	2	20
		82-R12	6+701	6+998	297	Size Change				12.16		90.0	120.0									Concrete	0.017	12	2	20
82E	ON12 Middle Ona West	82E-R1	0+928	1+061	133	1572	1+061	Ilori village, Biodun Obisesan Av	1 CC (0.8 dia)	1.09	Tertiary Road	11.9	15.9	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	1.07	Concrete	0.017	3	1	7
		82E-R2	1+061	1+353	292	Size Change				1.09		11.9	15.9									Concrete	0.017	3	1	7
82J	ON12 Middle Ona West	82J-R1	1+355	1+410	55	1571	1+410	Isoka Area		1.03	Tertiary Road	11.5	15.3	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	1.00	Concrete	0.017	3	1	7
		82J-R2	1+410	1+870	460	Size Change				1.03		11.5	15.3									Concrete	0.017	3	1	7

Channel Data						Structure Data								Design of Structures							Design of Channels					
Channel ID	Subbasin	Reach ID	Start Station	End Station	Reach Length (m)	Structure No.	Structure Station	Location	Existing Crossing Structure Dimensions	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Vertical Distance from Road L. to Prop. Culv. Inv.	Designed by	Status	Stream Slope (%)	Lining Protection	Roughness Coeff. For Channel	Bed Width (m)	Design Depth (m)	Top Width (m)
82M	ON12 Middle Ona West	82M-R1	1+159	1+306	147	1110 Prime	1+306	Apata, NNPC		1.19	Tertiary Road	12.7	16.9	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	0.90	Concrete	0.017	3.5	1.5	9.5
		82M-R2	1+306	2+107	801	1119	2+107	Apata, NNPC		1.65	Tertiary Road	16.1	21.5	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	0.90	Concrete	0.017	3.5	1.5	9.5
		82M-R3	2+107	2+247	140	1119 Prime	2+247	Apata, NNPC		1.71	Tertiary Road	16.6	22.1	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	0.90	Concrete	0.017	5	1.5	11
		82M-R4	2+247	2+459	212	1109	2+459	Apata, NNPC	4 CC (0.75 dia) + BC (4.04 x 1.03)	2.17	Tertiary Road	20.0	26.7	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	0.90	Concrete	0.017	5	1.5	11
		82M-R5	2+459	2+493	34	1118	2+493	Apata Area, Temidire	1 BC (4.4 x 1.8)	2.17	Tertiary Road	20.0	26.7	Existing							0.90	Concrete	0.017	5	1.5	11
		82M-R6	2+493	2+644	151	9	2+644	ADEBISI LAYOUT , OPPOSITE NNPC		2.23	Tertiary Road	20.5	27.3	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	0.90	Concrete	0.017	5.5	1.5	11.5
		82M-R7	2+644	2+815	171	8	2+815	ADEBISI LAYOUT		2.28	Tertiary Road	20.9	27.8	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	0.90	Concrete	0.017	5.5	1.5	11.5
		82M-R8	2+815	3+013	198	7	3+013	ISOKAN , GBEKUBA	2 BC (1.55 x 1.92)	2.83	Tertiary Road	25.0	33.3	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.90	Concrete	0.017	5.5	1.5	11.5
		82M-R9	3+013	3+186	173	Size Change				2.83		25.0	33.3									Concrete	0.017	5.5	1.5	11.5
80	ON13 Middle Ona South	80-R1		0+703	703	138B	0+703	New Eleyele road, Eleyele Bridge, New Eleyele Road	Br (2 Span 15.1)	318.60	Main Road	551.6	735.4	Proposed	Bridge	Channelized Stream	Br (55 x 20)	6	Dar	Masterplan	0.15	Concrete Sides	0.027	40	3.5	54
		80-R2	0+703	2+837	2134	145A	2+837	Nihort, Ona, Nihort	2 BC (2.9 x 1.7)	326.30	Secondary Road	551.6	735.4	Proposed	Bridge	Channelized Stream	Br (55 x 10)	6	Dar	Masterplan	0.15	Concrete Sides	0.027	40	3.5	54
		80-R3	2+837	4+401	1564	734	4+401	Lasokun-Baskol, Odubanjo, Odubanjo	Br (2 Span 11.03)	327.65	Tertiary Road	551.6	735.4	Proposed	Bridge	Channelized Stream	Br (55 x 10)	6	Dar	Masterplan	0.15	Concrete Sides	0.027	40	3.5	54
		80-R4	4+401	5+488	1087	Size Change				327.65		551.6	735.4									Concrete Sides	0.027	40	3.5	54
80A	ON13 Middle Ona South	80A-R1	1+209	1+370	161	619	1+370	Oba Ado, Oba Ado / Idiosan road	1 CC (1.9 dia)	1.34		13.8	18.4	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	0.85	Concrete	0.017	3.5	1	7.5
		80A-R2	1+370	1+499	129	Size Change				1.34		13.8	18.4									Concrete	0.017	3.5	1	7.5
80B	ON13 Middle Ona South	80B-R1	0+809	1+454	645	601	1+454	Benjamin Eleyele, Adeleke Street	2 BC (2.65 x 1.2)	2.47	Tertiary Road	22.3	29.7	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	0.83	Concrete	0.017	4	1.5	10
		80B-R2	1+454	1+681	227	595	1+681	Babalegba Eleyele, Sango-Eleyele road	1 BC (2.85 x 1.51)	2.55	Main Road	22.9	30.5	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	0.83	Concrete	0.017	4	1.5	10
		80B-R3	1+681	1+917	236	Size Change				2.55		22.9	30.5									Concrete	0.017	4	1.5	10
80B-3	ON13 Middle Ona South	80B-3-R1	1+024	1+028	4	602	1+028	Eleyele, Ladeti Street	1 BC (2.47 x 1.24)	1.01	Tertiary Road	11.3	15.1	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	0.95	Concrete	0.017	3	1	7
		80B-3-R2	1+028	1+407	379	Size Change				1.01		11.3	15.1									Concrete	0.017	3	1	7
80K	ON13 Middle Ona South	80K-R1	1+157	1+664	507	1543	1+664	Elenusonso Iletuntun, Elufisayo Rd		1.81	Tertiary Road	17.3	23.1	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	0.60	Concrete	0.017	4.5	1	8.5
		80K-R2	1+664	1+902	238	624	1+902	Ologuneru, Off Nihort / Elenusonso road Behind Olu Ojelabi close		1.92	Tertiary Road	18.2	24.2	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	0.60	Concrete	0.017	4.5	1	8.5
		80K-R3	1+902	2+618	716	Size Change				1.92		18.2	24.2									Concrete	0.017	4.5	1	8.5
80L	ON13 Middle Ona South	80L-R1	1+207	1+289	82	749	1+289	Eleyele, Police Barack	3 CC (0.9 dia) + BC (1.8 x 1.45)	1.26	Tertiary Road	13.2	17.6	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	0.77	Concrete	0.017	3.5	1	7.5
		80L-R2	1+289	2+620	1331	751	2+620	NIHORT, Eleyele road	1 BC (3.4 x 1.81)	2.32	Tertiary Road	21.2	28.2	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	0.77	Concrete	0.017	4	1.5	10
		80L-R3	2+620	3+647	1027	Size Change				2.32		21.2	28.2									Concrete	0.017	4	1.5	10
80U	ON13 Middle Ona South	80U-R1	1+171	1+813	642	1540	1+813	Idi Isin Ajumose GRA, Ajumose GRA	2 BC (1.98 x 1.54)	1.49	Tertiary Road	14.9	19.9	Existing							1.50	Concrete	0.017	2.5	1.5	8.5
		80U-R2	1+813	1+976	163	Size Change				1.49		14.9	19.9									Concrete	0.017	2.5	1.5	8.5
83	ON14 Lower Ona North	83-R1		0+480	480	735	0+480	Peku, Railway, Railway line	Br (12.1m)	354.77	Tertiary Road	551.6	735.4	Proposed	Bridge	Channelized Stream	Br (55 x 10)	6	Dar	Masterplan	0.21	Concrete Sides	0.027	40	3.5	54
		83-R2	0+480	1+137	657	Size Change						551.6	735.4									Concrete Sides	0.027	40	3.5	54
		83-R3	1+137	2+407	1270	139B	2+407	ODO-ONA GADA , APATA,	2 BC (10.9 x 5)	356.98	Highway	551.6	735.4	Proposed	Bridge	Channelized Stream	Br (63 x 11)		Dar	Lot3 (Going for Bid)	0.21	Concrete Sides	0.027	40	3.5	54
		83-R4	2+407	5+140	2733	Size Change						551.6	735.4									Concrete Sides	0.027	40	3.5	54
		83-R5	5+140	5+338	198	146B	5+338	Oluyole Extension, Beside Zion House, Owodu road	Br (3 Span 13.35)	366.82	Secondary Road	551.6	735.4	Proposed	Box Culvert	Channelized Stream	Add 4 Cv (7 x 5.1)		Dar	Lot3 (Going for Bid)	0.21	Concrete Sides	0.027	Var.	3.5	Var.
		83-R6	5+338	5+466	128	Size Change						551.6	735.4									Concrete Sides	0.027	Var.	3.5	Var.
		83-R7	5+466	5+953	487	147B	5+953	OLUYOLE ESTATE ROAD,	3 BC (3.08 x 3.16)	367.28	Main Road	563.6	751.5	Proposed	Bridge	Channelized Stream	Br (48 x 13)		Dar	Lot3 (Going for Bid)	0.21	Concrete Sides	0.027	33	3.5	47
		83-R8	5+953	6+180	227	Size Change						563.6	751.5									Concrete Sides	0.027	33	3.5	47
		83-R9	6+180	6+870	690	816	6+870	Zartech, Ona, Zartech compound	Br (13.4m)	372.32		563.6	751.5	Proposed	Bridge	Channelized Stream	Br (61 x 10)		Dar	Lot3 (Going for Bid)	0.21	Concrete Sides	0.027	40	3.5	54
		83-R10	6+870	7+415	545	Size Change				372.32		563.6	751.5									Concrete Sides	0.027	40	3.5	54
83F	ON14 Lower Ona North	83F-R1	0+939	2+605	1666	756	2+605	Kuole by Emmanuel Baptist Church, Railway line	1 BC (2.4 x 2.06)	2.92	Tertiary Road	25.7	34.2	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	0.88	Concrete	0.017	4	1.5	10
		83F-R2	2+605	2+789	184	757	2+789	Odo Ona Ayileka, Emmanuel Baptist Church	2 BC (1.38 x 1.39)	2.94	Tertiary Road	25.8	34.4	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	0.88	Concrete	0.017	4	1.5	10
		83F-R3	2+789	3+007	218	758	3+007	Odo Ona, Adeola Street	2 BC (1.15 x 1.51)	3.08	Tertiary Road	26.9	35.8	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	0.88	Concrete	0.017	4	1.5	10
		83F-R4	3+007	3+157	150	140	3+157	ODO-ONA OLUGBODE APATA	1 BC (3.4 x 3.75)	3.27		28.3	37.7	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.88	Concrete	0.017	4.5	1.5	10.5
		83F-R5	3+157	3+462	305	Size Change				3.27		28.3	37.7									Concrete	0.017	4.5	1.5	10.5
83G	ON14 Lower Ona North	83G-R1	1+513	1+574	61	774	1+574	Ago Taylor, Ring road	1 BC (1.98 x 1.5)	1.02	Main Road	11.4	15.2	Proposed	Box Culvert	Channelized Stream	1 Cv (2 x 2)	2.6	Dar	Masterplan	1.58	Concrete	0.017	2	1.5	8
		83G-R2	1+574	1+697	123	775	1+697	Ago Taylor, Akinyemi way	1 BC (1.5 x 1.23)	1.30	Main Road	13.5	18.0	Proposed	Box Culvert	Channelized Stream	1 Cv (2 x 2)	2.6	Dar	Masterplan	1.58	Concrete	0.017	2	1.5	8
		83G-R3	1+697	2+044	347	776	2+044	Odo Ona, Abdullahi Street	1 BC (2 x 2.01)	1.42	Tertiary Road	14.4	19.2	Existing							1.58	Concrete	0.017	2	1.5	8
		83G-R4	2+044	2+344	300	777	2+344	Odo Ona, Off Fatimo Street	1 BC (3.6 x 1.4)	1.51	Tertiary Road	15.1	20.1	Existing							1.58	Concrete	0.017	2.5	1.5	8.5
		83G-R5	2+344	2+396	52	778	2+396	Oke Ayo-Odo Ona, Fatimo Street	1 BC (3.6 x 1.72)	1.64	Tertiary Road	16.1	21.4	Existing							1.58	Concrete	0.017	2.5	1.5	8.5
		83G-R6	2+396	2+438	42	Size Change				1.64		16.1	21.4									Concrete	0.017	2.5	1.5	8.5
83H	ON14 Lower Ona North	83H-R1	1+068	1+324	256	780	1+324	Federal college of Animal health & Production Technology	1 BC (1.5 x 1.24)	1.12	Tertiary Road	12.2	16.2	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	1.27	Concrete	0.017	3	1	7
		83H-R2	1+324	1+396	72	771	1+396	Federal college of Animal health & Production Technology, IA & RT road	2 CC (0.9 dia)	1.14	Tertiary Road	12.3	16.4	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	1.27	Concrete	0.017	3	1	7
		83H-R3	1+396	1+525	129	770	1+525	Federal college of Animal health & Production Technology, Main gate road	1 BC (2.9 x 1)	1.19	Tertiary Road	12.7	16.9	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	1.27	Concrete	0.017	3	1	7
		83H-R4	1+525	2+099	574	Size Change				1.19		12.7	16.9									Concrete	0.017	3	1	7
83M	ON14 Lower Ona North	83M-R1	0+900	1+430	530	154	1+430	OLUAWO ROAD	2 BC (2.8 x 1.86)	2.24	Tertiary Road	20.6	27.4	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 2)	2.6	Dar	Masterplan	0.85	Concrete	0.017	3.5	1.5	9.5
		83M-R2	1+430	1+544	114	360	1+544	Jogor Centre	2 BC (3 x 1.12)	2.26	Tertiary Road	20.7	27.6	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 2)	2.6	Dar	Masterplan	0.85	Concrete	0.017	3.5	1.5	9.5
		83M-R3	1+544	2+180	636	819	2+180	Ring Road	3 CC (1.2 dia) + BC (1.55 x 1.26)	2.74	Main Road	24.3	32.4	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	0.85	Concrete	0.017	4	1.5	10
		83M-R4	2+180	3+388	1208	818	3+388	Oluyole Estate, 14 Avenue	2 BC (3 x 2.92)	4.14	Tertiary Road	34.8	46.4	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2.5)	3.25	Dar	Masterplan	0.85	Concrete	0.017	4	2	12
		83M-R5	3+388	3+519	131	Size Change				4.14		34.8	46.4									Concrete	0.017	4	2	12
84	ON15 Alaro	84-R1	0+881	1+638	757	1289	1+638	OLU-OJO STRT,OFF IDI-AHUN		1.76	Local Road	17.0	22.6	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	1.00	Concrete	0.017	4	1	8
		84-R2	1+638	1+913	275	1290	1+913	ODEGBAMI LAYOUT, OLUYOLE EXT. ELEBU	1 CC (0.8 dia)	2.07	Local Road	19.3	25.7	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	1.00	Concrete	0.017	4	1	8
		84-R3	1+913	2+098	185	1322	2+098	OKE-IBUNKUN ALONG,PIPELINE ELEBU	3 CC (0.7 dia)	2.21	Tertiary Road	20.3	27.1	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	1.00	Concrete	0.017	4.5	1	8.5
		84-R4	2+098	2+247	149	1291	2+247	IFELODUN, ABA- PANU,OFF DALE COLLEGE		2.29	Tertiary Road	20.9	27.9	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	1.00	Concrete	0.017	4.5	1	8.5
		84-R5	2+247	2+684	437	1298	2+684	IFELODUN, ABA- PANU	1 CC (0.76 dia)	2.51	No Road	22.6	30.1	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	1.00	Concrete	0.017	4.5	1	8.5
		84-R6	2+684	2+736	52	Size Change						22.6	30.1									Concrete	0.017	4.5	1	8.5
		84-R7	2+736	2+952	216	1299	2+952	ORITA MERIN JUNCTION,OFF ELEBU, ODO ALAGBA, OLUYOLE EXTENSION, ELEBU		5.33	Secondary Road	44.9	59.9	Proposed	Box Culvert	Channelized Stream	2 Cv (3.5 x 2)	2.6	Dar	Masterplan	0.73	Concrete	0.017	7	1.5	13
		84-R8	2+952	3+395	443	1300	3+395	OLADIPUPO GBOLAHAN STRT. ELEBU, ODO ALAGBA, LABUTA RD, ELEBU		5.70	Tertiary Road	44.9	59.9	Proposed	Box Culvert	Channelized Stream	2 Cv (3.5 x 2)	2.6	Dar	Masterplan	0.73	Concrete	0.017	7	1.5	13
		84-R9	3+395	4+336	941	Size Change						44.9	59.9									Concrete	0.017	7	1.5	13
		84-R10	4+336	4+503	167	19	4+503	AKALA ROAD,	1 BC (2.95 x 2.75)	6.94	Main Road	51.8	69.1	Proposed	Box Culvert	Channelized Stream	2 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.73	Concrete	0.017	8	1.5	14
		84-R11	4+503	4+894	391	Size Change				6.94		51.8	69.1									Concrete	0.017	8	1.5	14

Channel Data						Structure Data								Design of Structures							Design of Channels					
Channel ID	Subbasin	Reach ID	Start Station	End Station	Reach Length (m)	Structure No.	Structure Station	Location	Existing Crossing Structure Dimensions	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Vertical Distance from Road L. to Prop. Culv. Inv.	Designed by	Status	Stream Slope (%)	Lining Protection	Roughness Coeff. For Channel	Bed Width (m)	Design Depth (m)	Top Width (m)
84D	ON15 Alaro	84D-R1	1+225	1+279	54	1293	1+279	JIM-ROCK BLOCK INDUSTRY RD, IDI-AHUN ELEBU		1.04	Tertiary Road	11.6	15.4	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	1.00	Concrete	0.017	4	1	8
		84D-R2	1+279	1+726	447	1294	1+726	BESIDE MAXWELL MONTESSORI SCH, ALONG IDI-AHUN	1 BC (2 x 1.4)	1.74	Local Road	16.8	22.4	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	1.00	Concrete	0.017	4	1	8
		84D-R3	1+726	1+806	80	1295	1+806	ARAROMI ALONG IDI-AHUN	1 BC (2.87 x 0.88)	1.80	Tertiary Road	17.3	23.0	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	1.00	Concrete	0.017	4	1	8
		84D-R4	1+806	2+226	420	1296	2+226	BEFORE GETHSEMAN CHURCH,ORITA -MERIN	1 BC (1.1 x 1.14)	2.25	Tertiary Road	20.6	27.5	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	1.00	Concrete	0.017	4.5	1	8.5
		84D-R5	2+226	2+289	63	1297	2+289	ARAROMI ALONG , IDI-AHUN ROAD	1 CC (0.68 dia)	2.33	Secondary Road	21.2	28.3	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	1.00	Concrete	0.017	4.5	1	8.5
		84D-R6	2+289	2+496	207	Size Change				2.33		21.2	28.3									Concrete	0.017	4.5	1	8.5
85	ON15 Alaro	85-R1	1+097	1+196	99	1095	1+196	Apata	1 BC (2.9 x 1.14)	1.03	Tertiary Road	11.5	15.3	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	0.79	Concrete	0.017	3.5	1.5	9.5
		85-R2	1+196	1+730	534	1122	1+730	Apata	2 CC (1.2 dia)	1.93	Tertiary Road	18.2	24.3	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 2)	2.6	Dar	Masterplan	0.79	Concrete	0.017	3.5	1.5	9.5
		85-R3	1+730	2+577	847	1096	2+577	Bembo Area	1 BC (1.6 x 1.53)	3.09	Tertiary Road	26.9	35.9	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.79	Concrete	0.017	5	1.5	11
		85-R4	2+577	2+763	186	1097	2+763	Oloruntumo		3.67	Tertiary Road	31.3	41.7	Proposed	Box Culvert	Channelized Stream	1 Cv (5 x 2)	2.6	Dar	Masterplan	0.79	Concrete	0.017	5	1.5	11
		85-R5	2+763	2+893	130	1098	2+893	Olakunle		3.78	Tertiary Road	32.1	42.8	Proposed	Box Culvert	Channelized Stream	1 Cv (5 x 2)	2.6	Dar	Masterplan	0.79	Concrete	0.017	5	1.5	11
		85-R6	2+893	2+992	99	1573	2+992	Olorun Tumo Road		3.86	Tertiary Road	32.7	43.6	Proposed	Box Culvert	Channelized Stream	1 Cv (5.5 x 2)	2.6	Dar	Masterplan	0.79	Concrete	0.017	5.5	1.5	11.5
		85-R7	2+992	3+062	70	1099	3+062	Apata		3.93	Tertiary Road	33.2	44.3	Proposed	Box Culvert	Channelized Stream	1 Cv (5.5 x 2)	2.6	Dar	Masterplan	0.79	Concrete	0.017	5.5	1.5	11.5
		85-R8	3+062	3+205	143	1574	3+205	Olorun Tumo Road		4.07	Tertiary Road	34.3	45.7	Proposed	Box Culvert	Channelized Stream	1 Cv (5.5 x 2)	2.6	Dar	Masterplan	0.79	Concrete	0.017	5.5	1.5	11.5
		85-R9	3+205	3+372	167	1121	3+372	Oloruntumo		4.15	Tertiary Road	34.9	46.5	Proposed	Box Culvert	Channelized Stream	1 Cv (5.5 x 2)	2.6	Dar	Masterplan	0.79	Concrete	0.017	5.5	1.5	11.5
		85-R10	3+372	3+502	130	1575	3+502	Olorun Tumo Road		4.27	Tertiary Road	35.8	47.7	Proposed	Box Culvert	Channelized Stream	1 Cv (5.5 x 2)	2.6	Dar	Masterplan	0.79	Concrete	0.017	5.5	1.5	11.5
		85-R11	3+502	3+593	91	1062	3+593	Apata	2 BC (2.5 x 2.53)	4.33	Tertiary Road	36.2	48.3	Existing							0.79	Concrete	0.017	5.5	1.5	11.5
		85-R12	3+593	3+666	73	Size Change						36.2	48.3									Concrete	0.017	5.5	1.5	11.5
		85-R13	3+666	4+002	336	1063	4+002	Apata, Alafia Estate, Alafia Estate	1 BC (3.06 x 1.7)	5.84	Tertiary Road	60.1	80.2	Proposed	Box Culvert	Channelized Stream	1 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.60	Concrete	0.017	6	2	14
		85-R14	4+002	4+143	141	1576	4+143	Onigele Apata, Apata, Onigele		5.91	Tertiary Road	60.1	80.2	Proposed	Box Culvert	Channelized Stream	1 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.60	Concrete	0.017	6	2	14
		85-R15	4+143	4+275	132	1064	4+275	Iyana cele, Iyana cele, Off NNPC Road	1 BC (1.6 x 1.58)	5.97	Main Road	60.1	80.2	Proposed	Box Culvert	Channelized Stream	1 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.60	Concrete	0.017	6	2	14
		85-R16	4+275	4+370	95	1577	4+370	Cele Road Apata, Cele Road		5.97	Tertiary Road	60.1	80.2	Proposed	Box Culvert	Channelized Stream	1 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.60	Concrete	0.017	6	2	14
		85-R17	4+370	4+554	184	10	4+554	BEMBU ROAD , ABA-ALAMU,	2 BC (2.4 x 1.84)	8.20	Main Road	60.1	80.2	Proposed	Box Culvert	Channelized Stream	1 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.60	Concrete	0.017	6	2	14
		85-R18	4+554	4+778	224	11	4+778	REPODUN , ALEXANDA AREA,		8.57	Tertiary Road	87.1	116.1	Proposed	Box Culvert	Channelized Stream	2 Cv (4.5 x 2.5)	3.25	Dar	Masterplan	0.60	Concrete	0.017	9	2	17
		85-R19	4+778	5+100	322	12	5+100	ILUPEJU , APATA,	1 BC (2.85 x 1.8)	8.83	Tertiary Road	87.1	116.1	Proposed	Box Culvert	Channelized Stream	2 Cv (4.5 x 2.5)	3.25	Dar	Masterplan	0.60	Concrete	0.017	9	2	17
		85-R20	5+100	5+645	545	Size Change						87.1	116.1									Concrete	0.017	9	2	17
		85-R21	5+645	5+696	51	1065	5+696	Kuola Apata, Chief Awopeju Ogumbe, Chief Awopeju Ogumbe Street		12.05	Tertiary Road	105.1	140.2	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.60	Concrete	0.017	12	2	20
		85-R22	5+696	6+044	348	15	6+044	ABA ALADIE,	2 BC (2.98 x 2.48)	12.30	Secondary Road	105.1	140.2	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.60	Concrete	0.017	12	2	20
		85-R23	6+044	6+221	177	Size Change						105.1	140.2									Concrete	0.017	12	2	20
		85-R24	6+221	6+420	199	16	6+420	SHARP CORNER , OLUYOLE ESTATE,	1 BC (5.8 x 2.7)	13.63	Tertiary Road	115.5	154.0	Proposed	Box Culvert	Channelized Stream	2 Cv (6.5 x 2.5)	3.25	Dar	Masterplan	0.60	Concrete	0.017	13	2	21
		85-R25	6+420	6+958	538	17	6+958	OLUYOLE ESTATE (ABA OLU ODE STATE),	2 BC (3.08 x 2.97)	13.98	Tertiary Road	115.5	154.0	Proposed	Box Culvert	Channelized Stream	2 Cv (6.5 x 2.5)	3.25	Dar	Masterplan	0.60	Concrete	0.017	13	2	21
		85-R26	6+958	7+187	229	Size Change				13.98		115.5	154.0									Concrete	0.017	13	2	21
85F	ON15 Alaro	85F-R1	1+156	1+495	339	1080	1+495	Apata, Oloruntumo Road	2 CC (0.8 dia)	1.24	Tertiary Road	13.1	17.4	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	1.25	Concrete	0.017	3	1	7
		85F-R2	1+495	1+697	202	Size Change				1.24		13.1	17.4									Concrete	0.017	3	1	7
85G	ON15 Alaro	85G-R1	1+228	1+374	146	1086	1+374	Apata, Tanimowo road,behind Krisbvow International hotel	1 BC (2.4 x 1.65)	1.12		12.2	16.2	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.00	Concrete	0.017	2.5	1.5	8.5
		85G-R3	1+374	1+651	277	19D5	1+651	APATA-PATE COMMUNITY		1.33	No Road	13.7	18.3									Concrete	0.017	2.5	1.5	8.5
		85G-R4	1+651	1+722	71	19D4	1+722	APATA-PATE COMMUNITY		1.37	No Road	14.0	18.7									Concrete	0.017	2.5	1.5	8.5
		85G-R5	1+722	1+803	81	19D3	1+803	APATA-PATE COMMUNITY		1.39	No Road	14.2	18.9									Concrete	0.017	2.5	1.5	8.5
		85G-R6	1+803	1+844	41	19D2	1+844	APATA-PATE COMMUNITY		1.39	No Road	14.2	18.9									Concrete	0.017	2.5	1.5	8.5
		85G-R2	1+844	1+957	113	1087	1+957	APATA-PATE COMMUNITY	1 BC (1.6 x 1.65)	1.44	Secondary Road	14.6	19.4	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.00	Concrete	0.017	2.5	1.5	8.5
		85G-R7	1+957	2+099	142	1088	2+099	Iyana cele, Prince Abayomi Oladeinde Street		1.53		15.2	20.3	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.00	Concrete	0.017	2.5	1.5	8.5
		85G-R8	2+099	2+217	118	1089	2+217	Aba Alamu Apata, Mosyln Royal International School Road	1 BC (3.7 x 0.9)	2.12		19.7	26.2	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 2)	2.6	Dar	Masterplan	1.00	Concrete	0.017	3	1.5	9
		85G-R9	2+217	2+307	90	Size Change				2.12		19.7	26.2									Concrete	0.017	3	1.5	9
85L	ON15 Alaro	85L-R1	0+990	1+211	221	1090	1+211	Kuola Apata, Aba Elesin	1 BC (2.2 x 1.55)	1.32	Secondary Road	13.7	18.2	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.16	Concrete	0.017	2.5	1.5	8.5
		85L-R2	1+211	1+541	330	1059	1+541	Kuola Apata,Jimoh Soyombo		1.72	Tertiary Road	16.7	22.2	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.16	Concrete	0.017	2.5	1.5	8.5
		85L-R3	1+541	1+779	238	13	1+779	APATA , PIPE LINE	2 BC (2.43 x 1.95)	1.91		18.1	24.1	Existing						New	1.16	Concrete	0.017	3	1.5	9
		85L-R4	1+779	1+911	132	14	1+911	Kuola Apata, Off Confidence road		2.02	Tertiary Road	18.9	25.2	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 2)	2.6	Dar	Masterplan	1.16	Concrete	0.017	3	1.5	9
		85L-R5	1+911	2+510	599	Size Change				2.02		18.9	25.2									Concrete	0.017	3	1.5	9
86	ON15 Alaro	86-R1		0+322	322	18	0+322	OLUSOJI COMMUNITY,	2 BC (3.04 x 3.22)	21.24	Tertiary Road	160.8	214.4	Proposed	Box Culvert	Channelized Stream	3 Cv (5.5 x 2.75)	3.575	Dar	Masterplan	0.47	Concrete	0.017	17	2.25	26
		86-R2	0+322	1+016	694	20	1+016	ALARO AREA ONE COMMUNITY,	2 BC (3.25 x 2.48)	22.69	Tertiary Road	160.8	214.4	Proposed	Box Culvert	Channelized Stream	3 Cv (5.5 x 2.75)	3.575	Dar	Masterplan	0.47	Concrete	0.017	17	2.25	26
		86-R3	1+016	1+334	318	Size Change						160.8	214.4									Concrete	0.017	17	2.25	26
		86-R4	1+334	1+514	180	22	1+514	ABULEX ROAD ELEWURE,	3 BC (2.75 x 2.69)	24.89	Tertiary Road	181.6	242.2	Proposed	Box Culvert	Channelized Stream	3 Cv (6 x 2.75)	3.575	Dar	Masterplan	0.47	Concrete	0.017	18	2.25	27
		86-R5	1+514	2+044	530	827	2+044	Oluyole Extension, Off Zartech road, Off Zartech road	5 BC (1.75 x 1.7)	25.69		181.6	242.2	Proposed	Bridge	Channelized Stream	Br (15m)		Pheman	Going For Bid	0.47	Concrete	0.017	18	2.25	27
		86-R6	2+044	2+222	178	Size Change						181.6	242.2									Concrete	0.017	18	2.25	27
		86-R7	2+222	2+521	299	23	2+521	ZATECH ROAD METERS,	1 BC (1.95 x 8.2)	25.96		199.4	265.9	Proposed	Box Culvert	Channelized Stream	8 Cv (6 x 2)		Dar	Lot2 (Going for Bid)	0.47	Concrete Sides	0.027	48	2.25	57
		86-R8	2+521	3+247	726	Size Change				30.00		255.7	340.9									Concrete Sides	0.027	48	2.25	57
86C	ON15 Alaro	86C-R1	1+184	1+292	108	25	1+292	AKURU SECOND BORE HOLE		1.17	Tertiary Road	12.5	16.7	Proposed	Box Culvert	Channelized Stream	1 Cv (2 x 2)	2.6	Dar	Masterplan	1.27	Concrete	0.017	2	1.5	8
		86C-R2	1+292	1+776	484	825	1+776	Akuru, By Ishola Alarape close	2 CC (0.6 dia)	1.40	Tertiary Road	14.3	19.0	Proposed	Box Culvert	Channelized Stream	1 Cv (2 x 2)	2.6	Dar	Masterplan	1.27	Concrete	0.017	2	1.5	8
		86C-R3	1+776	1+926	150	21	1+926	AKURU EXPRESS ROAD	1 BC (3.4 x 2.85)	1.85	Main Road	17.6	23.5	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.27	Concrete	0.017	2.5	1.5	8.5
		86C-R4	1+926	2+174	248	1570	2+174	Cherry Lane		1.95	Tertiary Road	18.4	24.5	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.27	Concrete	0.017	2.5	1.5	8.5
		86C-R5	2+174	2+254	80	Size Change				1.95		18.4	24.5									Concrete	0.017	2.5	1.5	8.5
86G	ON15 Alaro	86G-R1	1+223	1+385	162	24	1+385		2 BC (2.7 x 3.03)	1.15	Main Road	12.4	16.5	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 1.5)	1.95	Dar	Masterplan	1.52	Concrete	0.017	2.5	1	6.5
		86G-R2	1+385	1+560	175	1568	1+560	Oke Alaro Orelope Community, Oke Alaro Street	2 BC (1.76 x 1.29)	1.22	Tertiary Road	12.9	17.2	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 1.5)	1.95	Dar	Masterplan	1.52	Concrete	0.017	2.5	1	6.5
		86G-R3	1+560	1+640	80	829	1+640	Orelope Community, Lane 17		1.27	Tertiary Road	13.3	17.7	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 1.5)	1.95	Dar	Masterplan	1.52	Concrete	0.017	2.5	1	6.5
		86G-R4	1+640	1+648	8	830	1+648	Orelope Community-Oluyole, Zartech road	1 BC (1.77 x 0.88)	1.33	Tertiary Road	13.7	18.3	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 1.5)	1.95	Dar	Masterplan	1.52	Concrete	0.017	2.5	1	6.5
		86G-R5	1+648	1+922	274	Size Change				1.33		13.7	18.3									Concrete	0.017	2.5	1	6.5

Channel Data						Structure Data								Design of Structures							Design of Channels					
Channel ID	Subbasin	Reach ID	Start Station	End Station	Reach Length (m)	Structure No.	Structure Station	Location	Existing Crossing Structure Dimensions	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Vertical Distance from Road L. to Prop. Culv. Inv.	Designed by	Status	Stream Slope (%)	Lining Protection	Roughness Coeff. For Channel	Bed Width (m)	Design Depth (m)	Top Width (m)
89	ON16 Agara Kasumu	89-R1	1+007	1+993	986	1304	1+993	BESIDE DANGOTE CEMENT DEPORT,ALAAKA IBUDO EST	2 BC (1.265 x 1.1)	2.58	Tertiary Road	23.1	30.8	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	0.84	Concrete	0.017	4	1.5	10
		89-R2	1+993	2+773	780	1306	2+773	FEDERAL HOUSING EST. AREA,ALONG HALLELUYAH HOUSE		4.77	Secondary Road	39.5	52.7	Proposed	Box Culvert	Channelized Stream	1 Cv (6 x 2)	2.6	Dar	Masterplan	0.84	Concrete	0.017	6	1.5	12
		89-R3	2+773	3+118	345	1308	3+118	AREA 1, BOTA EST LIBERTY ACADEMY	1 CC (0.6 dia)	4.77	Tertiary Road	39.5	52.7	Proposed	Box Culvert	Channelized Stream	1 Cv (6 x 2)	2.6	Dar	Masterplan	0.84	Concrete	0.017	6	1.5	12
		89-R4	3+118	3+197	79	Size Change						39.5	52.7									Concrete	0.017	6	1.5	12
		89-R5	3+197	3+296	99	1309	3+296	OFF JANEADEY WAY, FEDERAL LOW COST AREA, ODO LOW COST, BOTA ROAD, ODO-ONA ELEWE		5.32	Tertiary Road	56.7	75.6	Proposed	Box Culvert	Channelized Stream	2 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.60	Concrete	0.017	9	1.5	15
		89-R6	3+296	3+727	431	1310	3+727	BESIDE ST.ANNE'S COMPREHENSIVE COLLEGE, ODO ST.ANNE'S, ODEKU, IDI-IROKO ODO-ONA ELEWE	1 BC (2.5 x 1.87)	5.91	Secondary Road	56.7	75.6	Proposed	Box Culvert	Channelized Stream	2 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.60	Concrete	0.017	9	1.5	15
		89-R7	3+727	3+875	148	1311	3+875	BESIDE ILE AANU-MAJEMU,BEHIND ST.ANNE COMPREHENSIVE COLLEGE, ODO BESIDE ILE MAJEMU CHURCH, FEDERAL HOUSING RD ALONG IDI-IROKO	2 CC (1.2 dia)	5.95		56.7	75.6	Proposed	Box Culvert	Channelized Stream	2 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.60	Concrete	0.017	9	1.5	15
		89-R8	3+875	3+970	95	Size Change						56.7	75.6									Concrete	0.017	9	1.5	15
		89-R9	3+970	4+127	157	1318	4+127	ALONG TOM-TIN BLOCK INDUSTRY, ODEKU VILLAGE, ODO OLUWAWE,ODEKU, ODO-ONA ELEWE, ACADEMY.		8.85	Tertiary Road	73.5	98.0	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2)	2.6	Dar	Masterplan	0.60	Concrete	0.017	12	1.5	18
		89-R10	4+127	4+311	184	1319	4+311	ALONG GOSPEL INT. CHURCH, ODEKU VILLAGE, ODO ODEKU, ODO-ONA ELEWE, ACADEMY.	2 CC (1.3 dia)	9.02	Tertiary Road	73.5	98.0	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2)	2.6	Dar	Masterplan	0.60	Concrete	0.017	12	1.5	18
		89-R11	4+311	4+494	183	1320	4+494	KOGUO AREA, ALONG IDI-IROKO, ODO ODEKU, IDI-IROKO,ODO-ONA ELEWE		9.17	Tertiary Road	73.5	98.0	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2)	2.6	Dar	Masterplan	0.60	Concrete	0.017	12	1.5	18
		89-R12	4+494	4+852	358	Size Change						73.5	98.0									Concrete	0.017	12	1.5	18
		89-R13	4+852	5+034	182	862	5+034	Oke Odo-Bola, Eri-Kalofih, Eri-Kalofih Street	2 BC (2.15 x 1.3)	10.51	Tertiary Road	108.3	144.5	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.60	Concrete	0.017	12	2	20
		89-R14	5+034	5+168	134	856	5+168	Odo Ona -Bola, Open heaven, Open heaven Avenue	2 BC (2.68 x 2.45)	10.58	Tertiary Road	108.3	144.5	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.60	Concrete	0.017	12	2	20
		89-R15	5+168	5+387	219	857	5+387	Oke Odo-Bola, Ogunse, Ogunse road		10.70	Tertiary Road	108.3	144.5	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.60	Concrete	0.017	12	2	20
		89-R16	5+387	5+823	436	858	5+823	Isale Olosan, Ifesowapo, Ifesowapo road		11.48	Tertiary Road	108.3	144.5	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.60	Concrete	0.017	12	2	20
		89-R17	5+823	6+869	1046	30	6+869	ASIPA ROAD,	2 BC (3.78 x 2.15)	13.46	Tertiary Road	108.3	144.5	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.60	Concrete	0.017	12	2	20
		89-R18	6+869	7+798	929	31	7+798	DALUTE,	3 BC (3 x 2)	14.48	Secondary Road	108.3	144.5	Proposed	Box Culvert	Channelized Stream	Add 2 Cv (5 x 2)		Abfort	Addition by Dar	0.60	Concrete	0.017	12	2	20
		89-R19	7+798	8+491	693	1214	8+491	KASUMU, AGARA KASUMU, ZONE B		14.99	Tertiary Road	108.3	144.5	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.60	Concrete	0.017	12	2	20
		89-R20	8+491	8+874	383	Size Change				14.99		108.3	144.5									Concrete	0.017	12	2	20
89L	ON16 Agara Kasumu	89L-R1	1+110	1+334	224	1312	1+334	OFF ALALADE FAMILY RD,BOTA EST AREA	2 CC (0.7 dia)	1.16	Tertiary Road	12.5	16.6	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	0.97	Concrete	0.017	3	1	7
		89L-R2	1+334	1+994	660	1313	1+994	BESIDE JIMI BLOCK INDUSTRY AREA, NNPC PIPELINE		1.87	Secondary Road	17.8	23.7	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	0.97	Concrete	0.017	4	1	8
		89L-R3	1+994	2+296	302	1316	2+296	ESTATE EXTENSION, LANE 6 PIPELINE AREA		2.00	Tertiary Road	18.8	25.0	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	0.97	Concrete	0.017	4	1	8
		89L-R4	2+296	2+992	696	1317	2+992	BEHIND ILE AANU-MAJEMU,BEHIND ST.ANNE COMPREHENSIVE COLLEGE	2 CC (0.76 dia)	2.72	Tertiary Road	24.2	32.2	Proposed	Box Culvert	Channelized Stream	1 Cv (5.5 x 1.5)	1.95	Dar	Masterplan	0.97	Concrete	0.017	5.5	1	9.5
		89L-R5	2+992	3+084	92	Size Change				2.72		24.2	32.2									Concrete	0.017	5.5	1	9.5
89M	ON16 Agara Kasumu	89M-R1	0+928	1+120	192	854	1+120	Bola Estate, Idi-Iroko road	2 CC (0.85 dia)	1.07		11.8	15.7	Proposed	Box Culvert	Channelized Stream	1 Cv (3 x 1.5)	1.95	Dar	Masterplan	0.89	Concrete	0.017	3	1	7
		89M-R2	1+120	1+159	39	Size Change				1.07												Concrete	0.017	3	1	7
87	ON17 Lower Ona East	87-R1	0+851	1+208	357	870	1+208	CHALLENGE, RING ROAD	2 BC (1.48 x 1.24)	1.63	Main Road	16.0	21.3	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	0.75	Concrete	0.017	4.5	1	8.5
		87-R2	1+208	1+383	175	1567	1+383	Oluyole, Abiodun Tomori Avenue		1.72	Tertiary Road	16.7	22.2	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	0.75	Concrete	0.017	4.5	1	8.5
		87-R3	1+383	1+625	242	839	1+625	Elewura Challenge	2 BC (1.84 x 1.6)	1.81	Tertiary Road	17.3	23.1	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	0.75	Concrete	0.017	4.5	1	8.5
		87-R4	1+625	2+077	452	1566	2+077	Kola Oyewuwo Street, Road 5		3.58	Tertiary Road	30.6	40.8	Proposed	Box Culvert	Channelized Stream	1 Cv (5 x 2)	2.6	Dar	Masterplan	0.75	Concrete	0.017	5	1.5	11
		87-R5	2+077	2+261	184	1560	2+261	Oke Odo Titun, Road 4		3.66	Tertiary Road	31.2	41.6	Proposed	Box Culvert	Channelized Stream	1 Cv (5 x 2)	2.6	Dar	Masterplan	0.75	Concrete	0.017	5	1.5	11
		87-R6	2+261	2+479	218	842	2+479	Orita Challenge, Oladapo Adesanya Street	2 BC (2.84 x 2.95)	4.68	Tertiary Road	38.9	51.8	Existing							0.75	Concrete	0.017	6	1.5	12
		87-R7	2+479	3+020	541	Size Change						38.9	51.8									Concrete	0.017	6	1.5	12
		87-R8	3+020	3+958	938	Size Change				7.50		40.7	54.2								0.89	Concrete	0.017	6	1.5	12
87E	ON17 Lower Ona East	87E-R1	1+206	1+400	194	836	1+400	Challenge ring road, Bolumole Street		1.48	Tertiary Road	14.9	19.8	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.10	Concrete	0.017	2.5	1.5	8.5
		87E-R2	1+400	1+479	79	837	1+479	Challenge ring road ,Popoola Street	1 BC (4.8 x 1.98)	1.52	Tertiary Road	15.2	20.2	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.10	Concrete	0.017	2.5	1.5	8.5
		87E-R3	1+479	1+622	143	838	1+622	Fodacis Area ring road,		1.56	Tertiary Road	15.5	20.6	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	1.10	Concrete	0.017	2.5	1.5	8.5
		87E-R4	1+622	1+688	66	Size Change				1.56												Concrete	0.017	2.5	1.5	8.5
88	ON17 Lower Ona East	88-R1		1+654	1654	148B	1+654	ODO-ONA ELEWE,	2 BC (8.95 x 2.87)	408.68	Tertiary Road	564.7	752.9	Proposed	Bridge	Channelized Stream	Br (15m)		Pheman	Going For Bid	0.21	Concrete Sides	0.027	50	3.5	67.5
		88-R2	1+654	2+503	849	149B	2+503	New Garage, Agara river, Akala road	Br (2 Span 10.2)	411.75	Main Road	574.3	765.7	Proposed	Bridge	Channelized Stream	Br (72m)		Dar	Lot4	0.21	Concrete Sides	0.027	50	3.5	67.5
		88-R3	2+503	2+723	220	1584	2+723	Akala, Ona River, Akala		413.34	Tertiary Road	574.3	765.7									Concrete Sides	0.027	50	3.5	67.5
		88-R4	2+723	3+625	902	1215	3+625	OPERE, ODO ONA, ROAD 1, ZONE 2		415.18	Tertiary Road	574.3	765.7	Proposed	Bridge	Channelized Stream	Br (72 x 10)	5.7	Dar	Masterplan	0.21	Concrete Sides	0.027	50	3.5	67.5
		88-R5	3+625	3+893	268	Size Change				415.18		574.3	765.7									Concrete Sides	0.027	50	3.5	67.5
88D	ON17 Lower Ona East	88D-R1	0+977	1+217	240	843	1+217	Orita Challenge, Ogundipe Street	2 BC (1.5 x 1.55)	1.25	Tertiary Road	13.1	17.5	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 1.5)	1.95	Dar	Masterplan	0.94	Concrete	0.017	3.5	1	7.5
		88D-R2	1+217	1+625	408	844	1+625	Orita Challenge, Old lagos road	2 CC (1.2 dia) + BC (3.05 x 1.92)	1.59	Highway	15.7	20.9	Existing							0.94	Concrete	0.017	3.5	1	7.5
		88D-R3	1+625	2+406	781	847	2+406	New Garage, Itesiwaju road	2 BC (1.3 x 1.78)	2.52	Tertiary Road	22.7	30.2	Proposed	Box Culvert	Channelized Stream	1 Cv (3.5 x 2)	2.6	Dar	Masterplan	0.94	Concrete	0.017	3.5	1.5	9.5
		88D-R4	2+406	2+656	250	Size Change				2.52		22.7	30.2									Concrete	0.017	3.5	1.5	9.5
88E	ON17 Lower Ona East	88E-R1	1+462	1+756	294	1565	1+756	Iyana Agara, Zone 4	1 BC (4.8 x 1.55)	1.39	Tertiary Road	14.2	18.9	Existing							0.77	Concrete	0.017	4	1	8
		88E-R2	1+756	1+837	81	29	1+837	AGARRA ODO-EJA	1 BC (1.85 x 0.9)	1.43	Tertiary Road	14.5	19.3	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	0.77	Concrete	0.017	4	1	8
		88E-R3	1+837	2+077	240	1585	1+913	Akala Road, Omotosho Akanji Estate		1.46	Tertiary Road	14.7	19.6	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	0.77	Concrete	0.017	4	1	8
88G	ON17 Lower Ona East	88G-R1	1+526	1+705	179	1186	1+705	OPERE/OLOGEDE, OFF ALHAJI ADEEYO STR.		1.09	Tertiary Road	11.9	15.9	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 1.5)	1.95	Dar	Masterplan	2.09	Concrete	0.017	2.5	1	6.5
		88G-R2	1+705	2+055	350	Size Change				1.09		11.9	15.9									Concrete	0.017	2.5	1	6.5
91	ON18 Lower Ona South	91-R1		0+782	782	Size Change						590.4	787.2									Concrete Sides	0.027	50	3.5	64
		91-R2	0+782	1+111	329	1185	1+111	ONIPON COMMUNITY, ODO ONA, OFF AYODELE ALAKIU ST.	Br (11.7m)	431.99	Tertiary Road	599.8	799.8	Proposed	Bridge	Channelized Stream	Br (70 x 10)	6	Dar	Masterplan	0.11	Concrete Sides	0.027	54	3.5	68
		91-R3	1+111	2+061	950	1216	2+061	ABA IBEJI, ODO ONA RIVER, IYANA COLLEGE		447.34	Tertiary Road	599.8	799.8	Proposed	Bridge	Channelized Stream	Br (70 x 10)	6	Dar	Masterplan	0.11	Concrete Sides	0.027	54	3.5	68
		91-R4	2+061	2+206	145	Size Change						599.8	799.8									Concrete Sides	0.027	54	3.5	68
		91-R5	2+206	3+285	1079	150B	3+285	ODO ONA KEKERE, ODO ONA RIVER, OLD LAGOS ROAD	Br (2 Span 13)	452.22	Highway	603.4	804.5	Proposed	Bridge	Channelized Stream	Br (86m)		Dar	Lot4	0.11	Concrete Sides	0.027	67	3.5	81
		91-R6	3+285	3+398	113	1196	3+398	AKERELE, ODO ONA, OLD LAGOS ROAD	Br (2 Span 13.85)	452.28	Tertiary Road	603.4	804.5	Existing							0.11	Concrete Sides	0.027	67	3.5	81
		91-R7	3+398	3+746	348	151B	3+746	LAGOS/IBADAN EXPRESS WAY, ODO ONA RIVER, GURU AREA	Br (23.7m)	452.73	Expressway	603.4	804.5	Proposed	Bridge	Channelized Stream	Br (86 x 40)	6.5	Dar	Masterplan	0.11	Concrete Sides	0.027	67	3.5	81
		91-R8	3+746	4+118	372	Size Change				452.73		603.4	804.5									Concrete Sides	0.027	67	3.5	81

Channel Data						Structure Data								Design of Structures							Design of Channels					
Channel ID	Subbasin	Reach ID	Start Station	End Station	Reach Length (m)	Structure No.	Structure Station	Location	Existing Crossing Structure Dimensions	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Vertical Distance from Road L. to Prop. Culv. Inv.	Designed by	Status	Stream Slope (%)	Lining Protection	Roughness Coeff. For Channel	Bed Width (m)	Design Depth (m)	Top Width (m)
91H	ON18 Lower Ona South	91H-R1	1+060	1+673	613	1204	1+673	ABAMBA AREA, ABORE STR.	1 CC (0.62 dia)	1.83	Tertiary Road	17.5	23.3	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 1.5)	1.95	Dar	Masterplan	0.93	Concrete	0.017	4	1	8
		91H-R2	1+673	1+820	147	129	1+820	SIMISOLA FARM	3 CC (0.75 dia)	2.10	Secondary Road	19.5	26.0	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 1.5)	1.95	Dar	Masterplan	0.93	Concrete	0.017	4.5	1	8.5
		91H-R3	1+820	2+154	334	1203	2+154	ARAPAJA, ALAFIA ESTATE RD.	2 CC (0.8 dia)	2.58	Tertiary Road	23.1	30.8	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	0.93	Concrete	0.017	4	1.5	10
		91H-R4	2+154	2+267	113	1202	2+267	ARAPAJA/ODO ONA KEKERE, ORISUNBARE STREET	6 CC (0.77 dia)	2.71	Tertiary Road	24.1	32.1	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	0.93	Concrete	0.017	4	1.5	10
		91H-R5	2+267	2+377	110	1201	2+377	ARAPAJA, LOVE STREET	1 CC (0.76 dia)	2.77	Tertiary Road	24.5	32.7	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	0.93	Concrete	0.017	4	1.5	10
		91H-R6	2+377	2+606	229	1200	2+606	RAINBOW ESTATE, RAINBOW RD.		2.98	Tertiary Road	26.1	34.8	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	0.93	Concrete	0.017	4	1.5	10
		91H-R7	2+606	2+654	48	1199	2+654	RAINBOW ESTATE, RAINBOW RD.	1 CC (0.96 dia) + BC (1.79 x 2)	3.07	Tertiary Road	26.8	35.7	Proposed	Box Culvert	Channelized Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	0.93	Concrete	0.017	4	1.5	10
		91H-R8	2+654	3+147	493	1198	3+147	ABA IBEJI, ORE OFE ROAD	1 BC (3 x 2.6)	3.35	Tertiary Road	28.9	38.5	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.93	Concrete	0.017	4.5	1.5	10.5
		91H-R9	3+147	3+672	525	Size Change				3.35		28.9	38.5									Concrete	0.017	4.5	1.5	10.5
90	ON19 Lower Ona West		0+994	0+994		1324	0+994	AYEGUN, AMULETIGBO ROAD		0.99	Tertiary Road	11.2	14.9	Proposed	Box Culvert	Channelized Stream	1 Cv (2 x 2)	2.6	Dar	Masterplan	0.87	Concrete	0.017	2	1.5	8
		90-R1	0+994	1+177	183	1325	1+177	AYEGUN OLEYO, LAFIAJI ROAD	1 BC (1.8 x 1.78)	1.27	Tertiary Road	13.3	17.7	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	0.87	Concrete	0.017	2.5	1.5	8.5
		90-R2	1+177	1+576	399	1329	1+576	OGO-OLUWA AYEGUN, AYEGUN ROAD	1 BC (2 x 1.28)	1.52	Tertiary Road	15.2	20.2	Proposed	Box Culvert	Channelized Stream	1 Cv (2.5 x 2)	2.6	Dar	Masterplan	0.87	Concrete	0.017	2.5	1.5	8.5
		90-R3	1+576	2+617	1041	1330	2+617	ABADA, ABADA ROAD		3.67	Secondary Road	31.3	41.7	Proposed	Box Culvert	Channelized Stream	1 Cv (4.5 x 2)	2.6	Dar	Masterplan	0.87	Concrete	0.017	4.5	1.5	10.5
		90-R4	2+617	2+905	288	1333	2+905	ABADA, ABADA ROAD		4.32	Tertiary Road	36.2	48.2	Proposed	Box Culvert	Channelized Stream	1 Cv (5.5 x 2)	2.6	Dar	Masterplan	0.87	Concrete	0.017	5.5	1.5	11.5
		90-R5	2+905	3+088	183	Size Change						36.2	48.2									Concrete	0.017	5.5	1.5	11.5
		90-R6	3+088	3+714	626	Size Change						68.2	90.9									Concrete	0.017	9	1.5	15
		90-R7	3+714	4+162	448	Size Change						77.3	103.1									Concrete	0.017	12	1.5	18
		90-R8	4+162	5+654	1492	1180	5+654	ASUNLE AREA, ASUNLE CHANEL, OFF CHURCH CLOSE STREET	1 BC (2.43 x 1.38)	10.03	Secondary Road	101.3	135.0	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.51	Concrete	0.017	12	2	20
		90-R9	5+654	5+866	212	32	5+866	Regent Estate/14 Acres, Asunle Cv., Atere/Ilugusi	1 BC (1.96 x 1.2)	11.92	Tertiary Road	101.3	135.0	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.51	Concrete	0.017	12	2	20
		90-R10	5+866	6+717	851	1181	6+717	KASUMU/ABA IBEJI, KASUMU CHANNEL, KASUMU	1 CC (1.2 dia)	13.12	Tertiary Road	127.3	169.7	Proposed	Box Culvert	Channelized Stream	2 Cv (6 x 2.5)	3.25	Dar	Masterplan	0.51	Concrete	0.017	15	2	23
		90-R11	6+717	7+188	471	Size Change						127.3	169.7									Concrete	0.017	15	2	23
		90-R12	7+188	7+324	136	1182	7+324	ONIPON/ABA IBEJI, ONIKIN RIVER, ONIPON ESTATE RD.	1 CC (1.4 dia)	13.50	Tertiary Road	127.3	169.7	Proposed	Box Culvert	Channelized Stream	3 Cv (5.5 x 2.5)	3.25	Dar	Masterplan	0.51	Concrete	0.017	17	2	25
		90-R13	7+324	7+538	214	Size Change				13.50		127.3	169.7									Concrete	0.017	17	2	25
90M	ON19 Lower Ona West	90M-R1	0+968	1+592	624	Size Change				2.00		18.8	25.0								1.08	Concrete	0.017	3.5	1	7.5
90N	ON19 Lower Ona West	90N-R1	1+131	1+550	419	Size Change				2.00		18.8	25.0								1.11	Concrete	0.017	3.5	1	7.5

Annex

10

Cost Estimate of Channels and Crossing Structures lying on Proposed Channels

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1 Introduction

This annex presents the cost estimate of the channels and crossing structures (Bridges/Culverts) lying on these channels. The description of each of the drainage infrastructure items is first presented, followed by the unit rates for each drainage item, then the methodology is applied on a pilot system no. 32 (Egberi Stream). Finally, the cost estimate is presented for all proposed channels, bridges and culverts along with their final cost.

2 Basic Items

The drainage infrastructure items include the following works:

- Excavation/Earthworks
- Concrete and Steelwork
- Crossing Structures (Culverts/Bridges/Dams)
- Channels (Lined/Earth)

2.1 Excavation/Earthworks

This item covers earthworks for channels. Earth work is expected to be mechanized, and although various types of machinery and differing costs may be applied for earth work operations in different sections of the project area, unified average prices are used. All lands are expected to be loose and compactible and no rock is expected to be encountered. The unit cost includes the excavation, trimming, and transporting of excess material after backfilling.

2.2 Concrete and Steelwork

The concrete and steel works to be encountered in the proposed systems is divided into the following categories:

- Concrete Lining (250/20), 15cm thickness
- Concrete for Culverts (300/20), 50cm thickness
- Reinforcement: High tensile steel reinforcement of all diameters

2.3 Crossing Structures (Culverts/Bridges)

The cost estimate of bridges is based on a two-way carriage road; each carriage road consists of 1 to 3 lanes. The cost estimate of culverts is based on different culvert sizes and number of barrels. Culvert's barrel length varies from 12 to 60m according to the type of crossing with different kinds of roads, while bridge widths varies from 12m to 30m.

For both structures, the price includes all necessary accessories such as culvert inlets, outlets, fences and guardrails.

To cover expenses related to any necessary potential works for the roads, the cost estimated for the rehabilitation of culverts shall be multiplied by a factor ranging from 1.4 to 1.6 (taken as 1.6 in this report).

The cost estimate of culverts or bridges are based on replacing undersized culverts by new ones. However, maintaining the new ones and adding other cells is necessary to be investigated in detailed design projects in order to reduce the final cost of these structures.

2.4 Channels

The cost estimate of lined channels is based on both excavation and lining. Regarding excavation, the cost estimate is based on the assumption that 80% of the existing stream's section needs to be excavated to accommodate the required channel's capacity. The proposed section is presented in Figure 1.

Regarding the lining of the channel, the cost estimate is based on the concrete lining of channel's section (bed and side slopes) or the side slopes only with a thickness of 15cm and providing a key to the lining section with an initial dimension of 30cm x 2m. The proposed section is presented in Figure 2 and Figure 3 respectively.

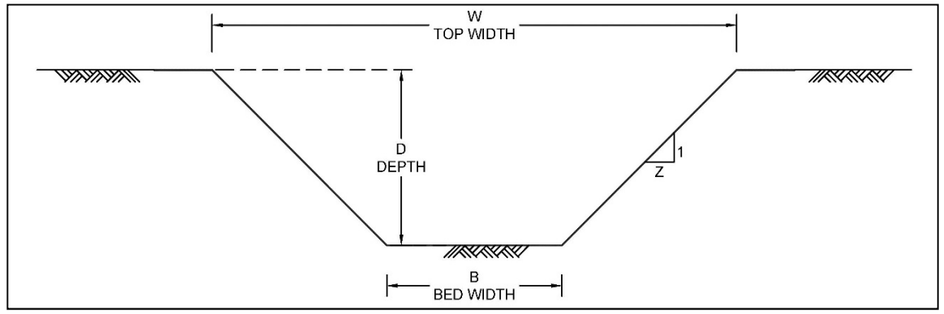

Figure 1: Typical Cross-Section for an Earth Channel

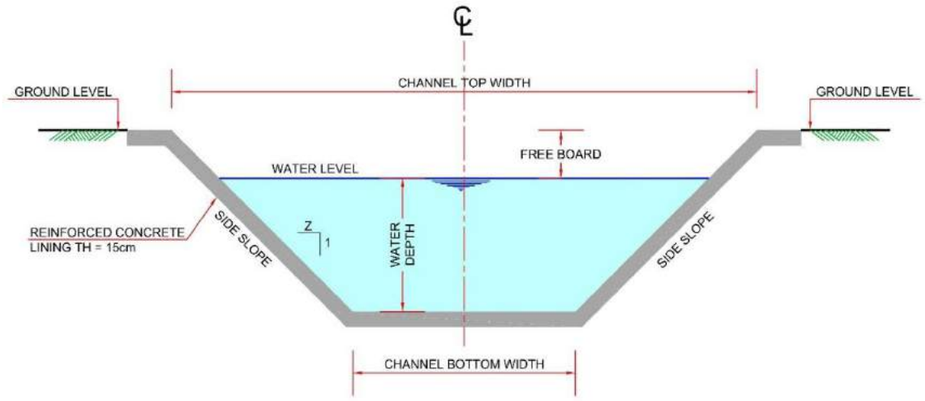

Figure 2: Typical Cross-Section for a Concrete Lined Channel (Bed and Sides)

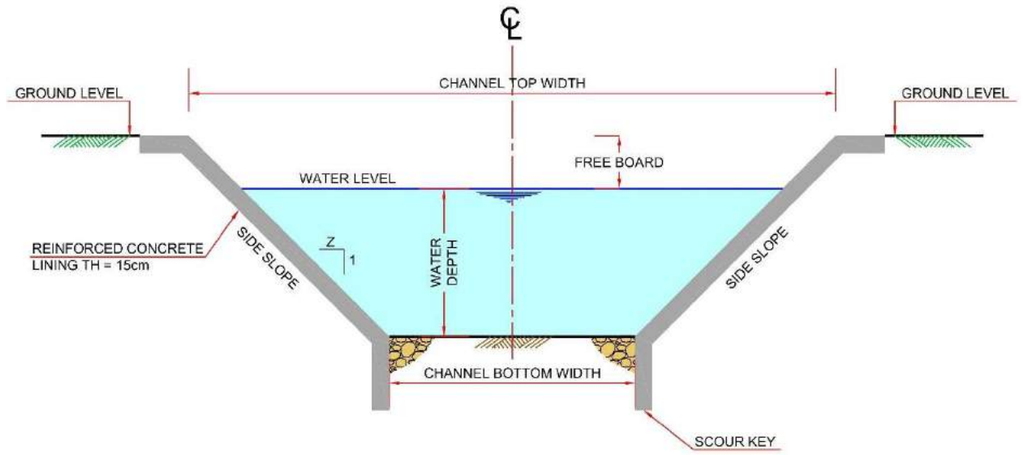

Figure 3: Typical Cross-Section for a Concrete Lined Channel Sides and Natural Bed

3 Unit Rates

The cost estimate unit rates are based on true figures extracted from awarded contracts in similar projects in West Africa and rates received from the PIU. Unit Rates of the main items in USD and Naira are summarized in Table 1.

Table 1: Basic Unit Rates of Drainage Infra-Structure Elements

	General Rates	Unit Rate in USD	Unit	Unit Rate in Naira	Unit
1	**Concrete**				
1.1	High yield steel	1,556	USD/Ton	474,580	Naira/Ton
1.2	In situ concrete class 300/20 for Box culverts, Wing Walls & Apron Slabs	260	USD/m^3	79,300	Naira/m^3
1.3	In situ concrete class 250/20 for Concrete Lining for Channels, Service Ramps and Pavement Screed Layer	240	USD/m^3	73,200	Naira/m^3
2	**Earthworks**				
2.1	Excavation	10	USD/m^3	3,050	Naira/m^3
2.2	Backfilling	11	USD/m^3	3,355	Naira/m^3
3	**Bridges**				
3.1	Vehicle Bridge	1500	USD/m^2	457,500	Naira/m^2
3.2	Vehicle Bridge and Road Rehabilitation	2500	USD/m^2	762,500	Naira/m^2
4	**Riprap**				
4.1	Riprap per m^3	65	USD/m^3	19,825	Naira/m^3

*Exchange Rate USD to Naira = 305

4 Cost Estimate of the Pilot System

The cost of the system is divided into two parts the cost of the channelization and the cost of the structures on the channel. The following sub-sections presents the cost estimate for the pilot sample.

a. Part 1 - Channels

This section investigates the 1st part of the cost estimate for the pilot system no. 32 (Egberi Stream), refer to annex 15. The proposed channelization begins from station 1+454 and ends at station no. 8+277 with a total length of around 6.8km. The channel is designed as a trapezoidal section with concrete lining protection in the bed and side slopes 2H:1V. The sizes of the channel vary from (bed width =3.5m x depth=1m) to (16m x 2m) respectively. The cost of excavation for this system is estimated as 1 MUSD, while the cost of lining for this system is estimated as 4.84 MUSD. The total cost for channelization is estimated as 5.84 MUSD (1.78 B Naira).

Table 1 presents a tabularized form of the data above with the following fields:

- Channel Id (System no.)
- Subbasin Id and Name
- Reach Identity
- Start Station
- End Station
- Lining Material
- Bed Width
- Design Depth
- Top Width
- Reach Length
- Excavation Volume
- Cost of Excavation
- Concrete Volume
- Concrete Cost
- Steel Weight
- Steel Cost
- Total Lining Cost
- Total Cost of Channel

Reach no 32-R2 starts from Station 1+926 and end at Station 2+960 with a total length of 1034m. It is proposed to channelize this reach with a trapezoidal section (bed width of 5m, a depth of 1.5m, a top width of 11m and side slopes 2H:1V). The channel is proposed to be fully lined (bed and side slopes). The estimated concrete volume is 1861 m^3 with a cost of 446,600 USD. The estimated excavation volume is 9926 m^3 with a cost of 99,200 USD. The estimated steel weight is 74.5 ton with a cost of 115,800 USD. The total cost of lining is 562,000 USD. The total cost of channelizing this reach is 661,800 USD.

b. Part 2 – Structures on Channels

This section investigates the 2nd part of the cost estimate for the pilot system no. 32 (Egberi Stream). There are 15 Proposed Box Culverts lying on System 32 with dimensions varying from 1 Box Culvert (3.5m x 1.5m) to 2 Box Culvert (7.5m x 2.5m). The barrel length for these structures are proposed with a length of 10m. Based on the unit rates provided in section 3, the cost of these culverts varies between 48,000 USD (14.64 M Naira) to 200,000 USD (61 M Naira).

Table 2 presents a tabularized form of the data above with the following fields:

- Channel Id (System no.),
- Sub basin Id and Name
- Reach Identity
- Crossing number (Structure no.)
- The Address (Location)
- The Structure Status (To be left as existing or proposed for rehabilitation)
- The proposed crossing structure type (Box Culvert or Bridge)
- The Proposed Crossing Structure Dimensions
- The Consultant whom designed this Structure (Dar or Abfort or Pheman or Others)
- The Barrel Length of the Culvert or the Width of the Bridge
- The total concrete volume (in m^3)
- The concrete cost of the Culvert (in USD)
- The steel weight (in tons)
- The cost of the Culvert
- The total cost of the Culvert considering roadworks.

For structure no. 100, a 2 Box Culvert with dimensions (4.5m x 2.5m). The estimate concrete volume is around 164 m^3 while the estimated steel weight is around 20.5 tons, the estimated cost for this Culvert is 120,000 USD (36.6 M Naira).

5 Proposed Channels and Crossing Structures Cost Estimate

The cost of the channelization including channels and crossing structures are presented in Table 4. The table includes the channelization stretches with the cost of cost channels and crossing structures within these stretches. The table includes five different groups of columns as follows:

- First group are the identification group
- Second group describes the crossing structures designed dimensions

- Third group presents the cost of the crossing structure
- Fourth group covers the channel designed dimensions and lining proposed.
- Fifth group presents the cost of channelization

First group (Identification Group):

- Channel ID
- Sub-basin name
- Reach ID

Second group (Crossing Structure Information):

- Structure ID no.
- Location
- Structure status
- Proposed Structure Type
- Proposed dimensions
- Designed by
- Crossing Structure Length

Third group (Crossing Structure Cost):

- Total concrete volume
- Concrete Cost
- Steel weight
- Steel cost
- Cost of Culverts/Bridges

Fourth group (Channel Information):

- Lining Type
- Bed/depth/top width
- Reach length

Fifth group (Channel Information):

- Excavation Volume
- Cost of Excavation
- Concrete volume
- Cost of concrete
- Steel weight
- Cost of Steel
- Lining cost
- Proposed Channel Cost

Table 1: Cost Estimate of Channel System 32 – Egberi Channel

Channel ID	Subbasin	Reach ID	Start Station	End Station	Lining Material	Bed Width (m)	Design Depth (m)	Top Width (m)	Reach Length (m)	Excavation Volume (m3)	Cost of Excavation US$	Concrete Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Total Lining Cost (USD)	Total Cost of Channel US$
32	OM3 Upper Omi West	32-R1	1+454	1+926	Concrete	3.5	1	7.5	472	2076.8	20,768	566.4	135,936	22.66	35,253	171,189	191,957
		32-R2	1+926	2+960	Concrete	5	1.5	11	1034	9926.4	99,264	1861.2	446,688	74.45	115,841	562,529	661,793
		32-R3	2+960	3+680	Concrete	6	1.5	12	720	7776	77,760	1404.0	336,960	56.16	87,385	424,345	502,105
		32-R5	3+780	4+192	Concrete	8	1.5	14	412	5438.4	54,384	927.0	222,480	37.08	57,696	280,176	334,560
		32-R6	4+192	4+665	Concrete	8	1.5	14	473	6243.6	62,436	1064.3	255,420	42.57	66,239	321,659	384,095
		32-R8	5+203	5+800	Concrete	9	1.5	15	597	8596.8	85,968	1432.8	343,872	57.31	89,177	433,049	519,017
		32-R9	5+800	6+301	Concrete	9	1.5	15	501	7214.4	72,144	1202.4	288,576	48.10	74,837	363,413	435,557
		32-R10	6+301	6+586	Concrete	13	1.5	19	285	5472	54,720	855.0	205,200	34.20	53,215	258,415	313,135
		32-R12	6+634	6+727	Concrete	13	1.5	19	93	1785.6	17,856	279.0	66,960	11.16	17,365	84,325	102,181
		32-R13	6+727	6+899	Concrete	13	1.5	19	172	3302.4	33,024	516.0	123,840	20.64	32,116	155,956	188,980
		32-R14	6+899	7+016	Concrete	13	1.5	19	117	2246.4	22,464	351.0	84,240	14.04	21,846	106,086	128,550
		32-R15	7+016	7+337	Concrete	13	1.5	19	321	6163.2	61,632	963.0	231,120	38.52	59,937	291,057	352,689
		32-R16	7+337	7+496	Concrete	13	1.5	19	159	3052.8	30,528	477.0	114,480	19.08	29,688	144,168	174,696
		32-R18	8+005	8+088	Concrete	16	2	24	83	2656	26,560	311.3	74,700	12.45	19,372	94,072	120,632
		32-R19	8+088	8+204	Concrete	16	2	24	116	3712	37,120	435.0	104,400	17.40	27,074	131,474	168,594
		32-R20	8204	8277	Concrete	16	2	24	73	2336	23360	273.8	65,700	10.95	17,038	82,738	106,098

Table 2: Cost Estimate of Structures lying on System 32 – Egberi Channel

Channel ID	Subbasin	Reach ID	Structure No.	Structure Station	Location	Structure Status	Proposed Crossing Structure Type	Proposed Crossing Structure Dimensions	Designed by	Barrel Length (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Culvert considering Roadworks (USD)
32	OM3 Upper Omi West	32-R1	1356	1+926	Olorunda Abaa, Road 1,Ogooluwa Estate	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16,900	8.13	12,643	30,000	48,000
		32-R2	1351	2+960	Eleshinla Village, Eleshinla Road	Proposed	Box Culvert	1 Cv (5 x 2)	Dar	10	98	25,480	12.25	19,061	45,000	72,000
		32-R3	1352	3+680	Alapata Estate, Onireke Road	Proposed	Box Culvert	1 Cv (6 x 2)	Dar	10	112	29,120	14.00	21,784	51,000	81,600
		32-R5	101	4+192	TEMIDIER , SOKA ELEGA,	Proposed	Box Culvert	2 Cv (4.5 x 2)	Dar	10	164	42,640	20.50	31,898	75,000	120,000
		32-R6	1534	4+665	Harmony Estate, Kumapayi	Proposed	Box Culvert	2 Cv (4.5 x 2)	Dar	10	164	42,640	20.50	31,898	75,000	120,000
		32-R8	100	5+800	AKOKA,	Proposed	Box Culvert	2 Cv (4.5 x 2)	Dar	10	164	42,640	20.50	31,898	75,000	120,000
		32-R9	931	6+301	Kute, Ibagun / Shokobi, Ibagun / Shokobi road	Proposed	Box Culvert	2 Cv (4.5 x 2)	Dar	10	164	42,640	20.50	31,898	75,000	120,000
		32-R10	932	6+586	Kute, Farinto, Farinto	Proposed	Box Culvert	2 Cv (4.5 x 2)	Dar	10	164	42,640	20.50	31,898	75,000	120,000
		32-R12	972	6+727	Kute Area, Powerline, Powerline	Proposed	Box Culvert	2 Cv (6 x 2)	Dar	10	206	53,560	25.75	40,067	94,000	150,400
		32-R13	974	6+899	Kute Area, Sobaloju, Sobaloju	Proposed	Box Culvert	2 Cv (6 x 2)	Dar	10	206	53,560	25.75	40,067	94,000	150,400
		32-R14	933	7+016	Kute, Ifellodun zone 17, Ifelodun Zone 17	Proposed	Box Culvert	2 Cv (6 x 2)	Dar	10	206	53,560	25.75	40,067	94,000	150,400
		32-R15	97	7+337	SIONI/OPEOLU,	Proposed	Box Culvert	2 Cv (6 x 2)	Dar	10	206	53,560	25.75	40,067	94,000	150,400
		32-R16	990	7+496	Agbaja Olodo, Opeolu Layout, Behind Oremeji house	Proposed	Box Culvert	2 Cv (6 x 2)	Dar	10	206	53,560	25.75	40,067	94,000	150,400
		32-R18	1522	8+088	Olodo kumapayi, Opeolu Agbaja	Proposed	Box Culvert	2 Cv (7.5 x 2.5)	Dar	10	275	71,500	34.38	53,488	125,000	200,000
		32-R19	934	8+204	Arulogun Alaja, Along railway line, Railway line	Proposed	Box Culvert	2 Cv (7.5 x 2.5)	Dar	10	275	71,500	34.38	53,488	125,000	200,000

Structure Data										Structure Cost						Channel Data					Channel Cost							
Channel ID	Subbasin	Reach ID	Structure No.	Location	Structure Status	Proposed Crossing Structure Type	Proposed Crossing Structure Dimensions	Designed by	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)	Lining Protection	Bed Width (m)	Design Depth (m)	Top Width (m)	Reach Length (m)	Excavation Volume (m3)	Cost of Excavation US$	Concrete Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Total Lining Cost (USD)	Total Cost of Channel US$
Channel_ID	Subbasin	Reach_ID		Location												Lining	BedWidth_m	Depth_m	TopWidth_m	Length_R_m	Exc_Vol_m3	Ex_Cst_USD	Con_Vol_m3	C_Cst_USD	Stl_Wgt_T	St_Cst_USD	T_Ln_C_USD	T_Ch_C_USD
Channel_ID	Subbasin		Structu_No	Address	Str_Status	Pr_X_StrTy	Pr_X_StDim	Designd_by	BrLength_m	Con_Vol_m3	C_Cst_USD	Stl_Wgt__T	St_Cst_USD	Cv_TCostUS	BrgCst_USD														
11	Ob1 Ogbere Headwaters	11-R1	713	Akobo, Opposite Amazing investment filling station Olohunda road	Proposed	Box Culvert	1 Cv (2 x 2)	Dar	20	96	24960	12	18672	70,400		Concrete	2	1.5	8	173	1038	10380	233.6	56,052	9.34	14,536	70,588	81,000
		11-R2	115	BASHORUN , ESTATE AKOBO	Proposed	Box Culvert	1 Cv (2 x 2)	Dar	10	56	14560	7	10892	41,600		Concrete	2	1.5	8	715	4290	42900	965.3	231,660	38.61	60,077	291,737	335,000
		11-R3	Size Change													Concrete	2	1.5	8	189	1134	11340	255.2	61,236	10.21	15,881	77,117	88,000
		11-R4	114	GENERAL GAS - NANA CHURCH ROAD	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	521	4376.4	43764	859.7	206,316	34.39	53,505	259,821	304,000
		11-R5	113	PAPA ELEWE-ODO	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	415	3486	34860	684.8	164,340	27.39	42,619	206,959	242,000
		11-R6	Size Change													Concrete	4	1.5	10	208	1747.2	17472	343.2	82,368	13.73	21,361	103,729	121,000
12	Ob2 Upper Ogbere	12-R1	703	Elewi Odo, Elewi Odo, Ojo / Iwo road	Existing											Concrete	4	1.5	10	33								
		12-R2	Size Change													Concrete	4	1.5	10	187								
		12-R3	Size Change													Concrete	4	1.75	11	175								
		12-R4	704	Bashorun, Surulere, Surulere street off Iwo road	Existing											Concrete	7	2	15	111								
		12-R5	814	ARIJE AREA/IWO RAOD, OGBERE AKERE RIVER, SURULERE STREET												Concrete	7	2	15	147								
		12-R6	Size Change													Concrete	7	2	15	84								
		12-R7	786	IWO ROAD, OGBERE RIVER, OLORUNBO STREET												Concrete	7	2.25	16	223								
		12-R8	796	BASORUN/IWO ROAD, ABIMBOLA CHANNEL, ABIMBOLA STREET	Existing											Concrete	7	2.25	16	230								
		12-R9	796B	Iwo road/Abayomi/Sule-manager, Ogbere S.C., Olagoke Akano/CAC												Concrete	7	2.25	16	184								
		12-R10	787	IWO ROAD, IWO ROAD	Existing	Box Culvert	Add 1 Cv (3 x 2)	Dar								Concrete	10	2.25	19	404								
		12-R11	Size Change													Concrete	10	2.25	19	372								
		12-R12	788	BODE KUMAPAYI/IWO ROAD, OGBERE RIVER, AKINWUNMI/ODEWENWA STREET	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar								Concrete	10	2.5	20	119								
		12-R13	304	Old Ife Road, Onipepeye/Ogbeere Stream, Abayomi Street	Existing											Concrete	14	2.5	24	705								
		12-R14	87	ONIPEPEYE,	Proposed	Box Culvert	Add 2 Cv (4 x 2.5)	Dar								Concrete	14	2.5	24	129								
		12-R15	304B	Onipepeye, Onipepeye Stream, Lagos-Ibadan Road	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar								Concrete	14	2.5	24	187								
		12-R16	Size Change													Concrete	12	2.5	17	700								
		12-R17	84	OGBERE MORADEYO,	Proposed	Bridge	Br (15m)	Pheman								Concrete	14	2.5	19	328								
		12-R18	82	Oremeji, Babanla	Existing											Concrete	14	2.5	19	487								
		12-R19	1562	Ogbere Idi Obi, Off Itamerin Road												Concrete	14	2.5	19	76								
		12-R20	Size Change													Concrete	14	2.5	19	1119								
		12-R21	Size Change													Concrete	14	2.75	25	350								
		12-R22	425	Ogbere, Ogere Babarere, Seriki Market	Proposed	Box Culvert	Add 1 Cv (4 x 3)	Dar								Concrete	14	3	26	124								
		12-R23	Size Change													Concrete	14	3	26	403								
12C	Ob2 Upper Ogbere	12C-R1	797	IWO ROAD, AMUDA STREET	Proposed	Box Culvert	1 Cv (2.5 x 1.5)	Dar	40	172	44720	21.5	33454	126,400		Concrete	4	1	8	80	384	3840	108.0	25,920	4.32	6,722	32,642	36,000
		12C-R2	795	JONKU/IWO ROAD, ARIJE FAFUNLAYO STREET	Existing											Concrete	4	1	8	154	739.2	7392	207.9	49,896	8.32	12,940	62,836	70,000
		12C-R3	Size Change													Concrete	4	1	8	117	561.6	5616	158.0	37,908	6.32	9,831	47,739	53,000
12F	Ob2 Upper Ogbere	12F-R1	802	IWO ROAD, ALAREPE STREET	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	40	198	51480	24.75	38511	144,000		Concrete	4	1	8	429	2059.2	20592	579.2	138,996	23.17	36,046	175,042	196,000
		12F-R2	801	ABAYOMI ATELE/IWO ROAD, ATELE/OLADAPO STREET	Existing											Concrete	4	1	8	115	552	5520	155.3	37,260	6.21	9,663	46,923	52,000
		12F-R3	813	ABAYOMI/IWO ROAD, ABAYOMI IWO ROAD	Existing											Concrete	4.5	1	8.5	200	1040	10400	270.0	64,800	10.80	16,805	81,605	92,000
		12F-R4	Size Change													Concrete	4.5	1	8.5	66	343.2	3432	89.1	21,384	3.56	5,546	26,930	30,000
12P	Ob2 Upper Ogbere	12P-R1	310	Oke Koto Sawmill, Old Army Barrack	Proposed	Box Culvert	1 Cv (2 x 2)	Dar	10	56	14560	7	10892	41,600		Concrete	4	1	8	156	748.8	7488	210.6	50,544	8.42	13,108	63,652	71,000
		12P-R2	83	MAKU , OGBERE IDI-OSAN	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	4	1	8	336	1612.8	16128	453.6	108,864	18.14	28,232	137,096	153,000
		12P-R3	1561	Ogbere Idi Obi	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	4.5	1	8.5	198	1029.6	10296	267.3	64,152	10.69	16,637	80,789	91,000
		12P-R4	Size Change													Concrete	4.5	1	8.5	240	1248	12480	324.0	77,760	12.96	20,166	97,926	110,000
13	Ob3 Middle Ogbere	13-R1	Size Change													Concrete Sides	18	2.5	28	325								
		13-R2	Size Change													Concrete Sides	24	2.5	34	150								
		13-R3	73	OGBERETIOYA,	Proposed	Box Culvert	4 Cv (6 x 3)	Dar								Concrete Sides	24	2.5	34	100								
		13-R4	Size Change													Concrete Sides	18	2.5	28	750								
		13-R5	7M	Ogbere Aba Onde single span bridge	Proposed	Bridge	Br (15m)	Pheman								Concrete Sides	25	2.5	35	616								
		13-R6	Size Change													Concrete Sides	25	2.5	35	898								
		13-R7	68	GBEGBA , OGBERE, Mosfala Road,	Existing			Abfort								Concrete Sides	29	3	41	333								
		13-R8	Size Change													Concrete Sides	29	3	41	378								
		13-R9	28D	ZONE 2 AND 3- PAPA ELEYE COMMUNITY , OLOMI AREA, IBADAN 2	Proposed	Bridge	Br (55 x 10)	Dar	10						1,375,000	Concrete Sides	45	2.5	55	750								
		13-R10	Size Change													Concrete Sides	45	2.5	55	200								
13A	Ob3 Middle Ogbere	13A-R1	427	Ogbere, Transformer road	Existing											Concrete	2	1.5	8	172	1032	10320	232.2	55,728	9.29	14,452	70,180	81,000
		13A-R2	426	Ile eja bus stop Oritamrin road, Ifelodun street	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	236	1557.6	15576	354.0	84,960	14.16	22,033	106,993	123,000
		13A-R3	Size Change													Concrete	2.5	1.5	8.5	68	448.8	4488	102.0	24,480	4.08	6,348	30,828	35,000
13E	Ob3 Middle Ogbere	13E-R1	Size Change													Concrete	3.5	1	7.5	487	2142.8	21428	584.4	140,256	23.38	36,373	176,629	198,000
13K	Ob3 Middle Ogbere		909	MOSFALA, AMADIYA STREET	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5									
		13K-R1	1513	off Mosfala Road	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	287	1894.2	18942	430.5	103,320	17.22	26,794	130,114	149,000
		13K-R2	910	MOSFALA, ALATA STREET	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	324	2138.4	21384	486.0	116,640	19.44	30,249	146,889	168,000
		13K-R3	911	MOSFALA, TEMIDIRE OGUNDEPEO STREET	Existing											Concrete	3	1.5	9	137	986.4	9864	205.5	49,320	8.22	12,790	62,110	72,000
		13K-R4	67	ARAROMI OGUNDEPO	Proposed	Box Culvert	1 Cv (3 x 2)	Dar	10	70	18200	8.75	13615	51,200		Concrete	3	1.5	9	303	2181.6	21816	454.5	109,080	18.18	28,288	137,368	159,000
		13K-R5	Size Change													Concrete	3	1.5	9	125	900	9000	187.5	45,000	7.50	11,670	56,670	66,000
13M	Ob3 Middle Ogbere	13M-R1	Size Change													Concrete	3.5	1	7.5	982	4320.8	43208	1178.4	282,816	47.14	73,344	356,160	399,000

Structure Data										Structure Cost						Channel Data					Channel Cost							
Channel ID	Subbasin	Reach ID	Structure No.	Location	Structure Status	Proposed Crossing Structure Type	Proposed Crossing Structure Dimensions	Designed by	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)	Lining Protection	Bed Width (m)	Design Depth (m)	Top Width (m)	Reach Length (m)	Excavation Volume (m3)	Cost of Excavation US$	Concrete Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Total Lining Cost (USD)	Total Cost of Channel US$
14	Ob4 Foworogbun	14-R1	344	Gbagi, Gbagi Market	Proposed	Box Culvert	1 Cv (3 x 2)	Dar	10	70	18200	8.75	13615	51,200		Concrete	3	1.5	9	195	1404	14040	292.5	70,200	11.70	18,205	88,405	102,000
		14-R2	342	Onideure, Alebiosu road	Existing											Concrete	5	1.5	11	855	8208	82080	1539.0	369,360	61.56	95,787	465,147	547,000
		14-R3	353	Gbaremu Area, Gbaremu Akinlade	Proposed	Box Culvert	2 Cv (4 x 2)	Dar	10	150	39000	18.75	29175	110,400		Concrete	8	1.5	14	727	9596.4	95964	1635.8	392,580	65.43	101,809	494,389	590,000
		14-R4	81	GBAREMU OLOSUN	Proposed	Box Culvert	2 Cv (4 x 2)	Dar	20	260	67600	32.5	50570	190,400		Concrete	8	1.5	14	156	2059.2	20592	351.0	84,240	14.04	21,846	106,086	127,000
		14-R5	Size Change													Concrete	8	1.5	14	397	5240.4	52404	893.3	214,380	35.73	55,596	269,976	322,000
		14-R6	327	Adenira Olosun, Adeniran/Olosun Stream, Adeniran/Olosun	Proposed	Box Culvert	2 Cv (4 x 2.5)	Dar	10	170	44200	21.25	33065	124,800		Concrete	8	2	16	359	6892.8	68928	915.5	219,708	36.62	56,978	276,686	346,000
		14-R7	437	Gangan -Paraa road, Odo Paraa, Paraa	Proposed	Box Culvert	2 Cv (4 x 2.5)	Dar	10	170	44200	21.25	33065	124,800		Concrete	8	2	16	700	13440	134400	1785.0	428,400	71.40	111,098	539,498	674,000
		14-R8	445	Foworogun Area, Odo Foworogun, Foworogun	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	10	230	59800	28.75	44735	168,000		Concrete	12	2	20	991	25369.6	253696	3121.7	749,196	124.87	194,291	943,487	1,197,000
		14-R9	Size Change													Concrete	16	2	24	856	27392	273920	3210.0	770,400	128.40	199,790	970,190	1,244,000
		14-R10	Size Change													Concrete	18	2	26	382	13446.4	134464	1547.1	371,304	61.88	96,292	467,596	602,000
14L	Ob4 Foworogbun	14L-R1	329	Temidayo-Ogungbile, Temidire	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16900	8.125	12642.5	48,000		Concrete	3.5	1	7.5	136	598.4	5984	163.2	39,168	6.53	10,158	49,326	55,000
		14L-R2	80	AROYE / ORISUNBARE	Proposed	Box Culvert	1 Cv (4.5 x 1.5)	Dar	20	138	35880	17.25	26841	100,800		Concrete	4.5	1	8.5	614	3192.8	31928	828.9	198,936	33.16	51,591	250,527	282,000
		14L-R3	328	Alagbayun, Oke ola/Alaba Road	Proposed	Box Culvert	2 Cv (3 x 1.5)	Dar	10	105	27300	13.125	20422.5	76,800		Concrete	6	1	10	271	1734.4	17344	447.2	107,316	17.89	27,831	135,147	152,000
		14L-R4	Size Change													Concrete	6	1	10	244	1561.6	15616	402.6	96,624	16.10	25,058	121,682	137,000
14Q	Ob4 Foworogbun	14Q-R1	79	AIMASIKO	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	4	1	8	66	316.8	3168	89.1	21,384	3.56	5,546	26,930	30,000
		14Q-R2	1524	Kate Idi Obi, Kate zone 1	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	4	1	8	305	1464	14640	411.8	98,820	16.47	25,627	124,447	139,000
		14Q-R3	89	PAARA	Proposed	Box Culvert	1 Cv (4.5 x 1.5)	Dar	10	78	20280	9.75	15171	57,600		Concrete	4.5	1	8.5	574	2984.8	29848	774.9	185,976	31.00	48,230	234,206	264,000
		14Q-R4	Size Change													Concrete	4.5	1	8.5	212	1102.4	11024	286.2	68,688	11.45	17,813	86,501	98,000
14V	Ob4 Foworogbun	14V-R1	443	Aseyori-Alapafon, Alapafon Estate	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3	1	7	323	1292	12920	387.6	93,024	15.50	24,124	117,148	130,000
		14V-R2	442	Bamitale-Alapafon	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	4	1	8	339	1627.2	16272	457.7	109,836	18.31	28,484	138,320	155,000
		14V-R3	78	MAKU , OGBERE IDI-OSAN	Proposed	Box Culvert	1 Cv (4.5 x 1.5)	Dar	10	78	20280	9.75	15171	57,600		Concrete	4.5	1	8.5	271	1409.2	14092	365.9	87,804	14.63	22,771	110,575	125,000
		14V-R4	440	Olunloyo Area, Irepodun Alapafon	Proposed	Box Culvert	1 Cv (4.5 x 1.5)	Dar	10	78	20280	9.75	15171	57,600		Concrete	4.5	1	8.5	211	1097.2	10972	284.9	68,364	11.39	17,729	86,093	97,000
		14V-R5	439	Alagbaa-Emilagbe, Oluwalogbon Church	Proposed	Box Culvert	2 Cv (3 x 1.5)	Dar	10	105	27300	13.125	20422.5	76,800		Concrete	6	1	10	237	1516.8	15168	391.1	93,852	15.64	24,339	118,191	133,000
		14V-R6	Size Change													Concrete	6	1	10	277	1772.8	17728	457.1	109,692	18.28	28,447	138,139	156,000
14X	Ob4 Foworogbun	14X-R1	401	Sogade, Ireakari Road	Proposed	Box Culvert	1 Cv (2.5 x 1.5)	Dar	10	52	13520	6.5	10114	38,400		Concrete	2.5	1	6.5	251	903.6	9036	263.6	63,252	10.54	16,403	79,655	89,000
		14X-R2	Size Change													Concrete	2.5	1	6.5	158	568.8	5688	165.9	39,816	6.64	10,326	50,142	56,000
15	Ob4 Foworogbun	15-R1	76	OLUNLOYO IDIAGBON , ASOLO ROAD,	Proposed	Box Culvert	6 Cv (6 x 2.5)	Dar								Concrete	18	2	26	15	528	5280	60.8	14,580	2.43	3,781	18,361	24,000
		15-R2	20D	JOINT VIGILANTE GROUP, COMPRISES OF IFESEYI IDIAGBON, TEMIDIRE, OLUWAFIRANTI AND ISOKAN COMMUNTIY	Proposed	Box Culvert	3 Cv (6 x 2.5)	Dar	10	333	86580	41.625	64768.5	243,200		Concrete	18	2	26	872	30694.4	306944	3531.6	847,584	141.26	219,807	1,067,391	1,374,000
		15-R3	Size Change													Concrete	18	2	26	674	23724.8	237248	2729.7	655,128	109.19	169,897	825,025	1,062,000
		15-R4	924	ALAAKA, ALAAKA/IDIOSAN	Proposed	Box Culvert	3 Cv (6.5 x 2.5)	Dar	10	355	92300	44.375	69047.5	259,200		Concrete	20	2	28	59	2265.6	22656	256.7	61,596	10.27	15,974	77,570	100,000
		15-R5	904	IDI OSAN, FOWOROGI, OGBERE/IDI OSAN	Proposed	Bridge	Br (15m)	Pheman								Concrete	20	2	28	430	16512	165120	1870.5	448,920	74.82	116,420	565,340	730,000
		15-R6	Size Change													Concrete	20	2	28	111	4262.4	42624	482.9	115,884	19.31	30,053	145,937	189,000
		15-R7	Size Change													Concrete	27	2	35	794	39382.4	393824	4287.6	1,029,024	171.50	266,860	1,295,884	1,690,000
15H	Ob4 Foworogbun	15H-R1	70	ADEYE	Proposed	Box Culvert	1 Cv (3 x 3.5)	Pheman								Concrete	4	1	8	833	3998.4	39984	1124.6	269,892	44.98	69,992	339,884	380,000
		15H-R2	926	BALOGUN/ADEYORI, ADEYORI STREET	Proposed	Box Culvert	1 Cv (4.5 x 1.5)	Dar	10	78	20280	9.75	15171	57,600		Concrete	4.5	1	8.5	416	2163.2	21632	561.6	134,784	22.46	34,954	169,738	191,000
		15H-R3	1509	orisumbare akeyo, orisumbare Road	Proposed	Box Culvert	2 Cv (3 x 1.5)	Dar	10	105	27300	13.125	20422.5	76,800		Concrete	6	1	10	377	2412.8	24128	622.1	149,292	24.88	38,716	188,008	212,000
		15H-R4	1510	Balogun 2	Proposed	Box Culvert	2 Cv (3 x 1.5)	Dar	10	105	27300	13.125	20422.5	76,800		Concrete	6	1	10	181	1158.4	11584	298.7	71,676	11.95	18,588	90,264	102,000
		15H-R5	Size Change													Concrete	6	1	10	159	1017.6	10176	262.4	62,964	10.49	16,329	79,293	89,000
16	Ob5 Lower Ogbere North	16-R1	74D	ORISUMBARE GENERAL COMMUNITY DEVELOPMENT ASSOCIATION	Proposed	Bridge	Br (55 x 10)	Dar	10						1,375,000	Concrete Sides	45	2.5	55	200	20000	200000	600.0	144,000	24.00	37,344	181,344	381,000
		16-R2	916	PAPA ELEYE, OGBERE RIVER, ZONE 4	Proposed	Bridge	Br (55 x 10)	Dar	10						1,375,000	Concrete Sides	45	2.5	55	227	22700	227000	681.0	163,440	27.24	42,385	205,825	433,000
		16-R3	1260	AKEYO-ODU, OGBERE, IDI-OSAN MUSLIM	Proposed	Bridge	Br (55 x 10)	Dar	10						1,375,000	Concrete Sides	45	2.5	55	736	73600	736000	2208.0	529,920	88.32	137,426	667,346	1,403,000
		16-R4	43D	APABIELESIN LANDLORDS AND LANDLADIES ASSOCIATION ORELOPE ISALE ALFA ZONE 2 UNIT 2 OLUYOLE	Proposed	Bridge	Br (55 x 10)	Dar	10						1,375,000	Concrete Sides	45	2.5	55	347	34700	347000	1041.0	249,840	41.64	64,792	314,632	662,000
		16-R5	Size Change													Concrete Sides	45	2.5	55	790	79000	790000	2370.0	568,800	94.80	147,509	716,309	1,506,000
		16-R6	1270	ODO-DUDU, IRORUN OLUWA RD E, ODO-DUDU, OLOMI-OLUNDE AYEGUN	Proposed	Bridge	Br (60 x 10)	Dar	10						1,500,000	Concrete Sides	45	3	57	414	50673.6	506736	1366.2	327,888	54.65	85,032	412,920	920,000
16D	Ob5 Lower Ogbere North	16D-R1	1255	TEMIDIRE, AYETORO, MUSLIM, EGBEDA-TUBA	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16900	8.125	12642.5	48,000		Concrete	3.5	1	7.5	336	1478.4	14784	403.2	96,768	16.13	25,095	121,863	137,000
		16D-R2	1514	ifesowapo iremide ajogbelede, ifesowopo zone D	Proposed	Box Culvert	1 Cv (4.5 x 1.5)	Dar	10	78	20280	9.75	15171	57,600		Concrete	4.5	1	8.5	652	3390.4	33904	880.2	211,248	35.21	54,784	266,032	300,000
		16D-R3	1256	OLOKOFEFE, IDI-IROKO, FATUNSI AREA,OLUNDE	Proposed	Box Culvert	2 Cv (3 x 1.5)	Dar	10	105	27300	13.125	20422.5	76,800		Concrete	6	1	10	579	3705.6	37056	955.4	229,284	38.21	59,461	288,745	326,000
		16D-R4	Size Change													Concrete	6	1	10	328	2099.2	20992	541.2	129,888	21.65	33,684	163,572	185,000
16F	Ob5 Lower Ogbere North	16F-R1	1258	TEMIDIRE,OLOWU, FATOSA, OLUNDE	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3	1	7	297	1188	11880	356.4	85,536	14.26	22,182	107,718	120,000
		16F-R2	Size Change													Concrete	3	1	7	1034	4136	41360	1240.8	297,792	49.63	77,227	375,019	416,000
17	Ob5 Lower Ogbere North	17-R1	1261	OBADA, OFF ISOKAN, AYEGUN RD, OLOMI	Proposed	Box Culvert	2 Cv (3.5 x 1.5)	Dar	10	118	30680	14.75	22951	86,400		Concrete	7	1	11	649	4672.8	46728	1168.2	280,368	46.73	72,709	353,077	400,000
		17-R2	1511	irepodun gbako, irepodun gbako road a	Proposed	Box Culvert	2 Cv (4 x 1.5)	Dar	10	131	34060	16.375	25479.5	96,000		Concrete	8	1	12	897	7176	71760	1749.2	419,796	69.97	108,867	528,663	600,000
		17-R3	Size Change													Concrete	8	1	12	422	3376	33760	822.9	197,496	32.92	51,217	248,713	282,000
		17-R4	1266	FATUNSI BRIDGE ODO-DUDU,ISOKAN, FATUNSI, ISOKAN, OLOMI-OLUNDE	Proposed	Box Culvert	1 Cv (6 x 2)	Dar	10	112	29120	14	21784	81,600		Concrete	6	1.5	12	205	2214	22140	399.8	95,940	15.99	24,880	120,820	143,000
		17-R5	1267	ODO-DUDU, IRORUN OLUWA ZONE 12, ODO-DUDU, ODO-DUDU OLOMI-OLUNDE	Proposed	Box Culvert	1 Cv (6 x 2)	Dar	10	112	29120	14	21784	81,600		Concrete	6	1.5	12	128	1382.4	13824	249.6	59,904	9.98	15,535	75,439	89,000
		17-R6	Size Change													Concrete	6	1.5	12	146	1576.8	15768	284.7	68,328	11.39	17,720	86,048	102,000
17H	Ob5 Lower Ogbere North	17H-R1	1263	ARANNSE OLUWA,IGBONNA, IGBONNA, OFF FATUSI	Proposed	Box Culvert	1 Cv (2.5 x 1.5)	Dar	10	52	13520	6.5	10114	38,400		Concrete	2.5	1	6.5	52	187.2	1872	54.6	13,104	2.18	3,398	16,502	18,000
		17H-R2	1512	irepodun zone, Area 1	Proposed	Box Culvert	1 Cv (2.5 x 1.5)	Dar	10	52	13520	6.5	10114	38,400		Concrete	2.5	1	6.5	118	424.8	4248	123.9	29,736	4.96	7,712	37,448	42,000
		17H-R3	1265	KAJOLA QUARTERS, FATUNSI AREA, MONDALA,OLOMI-OLUDE	Proposed	Box Culvert	1 Cv (2.5 x 1.5)	Dar	10	52	13520	6.5	10114	38,400		Concrete	2.5	1	6.5	186	669.6	6696	195.3	46,872	7.81	12,155	59,027	66,000
		17H-R4	Size Change													Concrete	2.5	1	6.5	68	244.8	2448	71.4	17,136	2.86	4,444	21,580	24,000
18	Ob5 Lower Ogbere North	18-R1	65B	MAARUN, ARO FATUNSI, OGUNPA, MAARUN ARO, FATUNSI RD, NEW FELELE ACADEMY	Existing			N/A								Concrete Sides	45	3	57	1002	122644.8	1226448	3306.6	793,584	132.26	205,803	999,387	2,226,000
		18-R2	Size Change													Concrete Sides	45	3	57	2550	312120	3121200	8415.0	2,019,600	336.60	523,750	2,543,350	5,665,000
18H	Ob5 Lower Ogbere North	18H-R1	1274	ARO OGO, IFESOWAPO, AYEGUN RD, OLOMI	Proposed	Box Culvert	1 Cv (2.5 x 1.5)	Dar	20	92	23920	11.5	17894	67,200		Concrete	2.5	1	6.5	52	187.2	1872	54.6	13,104	2.18	3,398	16,502	18,000
		18H-R2	Size Change													Concrete	2.5	1	6.5	809	2912.4	29124	849.5	203,868	33.98	52,870	256,738	286,000
18K	Ob5 Lower Ogbere North	18K-R1	Size Change													Concrete	3	1	7	375	1500	15000	450.0	108,000	18.00	28,008	136,008	151,000
19	Ob5 Lower Ogbere North	19-R1	Size Change													Concrete Sides	45	3	57	1040	127296	1272960	3432.0	823,680	137.28	213,608	1,037,288	2,310,000

Structure Data										Structure Cost						Channel Data					Channel Cost							
Channel ID	Subbasin	Reach ID	Structure No.	Location	Structure Status	Proposed Crossing Structure Type	Proposed Crossing Structure Dimensions	Designed by	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)	Lining Protection	Bed Width (m)	Design Depth (m)	Top Width (m)	Reach Length (m)	Excavation Volume (m3)	Cost of Excavation US$	Concrete Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Total Lining Cost (USD)	Total Cost of Channel US$
19A	Ob5 Lower Ogbere North	19A-R1	Size Change													Concrete	3.5	1	7.5	959	4219.6	42196	1150.8	276,192	46.03	71,626	347,818	390,000
19B	Ob5 Lower Ogbere North	19B-R1	Size Change													Concrete	4	1.5	10	1373	11533.2	115332	2265.5	543,708	90.62	141,002	684,710	800,000
1	Og1 Upper Ogunpa	1-R1	693	Ashi, Emiola Awe road	Existing											Concrete	3	1.5	9	85	612	6120	127.5	30,600	5.10	7,936	38,536	45,000
		1-R2	692	Ashi, Ladosu Ladipo Close	Existing											Concrete	3	1.5	9	193	1389.6	13896	289.5	69,480	11.58	18,018	87,498	101,000
		1-R3	46	OLUGA STREET , SALAMI ESTATE	Proposed	Box Culvert	1 Cv (3.5 x 2)	Dar	10	77	20020	9.625	14976.5	56,000		Concrete	3.5	1.5	9.5	438	3416.4	34164	722.7	173,448	28.91	44,981	218,429	253,000
		1-R4	Size Change													Concrete	3.5	1.5	9.5	433	3377.4	33774	714.5	171,468	28.58	44,467	215,935	250,000
		1-R5	627	New Bodija, Ladoke Akintola Street Channel, Ladoke Akintola Street	Proposed	Box Culvert	2 Cv (4 x 2.5)	Dar								Concrete	5	2.5	15	449								
		1-R6	44	Secretariat, Restoration Bridge, Secretariat Road	Existing											Concrete	8	2.5	18	459								
		1-R7	43	AWOLOWO AVENUE , OLUOKUN STREET,	Existing											Concrete	10	2.5	20	229								
		1-R8	42	FRANCIS OKEDEJI STREET , DAVIES HOTEL,	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar								Concrete	10	2.5	20	254								
		1-R9	41	ADEYI , OLD BODIJA,	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar								Concrete	12	2.5	22	430								
		1-R10	40	ADEYI , OLD BODIJA,	Proposed	Box Culvert	4 Cv (6 x 2.5)	Dar								Concrete	Var.	2.5	Var.	370								
		1-R11	Size Change													Concrete	24	2.5	34	48								
1E	Og1 Upper Ogunpa	1E-R1	732	Salami Estate Bodija, Off Awele road	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16900	8.125	12642.5	48,000		Concrete	3.5	1	7.5	402	1768.8	17688	482.4	115,776	19.30	30,025	145,801	163,000
		1E-R2	675	New Bodija,Salami Street	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16900	8.125	12642.5	48,000		Concrete	3.5	1	7.5	405	1782	17820	486.0	116,640	19.44	30,249	146,889	165,000
		1E-R3	Size Change													Concrete	3.5	1	7.5	112	492.8	4928	134.4	32,256	5.38	8,365	40,621	46,000
1F	Og1 Upper Ogunpa	1F-R1	638	New Bodija, Oladunni Ayanndipe Street	Existing											Concrete	2.5	1.5	8.5	133	877.8	8778	199.5	47,880	7.98	12,417	60,297	69,000
		1F-R2	639	New Bodija, Aretedo	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	88	580.8	5808	132.0	31,680	5.28	8,216	39,896	46,000
		1F-R3	45	KUNLE ABASS STREET , NEW BODIJA	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	395	2607	26070	592.5	142,200	23.70	36,877	179,077	205,000
		1F-R4	Size Change													Concrete	2.5	1.5	8.5	63	415.8	4158	94.5	22,680	3.78	5,882	28,562	33,000
1H	Og1 Upper Ogunpa	1H-R1	1559	Oyeniyi Street Ikolaba GRA, Oyeniyi Str	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3	1	7	526	2104	21040	631.2	151,488	25.25	39,286	190,774	212,000
		1H-R2	641	Ikolaba,Fadaaya Street	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3	1	7	116	464	4640	139.2	33,408	5.57	8,664	42,072	47,000
		1H-R3	640	Ikolaba, Olufemi Ilori Close	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16900	8.125	12642.5	48,000		Concrete	3.5	1	7.5	253	1113.2	11132	303.6	72,864	12.14	18,896	91,760	103,000
		1H-R4	Size Change													Concrete	3.5	1	7.5	151	664.4	6644	181.2	43,488	7.25	11,278	54,766	61,000
1P	Og1 Upper Ogunpa	1P-R1	642	Adeyi Estate, Beckley	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3	1	7	95	380	3800	114.0	27,360	4.56	7,095	34,455	38,000
		1P-R2	Size Change													Concrete	3	1	7	551	2204	22040	661.2	158,688	26.45	41,153	199,841	222,000
2	Og2 Middle Ogunpa		247	Secretariat, Ogunpa(Dandaru), Paliament Road	Existing											Concrete	8	4.4	8									
		2-R1	144B	DANDARU,	Proposed	Box Culvert	2 Cv (4.5 x 4)	Dar	20	404	105040	50.5	78578	294,400		Concrete	8	3.83	8	418								
		2-R2	1552	Ireakari Area, Ogunpa, Queen Elizath Road	Proposed	Box Culvert	2 Cv (5 x 4)	Dar	10	272	70720	34	52904	198,400		Concrete	10	3.55	10	379								
		2-R3	246	Mokola, Ogunpa, Mokola	Existing											Concrete	13	4.33	13	382								
		2-R4	245	Mokola, Omitowoju Street	Existing											Concrete	20	4.1	20	531								
		2-R5	143B	Salvation Army, Ogunpa, Atewoda Street	Proposed	Box Culvert	Add 1 Cv (3 x 3)	Dar	10	96	24960	12	18672	70,400		Concrete	20	2.95	20	372								
		2-R6	142B	Ogunpa, Ansarudeen Br., Anasrudeen	Proposed	Box Culvert	Add 1 Cv (5 x 3)	Dar	20	208	54080	26	40456	152,000		Concrete	20	2.5	20	401								
		2-R7	244	Ogunpa, Ogunpa Stream, Ogunpa	Existing											Concrete	20	3.1	20	213								
		2-R8	243	Ogunpa Market, Ogunpa Stream, Lebanon Street	Existing											Concrete	20	4.2	20	305								
		2-R9	242	Ogunpa Market, Ogunpa Stream, New Court Road	Existing											Concrete	20	4.1	20	81								
		2-R10	241	Foko Area, Ogunpa, Agbokojo street	Existing											Concrete	25	3.7	25	335								
		2-R11	141B	Foko Area, Ogunpa, Alubankudu street	Existing											Concrete	25	3.22	25	435								
		2-R12	235	Gege, Ogunpa, Gege road	Existing											Concrete	25	3.4	25	412								
		2-R13	236	Isale Asake, Ogunpa, Asake	Existing											Concrete	25	3.75	25	294								
		2-R14	156B	Akuro, Ogunpa, Oredeyin	Existing											Concrete	25	4.4	25	342								
		2-R15	64	Poopo, Ogunpa, Poopo road	Existing											Concrete	25	4.6	25	402								
		2-R16	155B	OGUNPA,	Existing											Concrete	25	3.23	25	710								
		2-R17	Size Change													Concrete	25	3.2	25	378								
2C	Og2 Middle Ogunpa	2C-R1	38	Mokola, Sabo Road	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	20	108	28080	13.5	21006	80,000		Concrete	2.5	1.5	8.5	200	1320	13200	300.0	72,000	12.00	18,672	90,672	104,000
		2C-R2	290	Mokola, Mokola Road	Existing											Concrete	2.5	1.5	8.5	192	1267.2	12672	288.0	69,120	11.52	17,925	87,045	100,000
		2C-R3	Size Change													Concrete	2.5	1.5	8.5	56	369.6	3696	84.0	20,160	3.36	5,228	25,388	29,000
2F	Og2 Middle Ogunpa	2F-R1	37	ONIREKE ROAD	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	20	127	33020	15.875	24701.5	92,800		Concrete	4	1	8	121	580.8	5808	163.4	39,204	6.53	10,167	49,371	55,000
		2F-R2	34	ONIREKE	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	4	1	8	269	1291.2	12912	363.2	87,156	14.53	22,602	109,758	123,000
		2F-R3	1549	Onireke	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	4	1	8	112	537.6	5376	151.2	36,288	6.05	9,411	45,699	51,000
		2F-R4	35	FAJUYI ROAD	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	20	144	37440	18	28008	105,600		Concrete	4	1.5	10	373	3133.2	31332	615.5	147,708	24.62	38,306	186,014	217,000
		2F-R5	33	DUGBE-ALAWO ROAD	Proposed	Box Culvert	1 Cv (4.5 x 2)	Dar	10	91	23660	11.375	17699.5	67,200		Concrete	4.5	1.5	10.5	246	2214	22140	442.8	106,272	17.71	27,560	133,832	156,000
		2F-R6	Size Change													Concrete	4.5	1.5	10.5	367	3303	33030	660.6	158,544	26.42	41,116	199,660	233,000
2Q	Og2 Middle Ogunpa	2Q-R1	248	Titi Akala, Aladorin Isale Osi	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	21	138.6	1386	31.5	7,560	1.26	1,961	9,521	11,000
		2Q-R2	358	Popo Area, Popo Road	Proposed	Box Culvert	1 Cv (3 x 2)	Dar	10	70	18200	8.75	13615	51,200		Concrete	3	1.5	9	751	5407.2	54072	1126.5	270,360	45.06	70,113	340,473	395,000
		2Q-R3	Size Change													Concrete	3	1.5	9	266	1915.2	19152	399.0	95,760	15.96	24,834	120,594	140,000
3	Og3 Kudeti	3-R1	279	Oluyoro, Oluyoro Road	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3	1	7	66	264	2640	79.2	19,008	3.17	4,929	23,937	27,000
		3-R2	278	Oluyoro, Oluyoro-Aladorin Road	Existing											Concrete	3	1.5	9	159	1144.8	11448	238.5	57,240	9.54	14,844	72,084	84,000
		3-R3	96	ODE AYE ALALUBOSA	Proposed	Box Culvert	1 Cv (3 x 2)	Dar	10	70	18200	8.75	13615	51,200		Concrete	3	1.5	9	309	2224.8	22248	463.5	111,240	18.54	28,848	140,088	162,000
		3-R4	277	Alabede, Alabede area	Proposed	Box Culvert	1 Cv (3 x 2)	Dar	10	70	18200	8.75	13615	51,200		Concrete	3	1.5	9	333	2397.6	23976	499.5	119,880	19.98	31,089	150,969	175,000
		3-R5	324	Aremo, Adekanbi Street	Proposed	Box Culvert	1 Cv (3.5 x 2)	Dar	10	77	20020	9.625	14976.5	56,000		Concrete	3.5	1.5	9.5	359	2800.2	28002	592.4	142,164	23.69	36,868	179,032	207,000
		3-R6	323	Ilupeju Agugu, Binukonu Area	Existing											Concrete	3.5	1.5	9.5	151	1177.8	11778	249.2	59,796	9.97	15,507	75,303	87,000
		3-R7	276	Aremo Adekile, Aremo grave yard	Proposed	Box Culvert	1 Cv (5 x 2)	Dar	10	98	25480	12.25	19061	72,000		Concrete	5	1.5	11	435	4176	41760	783.0	187,920	31.32	48,734	236,654	278,000
		3-R8	275	Aperin, Aperin Road	Proposed	Box Culvert	1 Cv (7 x 2.5)	Dar								Concrete	7	2	15	339	5966.4	59664	813.6	195,264	32.54	50,638	245,902	306,000
		3-R9	297	Adelagun, Oluyoro Stream, Alamuyo Gbelekale	Proposed	Box Culvert	2 Cv (4 x 2)	Dar	10	150	39000	18.75	29175	110,400		Concrete	4	1.5	10	724	6081.6	60816	1194.6	286,704	47.78	74,352	361,056	422,000
		3-R10	274	Kosodo Area, Oluyoro Stream, Kosodo-Labo	Proposed	Box Culvert	2 Cv (4 x 2)	Dar	10	150	39000	18.75	29175	110,400		Concrete	4	1.5	10	417	3502.8	35028	688.1	165,132	27.52	42,824	207,956	243,000
		3-R11	Size Change													Concrete	8	1.5	14	322	4250.4	42504	724.5	173,880	28.98	45,093	218,973	261,000
		3-R12	273	Beere, Labo Stream, Beere road	Proposed	Box Culvert	1 Cv (8 x 2.5)	Dar								Concrete	13	1.5to4	Var.	109								
		3-R13	Size Change													Concrete	8	2.5	18	333								
		3-R14	Size Change													Concrete	8 to 44	3	Var.	438								

Structure Data										Structure Cost						Channel Data					Channel Cost							
Channel ID	Subbasin	Reach ID	Structure No.	Location	Structure Status	Proposed Crossing Structure Type	Proposed Crossing Structure Dimensions	Designed by	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)	Lining Protection	Bed Width (m)	Design Depth (m)	Top Width (m)	Reach Length (m)	Excavation Volume (m3)	Cost of Excavation US$	Concrete Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Total Lining Cost (USD)	Total Cost of Channel US$
4	Og3 Kudeti	4-R1	51	Yemetu, Alawada Area	Proposed	Box Culvert	1 Cv (3 x 2)	Dar	20	120	31200	15	23340	88,000		Concrete	3	1.5	9	476	3427.2	34272	714.0	171,360	28.56	44,439	215,799	250,000
		4-R2	1553	Yemetu Akabiako, Orogbangba Street	Existing											Concrete	3.5	1.5	9.5	318	2480.4	24804	524.7	125,928	20.99	32,657	158,585	183,000
		4-R3	265	Yemetu-Adeoyo, Ade oyo Street	Proposed	Box Culvert	1 Cv (3.5 x 2)	Dar	20	132	34320	16.5	25674	96,000		Concrete	3.5	1.5	9.5	109	850.2	8502	179.9	43,164	7.19	11,194	54,358	63,000
		4-R4	1554	Yemetu Akabiako, Orogbangba Street	Proposed	Box Culvert	1 Cv (3.5 x 2)	Dar	10	77	20020	9.625	14976.5	56,000		Concrete	3.5	1.5	9.5	126	982.8	9828	207.9	49,896	8.32	12,940	62,836	73,000
		4-R5	266	Yemetu -Idi Ape Area, Traffic High way	Proposed	Box Culvert	1 Cv (3.5 x 2)	Dar	20	132	34320	16.5	25674	96,000		Concrete	3.5	1.5	9.5	214	1669.2	16692	353.1	84,744	14.12	21,977	106,721	123,000
		4-R6	1555	Oje Ibadan, Temidire	Existing											Concrete	3.5	1.5	9.5	95	741	7410	156.8	37,620	6.27	9,756	47,376	55,000
		4-R7	267	Aderogba, Obasanjo Road	Existing											Concrete	3.5	1.5	9.5	146	1138.8	11388	240.9	57,816	9.64	14,994	72,810	84,000
		4-R8	269	Alafara Bashorun, Oje Igosu	Proposed	Box Culvert	1 Cv (4.5 x 2)	Dar	20	156	40560	19.5	30342	113,600		Concrete	4.5	1.5	10.5	188	1692	16920	338.4	81,216	13.54	21,062	102,278	119,000
		4-R9	270	Abeni Ape	Proposed	Box Culvert	3 Cv (5 x 3)	Dar	20	528	137280	66	102696	384,000		Concrete	4.5	2	12.5	174	2366.4	23664	365.4	87,696	14.62	22,742	110,438	134,000
		4-R10	Size Change													Concrete	4.5	2	12.5	1005	13668	136680	2110.5	506,520	84.42	131,358	637,878	775,000
		4-R11	271	Beere, Orita Aperin Beere road	Existing											Concrete Sides	5	2	13	16	230.4	2304	43.2	10,368	1.73	2,689	13,057	15,000
		4-R12	Size Change													Concrete Sides	15	2.5	25	234								
		4-R13	Size Change													Concrete Sides	15 to 44	3	Var.	98								
5	Og3 Kudeti	5-R1	272	Asanke Street, Okun Stream, Asanke Street	Existing											Concrete Sides	44	3	56	59								
		5-R2	Size Change													Concrete Sides	44 to15	2.5	Var.	168								
		5-R3	367	Agbongbon, Beside Agbogbon pry health centre	Proposed											Concrete Sides	15	3	Var.	155								
		5-R4	393	Idi Arere,	Existing											Concrete Sides	15	3	27	410								
		5-R5	Size Change													Concrete Sides	15	3.5	29	384								
		5-R6	Size Change													Concrete Sides	15 to19.24	3.5	Var.	36								
		5-R7	Size Change													Concrete Sides	19.24 to 15	3.5	Var.	64								
		5-R8	Size Change													Concrete Sides	15	3.5	29	175								
		5-R9	Size Change													Concrete Sides	15 to 20	3.5	Var.	50								
		5-R10	363	Molete, Ogunpa, Yejide Avenue	Existing											Concrete Sides	20	3.5	34	251								
5B	Og3 Kudeti	5B-R1	369	Eleta, Eleta Road	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	20	108	28080	13.5	21006	80,000		Concrete	2.5	1.5	8.5	407	2686.2	26862	610.5	146,520	24.42	37,998	184,518	211,000
		5B-R2	365	Olunloyo, Tewogbade	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	257	1696.2	16962	385.5	92,520	15.42	23,994	116,514	133,000
		5B-R3	366	Olunloyo, Tewogbade	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	180	1188	11880	270.0	64,800	10.80	16,805	81,605	93,000
		5B-R4	368	Agbongbon, Olunloyo Street	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	142	937.2	9372	213.0	51,120	8.52	13,257	64,377	74,000
		5B-R5	Size Change													Concrete	2.5	1.5	8.5	283	1867.8	18678	424.5	101,880	16.98	26,421	128,301	147,000
5C	Og3 Kudeti	5C-R1	39D1	ODE-KERREWU LANDLORDS AND TENANTS ASSOCIATION												Concrete	3.5	1	7.5	21	92.4	924	25.2	6,048	1.01	1,568	7,616	9,000
		5C-R2	39D3	ODE-KERREWU LANDLORDS AND TENANTS ASSOCIATION												Concrete	3.5	1	7.5	153	673.2	6732	183.6	44,064	7.34	11,427	55,491	62,000
		5C-R3	63	YEJIDE , KUDETI ROAD	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16900	8.125	12642.5	48,000		Concrete	3.5	1	7.5	677	2978.8	29788	812.4	194,976	32.50	50,564	245,540	275,000
		5C-R4	Size Change													Concrete	3.5	1	7.5	11	48.4	484	13.2	3,168	0.53	822	3,990	4,000
		5C-R5	Size Change													Concrete	3.5	1	7.5	116	510.4	5104	139.2	33,408	5.57	8,664	42,072	47,000
6	Og4 Lower Ogunpa	6-R1	376	Molete, Ogunpa,	Existing											Concrete Sides	24	3.5	38	269	23349.2	233492	968.4	232,416	38.74	60,273	292,689	526,000
		6-R2	866	FELELE, OGUNPA RIVER, GBANAMU AREA	Existing											Concrete Sides	24	3.5	38	1114	96695.2	966952	4010.4	962,496	160.42	249,607	1,212,103	2,179,000
		6-R3	Size Change													Concrete Sides	24	3.5	38	918	79682.4	796824	3304.8	793,152	132.19	205,691	998,843	1,796,000
7	Og4 Lower Ogunpa	7-R1	382	Owode Academy	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	20	108	28080	13.5	21006	80,000		Concrete	2.5	1.5	8.5	85	561	5610	127.5	30,600	5.10	7,936	38,536	44,000
		7-R2	383	Owode Academy, Adekola street	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	410	2706	27060	615.0	147,600	24.60	38,278	185,878	213,000
		7-R3	384	Elere, Odo ile Tawa	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	472	3115.2	31152	708.0	169,920	28.32	44,066	213,986	245,000
		7-R4	385	Elere, Odo oba elere	Existing											Concrete	3	1.5	9	370	2664	26640	555.0	133,200	22.20	34,543	167,743	194,000
		7-R5	61	ODO OBA ELERE AREA	Proposed	Box Culvert	1 Cv (3 x 2)	Dar	10	70	18200	8.75	13615	51,200		Concrete	3	1.5	9	263	1893.6	18936	394.5	94,680	15.78	24,554	119,234	138,000
		7-R6	888	SANYO, SANYO STREET	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	155	1302	13020	255.8	61,380	10.23	15,918	77,298	90,000
		7-R7	889	SANYO, IREWUMI STREET	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	361	3032.4	30324	595.7	142,956	23.83	37,073	180,029	210,000
		7-R8	880	SANYO, SANYO AREA	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	427	3586.8	35868	704.6	169,092	28.18	43,851	212,943	249,000
		7-R9	Size Change													Concrete	4	1.5	10	553	4645.2	46452	912.5	218,988	36.50	56,791	275,779	322,000
		7-R10	55B	OGUNPA RCC RIVER	Existing											Concrete	6	2.5	16	259	5698	56980	699.3	167,832	27.97	43,524	211,356	268,000
7E	Og4 Lower Ogunpa	7E-R1	60	AKINFENWA	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	166	1095.6	10956	249.0	59,760	9.96	15,498	75,258	86,000
		7E-R2	59	SANYO , BOLUWAJI	Proposed	Box Culvert	1 Cv (3 x 2)	Dar	10	70	18200	8.75	13615	51,200		Concrete	3	1.5	9	589	4240.8	42408	883.5	212,040	35.34	54,989	267,029	309,000
		7E-R3	891	SANYO, OKESUNA STREET	Proposed	Box Culvert	1 Cv (3.5 x 2)	Dar	10	77	20020	9.625	14976.5	56,000		Concrete	3.5	1.5	9.5	303	2363.4	23634	500.0	119,988	20.00	31,117	151,105	175,000
		7E-R4	58	AGBAMU , TEMIDRE DAMO RIVER	Proposed	Box Culvert	1 Cv (3.5 x 2)	Dar	10	77	20020	9.625	14976.5	56,000		Concrete	3.5	1.5	9.5	214	1669.2	16692	353.1	84,744	14.12	21,977	106,721	123,000
		7E-R5	57	TMIDIRE , DAMO RIVER	Proposed	Box Culvert	1 Cv (3.5 x 2)	Dar	10	77	20020	9.625	14976.5	56,000		Concrete	3.5	1.5	9.5	259	2020.2	20202	427.4	102,564	17.09	26,598	129,162	149,000
		7E-R6	56	Sanyo/Sooka, Lagos/Ibadan Express	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	40	264	68640	33	51348	192,000		Concrete	4	1.5	10	358	3007.2	30072	590.7	141,768	23.63	36,765	178,533	209,000
		7E-R7	Size Change													Concrete	4	1.5	10	224	1881.6	18816	369.6	88,704	14.78	23,004	111,708	131,000
8	Og4 Lower Ogunpa	8-R1	54B	SOKA, SOKA	Existing											Concrete Sides	24	3.5	38	269	23349.2	233492	968.4	232,416	38.74	60,273	292,689	526,000
		8-R2	1230	RED ROOF AREA, TOLL GATE, OGUNPA,TOLL GATE, LEAD CITY ,TOLL GATE	Proposed	Bridge	Br (45 x 10)	Dar	10						1,125,000	Concrete Sides	30	3.5	44	2659	275472.4	2754724	9572.4	2,297,376	382.90	595,786	2,893,162	5,648,000
		8-R3	Size Change													Concrete Sides	30	3.5	44	830	85988	859880	2988.0	717,120	119.52	185,973	903,093	1,763,000
8D	Og4 Lower Ogunpa	8D-R1	883	IDI MANGORO/SOKA, AANU OLUWAPO STREET	Proposed	Box Culvert	1 Cv (2 x 1.5)	Dar	10	46	11960	5.75	8947	33,600		Concrete	2	1	6	73	233.6	2336	76.7	18,396	3.07	4,771	23,167	26,000
		8D-R2	882	SOKA/IDI MANGORO, ENGR BAYO STREET	Existing											Concrete	2	1	6	176	563.2	5632	184.8	44,352	7.39	11,502	55,854	61,000
		8D-R3	Size Change													Concrete	2	1	6	177	566.4	5664	185.9	44,604	7.43	11,567	56,171	62,000
9	Og4 Lower Ogunpa	9-R1	71	ATAGBA	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	493	3253.8	32538	739.5	177,480	29.58	46,026	223,506	256,000
		9-R2	1221	OKE-ODE, AGBAMU, AGBAMU-SANYO	Existing											Concrete	3.5	1.5	9.5	492	3837.6	38376	811.8	194,832	32.47	50,526	245,358	284,000
		9-R3	1224	INUEWE STRAIGT AJOFEEBO, ABA,AJOFEEBO	Proposed	Box Culvert	1 Cv (4.5 x 2)	Dar	10	91	23660	11.375	17699.5	67,200		Concrete	4.5	1.5	10.5	923	8307	83070	1661.4	398,736	66.46	103,406	502,142	585,000
		9-R4	Size Change													Concrete	4.5	1.5	10.5	75	675	6750	135.0	32,400	5.40	8,402	40,802	48,000
		9-R5	1234	IFESOWAPO, IDI-IROKO,OLUNDE, ODO AARIN MEJI INUEWE, INU EWE,OLUNDE	Proposed	Box Culvert	1 Cv (6 x 2.5)	Dar	10	128	33280	16	24896	94,400		Concrete	6	2	14	265	4240	42400	596.3	143,100	23.85	37,111	180,211	223,000
		9-R6	1237	PEACE RD, MAJE, ODO MAJE, MAJE SOKA	Proposed	Box Culvert	3 Cv (3 x 3.5)	Pheman								Concrete	6	2	14	510	8160	81600	1147.5	275,400	45.90	71,420	346,820	428,000
		9-R7	1239	IRORUN OLUWA RD 48, IRORUN OLUWA, GATE B, NEW FELELE, SOKA	Proposed	Box Culvert	1 Cv (6 x 2.5)	Dar	10	128	33280	16	24896	94,400		Concrete	6	2	14	400	6400	64000	900.0	216,000	36.00	56,016	272,016	336,000
		9-R8	1226	SURULERE, Zone 19, SURULERE, NEW FELELE,SOKA	Proposed	Box Culvert	1 Cv (6 x 2.5)	Dar	10	128	33280	16	24896	94,400		Concrete	6	2	14	567	9072	90720	1275.8	306,180	51.03	79,403	385,583	476,000
		9-R9	Size Change													Concrete	6	2	14	404	6464	64640	909.0	218,160	36.36	56,576	274,736	339,000
9F	Og4 Lower Ogunpa	9F-R1	1231	FARIA, OFF SANYO, FARIA, OLUNDE	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16900	8.125	12642.5	48,000		Concrete	3.5	1	7.5	353	1553.2	15532	423.6	101,664	16.94	26,365	128,029	144,000
		9F-R2	1232	ABA AJOFEEBO, AGBAMU SANYO, ABA,AJOFEEBO	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16900	8.125	12642.5	48,000		Concrete	3.5	1	7.5	252	1108.8	11088	302.4	72,576	12.10	18,821	91,397	102,000
		9F-R3	1233	ABA AJOFEEBO,ZONE 7	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16900	8.125	12642.5	48,000		Concrete	3.5	1	7.5	207	910.8	9108	248.4	59,616	9.94	15,460	75,076	84,000
		9F-R4	Size Change													Concrete	3.5	1	7.5	178	783.2	7832	213.6	51,264	8.54	13,294	64,558	72,000

Structure Data										Structure Cost						Channel Data					Channel Cost							
Channel ID	Subbasin	Reach ID	Structure No.	Location	Structure Status	Proposed Crossing Structure Type	Proposed Crossing Structure Dimensions	Designed by	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)	Lining Protection	Bed Width (m)	Design Depth (m)	Top Width (m)	Reach Length (m)	Excavation Volume (m3)	Cost of Excavation US$	Concrete Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Total Lining Cost (USD)	Total Cost of Channel US$
10	Og4 Lower Ogunpa		1240	SURULERE, OGUNPA,SURULERE, NEW FELELE,SOKA	Proposed	Bridge	Br (45 x 10)	Dar	10						1,125,000	Concrete Sides	30	3.5	44										
		10-R1	Size Change													Concrete Sides	30	3.5	44	2318	240144.8	2401448	8344.8	2,002,752	333.79	519,380	2,522,132	4,924,000
		10-R2	Size Change													Concrete Sides	48	3.5	62	1961	301994	3019940	7059.6	1,694,304	282.38	439,390	2,133,694	5,154,000
10B	Og4 Lower Ogunpa	10B-R1	1246	BESIDE LENBOLA BLOCK,OLOJE SURULERE, NEW FELELE, SOKA	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	4	1	8	910	4368	43680	1228.5	294,840	49.14	76,462	371,302	415,000
		10B-R2	Size Change													Concrete	4	1	8	328	1574.4	15744	442.8	106,272	17.71	27,560	133,832	150,000
10B-3	Og4 Lower Ogunpa	10B-3-R1	Size Change													Concrete	3	1	7	409	1636	16360	490.8	117,792	19.63	30,547	148,339	165,000
24	OM2 Omi Headwaters South	24-R1	1369	Olodo-odan, Omi, Olujinle/Onimo	Proposed	Box Culvert	3 Cv (6.5 x 2.5)	Dar	10	355	92300	44.375	69047.5	259,200		Concrete	20	2	28	1252	48076.8	480768	5446.2	1,307,088	217.85	338,971	1,646,059	2,127,000
		24-R2	Size Change													Concrete	20	2	28	496	19046.4	190464	2157.6	517,824	86.30	134,289	652,113	843,000
25	OM2 Omi Headwaters South	25-R1	Size Change													Concrete	3.5	1	7.5	1558	6855.2	68552	1869.6	448,704	74.78	116,364	565,068	634,000
		25-R2	1363	Onigbinde, Kojaja, Kojaja	Proposed	Box Culvert	2 Cv (4 x 2)	Dar	10	150	39000	18.75	29175	110,400		Concrete	6	1.5	12	572	6177.6	61776	1115.4	267,696	44.62	69,422	337,118	399,000
		25-R3	Size Change													Concrete	6	1.5	12	223	2408.4	24084	434.9	104,364	17.39	27,065	131,429	156,000
26	OM2 Omi Headwaters South	26-R1	1370	Onigbinde, Omi, Oloko-Kete	Proposed	Bridge	Br (35 x 10)	Dar	10						875,000	Concrete	22	2.5	32	489	26406	264060	2493.9	598,536	99.76	155,220	753,756	1,018,000
		26-R2	Size Change													Concrete	22	2.5	32	1824	98496	984960	9302.4	2,232,576	372.10	578,981	2,811,557	3,797,000
27	OM2 Omi Headwaters South	27-R1	1342	Atobaba/Alafia community, Alagbada	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3	1	7	193	772	7720	231.6	55,584	9.26	14,415	69,999	78,000
		27-R2	1343	Olorunda Abaa, Abaa Igbagbo	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	4	1	8	293	1406.4	14064	395.6	94,932	15.82	24,619	119,551	134,000
		27-R3	1344	Kutaayii, Kutaayii/Lamona	Proposed	Box Culvert	2 Cv (3.5 x 1.5)	Dar	10	118	30680	14.75	22951	86,400		Concrete	7	1	11	1030	7416	74160	1854.0	444,960	74.16	115,393	560,353	635,000
		27-R4	1345	Egba community zone 1, Road 14	Proposed	Box Culvert	2 Cv (4 x 1.5)	Dar	10	131	34060	16.375	25479.5	96,000		Concrete	8	1	12	1355	10840	108400	2642.3	634,140	105.69	164,454	798,594	907,000
		27-R5	1346	Egba community zone 1, Road 12	Proposed	Box Culvert	2 Cv (4 x 1.5)	Dar	10	131	34060	16.375	25479.5	96,000		Concrete	8	1	12	163	1304	13040	317.9	76,284	12.71	19,783	96,067	109,000
		27-R6	1535	Jenriyin, Egba Zone 1	Proposed	Box Culvert	2 Cv (4.5 x 1.5)	Dar	10	144	37440	18	28008	105,600		Concrete	9	1	13	241	2120.8	21208	506.1	121,464	20.24	31,500	152,964	174,000
		27-R7	1346 Prime	, Ahere 1, Olorunda	Proposed	Box Culvert	2 Cv (5 x 2)	Dar	10	178	46280	22.25	34621	129,600		Concrete	10	1.5	16	219	3416.4	34164	558.5	134,028	22.34	34,758	168,786	203,000
		27-R8	1348	Odan-Elekan, Ahere 2, Akinlumo	Proposed	Box Culvert	2 Cv (5 x 2)	Dar	10	178	46280	22.25	34621	129,600		Concrete	10	1.5	16	671	10467.6	104676	1711.1	410,652	68.44	106,496	517,148	622,000
		27-R9	106	ASAJU , UNITY ESTATE,	Proposed	Box Culvert	2 Cv (5 x 2)	Dar	10	178	46280	22.25	34621	129,600		Concrete	10	1.5	16	712	11107.2	111072	1815.6	435,744	72.62	113,003	548,747	660,000
		27-R10	Size Change													Concrete	10	1.5	16	162	2527.2	25272	413.1	99,144	16.52	25,711	124,855	150,000
27K	OM2 Omi Headwaters South	27K-R1	Size Change													Concrete	4	1.5	10	1597	13414.8	134148	2635.1	632,412	105.40	164,006	796,418	931,000
28	OM2 Omi Headwaters South	28-R1	1383	ASAJU-IFESOWAPO, ASAJU, ROAD 1	Proposed	Bridge	Br (35 x 10)	Dar	10						875,000	Concrete	23	2.5	33	961	53816	538160	5045.3	1,210,860	201.81	314,016	1,524,876	2,063,000
		28-R2	1384	OGANLA, OMI, PAGUN	Proposed	Bridge	Br (40 x 10)	Dar	10						1,000,000	Concrete	28	2.5	38	873	57618	576180	5238.0	1,257,120	209.52	326,013	1,583,133	2,159,000
		28-R3	105	OKE-OMI / OGA NLA,	Proposed	Bridge	Br (40 x 10)	Dar	10						1,000,000	Concrete	28	2.5	38	43	2838	28380	258.0	61,920	10.32	16,058	77,978	106,000
		28-R4	Size Change													Concrete	28	2.5	38	583	38478	384780	3498.0	839,520	139.92	217,716	1,057,236	1,442,000
28A	OM2 Omi Headwaters South	28A-R1	973	Kore Estate-Olodo, Orita Odan road	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16900	8.125	12642.5	48,000		Concrete	3.5	1	7.5	504	2217.6	22176	604.8	145,152	24.19	37,643	182,795	205,000
		28A-R2	979	Orita Odan Area-Jenriyin, Kute road	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16900	8.125	12642.5	48,000		Concrete	3.5	1	7.5	178	783.2	7832	213.6	51,264	8.54	13,294	64,558	72,000
		28A-R3	980	Olodo Area, Odan Road	Proposed	Box Culvert	1 Cv (4.5 x 2)	Dar	10	91	23660	11.375	17699.5	67,200		Concrete	4.5	1.5	10.5	1137	10233	102330	2046.6	491,184	81.86	127,380	618,564	721,000
		28A-R4	981	Iranlowo Oluwa Estate, Area C	Proposed	Box Culvert	1 Cv (4.5 x 2)	Dar	10	91	23660	11.375	17699.5	67,200		Concrete	4.5	1.5	10.5	680	6120	61200	1224.0	293,760	48.96	76,182	369,942	431,000
		28A-R5	1372	ASAJU CENTRAL ESTATE, MAIN ROAD 1	Proposed	Box Culvert	1 Cv (4.5 x 2)	Dar	10	91	23660	11.375	17699.5	67,200		Concrete	4.5	1.5	10.5	399	3591	35910	718.2	172,368	28.73	44,701	217,069	253,000
		28A-R6	Size Change													Concrete	4.5	1.5	10.5	136	1224	12240	244.8	58,752	9.79	15,236	73,988	86,000
28D	OM2 Omi Headwaters South	28D-R1	1373	OGANLA, OMOLASO	Proposed	Box Culvert	1 Cv (3 x 2)	Dar	10	70	18200	8.75	13615	51,200		Concrete	3	1.5	9	960	6912	69120	1440.0	345,600	57.60	89,626	435,226	504,000
		28D-R2	Size Change													Concrete	3	1.5	9	237	1706.4	17064	355.5	85,320	14.22	22,126	107,446	125,000
31	OM3 Upper Omi West	31-R1	719	Akobo-Ojurin, Yawiri Road	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	4	1	8	475	2280	22800	641.3	153,900	25.65	39,911	193,811	217,000
		31-R2	98	PAPA ATU	Proposed	Box Culvert	1 Cv (4.5 x 2)	Dar	10	91	23660	11.375	17699.5	67,200		Concrete	4.5	1.5	10.5	624	5616	56160	1123.2	269,568	44.93	69,908	339,476	396,000
		31-R3	Size Change													Concrete	4.5	1.5	10.5	1075	9675	96750	1935.0	464,400	77.40	120,434	584,834	682,000
		31-R4	939	Kute-Orisunbare zone 11, Shonekan, Shonekan road	Proposed	Box Culvert	2 Cv (4.5 x 2)	Dar	10	164	42640	20.5	31898	120,000		Concrete	7	1.5	13	1101	13212	132120	2312.1	554,904	92.48	143,905	698,809	831,000
		31-R5	Size Change													Concrete	7	1.5	13	274	3288	32880	575.4	138,096	23.02	35,813	173,909	207,000
		31-R6	119	GBO-ADURA-OJU IRIN,	Proposed	Box Culvert	2 Cv (5 x 2)	Dar	10	178	46280	22.25	34621	129,600		Concrete	10	1.5	16	670	10452	104520	1708.5	410,040	68.34	106,337	516,377	621,000
		31-R7	Size Change													Concrete	10	1.5	16	525	8190	81900	1338.8	321,300	53.55	83,324	404,624	487,000
32	OM3 Upper Omi West	32-R1	1356	Olorunda Abaa, Road 1,Ogooluwa Estate	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16900	8.125	12642.5	48,000		Concrete	3.5	1	7.5	472	2076.8	20768	566.4	135,936	22.66	35,253	171,189	192,000
		32-R2	1351	Eleshinla Village, Eleshinla Road	Proposed	Box Culvert	1 Cv (5 x 2)	Dar	10	98	25480	12.25	19061	72,000		Concrete	5	1.5	11	1034	9926.4	99264	1861.2	446,688	74.45	115,841	562,529	662,000
		32-R3	1352	Alapata Estate, Onireke Road	Proposed	Box Culvert	1 Cv (6 x 2)	Dar	10	112	29120	14	21784	81,600		Concrete	6	1.5	12	720	7776	77760	1404.0	336,960	56.16	87,385	424,345	502,000
		32-R4	Size Change													Concrete	6	1.5	12	100	1080	10800	195.0	46,800	7.80	12,137	58,937	70,000
		32-R5	101	TEMIDIER , SOKA ELEGA,	Proposed	Box Culvert	2 Cv (4.5 x 2)	Dar	10	164	42640	20.5	31898	120,000		Concrete	8	1.5	14	412	5438.4	54384	927.0	222,480	37.08	57,696	280,176	335,000
		32-R6	1534	Harmony Estate, Kumapayi	Proposed	Box Culvert	2 Cv (4.5 x 2)	Dar	10	164	42640	20.5	31898	120,000		Concrete	8	1.5	14	473	6243.6	62436	1064.3	255,420	42.57	66,239	321,659	384,000
		32-R7	Size Change													Concrete	8	1.5	14	538	7101.6	71016	1210.5	290,520	48.42	75,342	365,862	437,000
		32-R8	100	AKOKA,	Proposed	Box Culvert	2 Cv (4.5 x 2)	Dar	10	164	42640	20.5	31898	120,000		Concrete	9	1.5	15	597	8596.8	85968	1432.8	343,872	57.31	89,177	433,049	519,000
		32-R9	931	Kute, Ibagun / Shokobi, Ibagun / Shokobi road	Proposed	Box Culvert	2 Cv (4.5 x 2)	Dar	10	164	42640	20.5	31898	120,000		Concrete	9	1.5	15	501	7214.4	72144	1202.4	288,576	48.10	74,837	363,413	436,000
		32-R10	932	Kute, Farinto, Farinto	Proposed	Box Culvert	2 Cv (4.5 x 2)	Dar	10	164	42640	20.5	31898	120,000		Concrete	13	1.5	19	285	5472	54720	855.0	205,200	34.20	53,215	258,415	313,000
		32-R11	Size Change													Concrete	13	1.5	19	48	921.6	9216	144.0	34,560	5.76	8,963	43,523	53,000
		32-R12	972	Kute Area, Powerline, Powerline	Proposed	Box Culvert	2 Cv (6 x 2)	Dar	10	206	53560	25.75	40067	150,400		Concrete	13	1.5	19	93	1785.6	17856	279.0	66,960	11.16	17,365	84,325	102,000
		32-R13	974	Kute Area, Sobaloju, Sobaloju	Proposed	Box Culvert	2 Cv (6 x 2)	Dar	10	206	53560	25.75	40067	150,400		Concrete	13	1.5	19	172	3302.4	33024	516.0	123,840	20.64	32,116	155,956	189,000
		32-R14	933	Kute, Ifellodun zone 17, Ifelodun Zone 17	Proposed	Box Culvert	2 Cv (6 x 2)	Dar	10	206	53560	25.75	40067	150,400		Concrete	13	1.5	19	117	2246.4	22464	351.0	84,240	14.04	21,846	106,086	129,000
		32-R15	97	SIONI/OPEOLU,	Proposed	Box Culvert	2 Cv (6 x 2)	Dar	10	206	53560	25.75	40067	150,400		Concrete	13	1.5	19	321	6163.2	61632	963.0	231,120	38.52	59,937	291,057	353,000
		32-R16	990	Agbaja Olodo, Opeolu Layout, Behind Oremeji house	Proposed	Box Culvert	2 Cv (6 x 2)	Dar	10	206	53560	25.75	40067	150,400		Concrete	13	1.5	19	159	3052.8	30528	477.0	114,480	19.08	29,688	144,168	175,000
		32-R17	Size Change													Concrete	14	2	22	509	14659.2	146592	1756.1	421,452	70.24	109,297	530,749	677,000
		32-R18	1522	Olodo kumapayi, Opeolu Agbaja	Proposed	Box Culvert	2 Cv (7.5 x 2.5)	Dar	10	275	71500	34.375	53487.5	200,000		Concrete	16	2	24	83	2656	26560	311.3	74,700	12.45	19,372	94,072	121,000
		32-R19	934	Arulogun Alaja, Along railway line, Railway line	Proposed	Box Culvert	2 Cv (7.5 x 2.5)	Dar	10	275	71500	34.375	53487.5	200,000		Concrete	16	2	24	116	3712	37120	435.0	104,400	17.40	27,074	131,474	169,000
		32-R20	Size Change													Concrete	16	2	24	73	2336	23360	273.8	65,700	10.95	17,038	82,738	106,000
32C	OM3 Upper Omi West	32C-R1	103	AJARA	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	20	108	28080	13.5	21006	80,000		Concrete	2.5	1.5	8.5	35	231	2310	52.5	12,600	2.10	3,268	15,868	18,000
		32C-R2	Size Change													Concrete	2.5	1.5	8.5	401	2646.6	26466	601.5	144,360	24.06	37,437	181,797	208,000
32H	OM3 Upper Omi West	32H-R1	Size Change	Oloko Stream												Concrete	4	1	8	524	2515.2	25152	707.4	169,776	28.30	44,029	213,805	239,000
32P	OM3 Upper Omi West	32P-R1	943	Unity Estate- Akoka, Road 4	Proposed	Box Culvert	1 Cv (2.5 x 1.5)	Dar	10	52	13520	6.5	10114	38,400		Concrete	2.5	1	6.5	52	187.2	1872	54.6	13,104	2.18	3,398	16,502	18,000
		32P-R2	Size Change													Concrete	2.5	1	6.5	131	471.6	4716	137.6	33,012	5.50	8,561	41,573	46,000

Structure Data										Structure Cost						Channel Data					Channel Cost							
Channel ID	Subbasin	Reach ID	Structure No.	Location	Structure Status	Proposed Crossing Structure Type	Proposed Crossing Structure Dimensions	Designed by	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)	Lining Protection	Bed Width (m)	Design Depth (m)	Top Width (m)	Reach Length (m)	Excavation Volume (m3)	Cost of Excavation US$	Concrete Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Total Lining Cost (USD)	Total Cost of Channel US$
33	OM3 Upper Omi West	33-R1	1527	Akobo, Iyana Church Road	Existing											Concrete	4	1.5	10	349	2931.6	29316	575.9	138,204	23.03	35,841	174,045	203,000
		33-R2	118	OKE-IBADAN ESTATE	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	760	6384	63840	1254.0	300,960	50.16	78,049	379,009	443,000
		33-R3	1526	Iyana Church, Iyana Church Road	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	593	4981.2	49812	978.5	234,828	39.14	60,899	295,727	346,000
		33-R4	957	Wofun, Kute road	Proposed	Box Culvert	1 Cv (4.5 x 2)	Dar	10	91	23660	11.375	17699.5	67,200		Concrete	4.5	1.5	10.5	797	7173	71730	1434.6	344,304	57.38	89,290	433,594	505,000
		33-R5	Size Change													Concrete	4.5	1.5	10.5	177	1593	15930	318.6	76,464	12.74	19,830	96,294	112,000
		33-R6	935	Wofun, ARCEDEM, ARCEDEM	Proposed	Box Culvert	2 Cv (4.5 x 2)	Dar	10	164	42640	20.5	31898	120,000		Concrete	9	1.5	15	20	288	2880	48.0	11,520	1.92	2,988	14,508	17,000
		33-R7	Size Change													Concrete	9	1.5	15	557	8020.8	80208	1336.8	320,832	53.47	83,202	404,034	484,000
33F	OM3 Upper Omi West	33F-R1	116	WAKAJAIYE	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	124	818.4	8184	186.0	44,640	7.44	11,577	56,217	64,000
		33F-R2	117	IWDFUN , IWO EXPRESS WAY	Proposed	Box Culvert	1 Cv (3 x 2)	Dar	20	120	31200	15	23340	88,000		Concrete	3	1.5	9	431	3103.2	31032	646.5	155,160	25.86	40,238	195,398	226,000
		33F-R3	956	Wofun, Kute road	Proposed	Box Culvert	1 Cv (3 x 2)	Dar	10	70	18200	8.75	13615	51,200		Concrete	3	1.5	9	107	770.4	7704	160.5	38,520	6.42	9,990	48,510	56,000
		33F-R4	Size Change													Concrete	3	1.5	9	358	2577.6	25776	537.0	128,880	21.48	33,423	162,303	188,000
34	OM3 Upper Omi West	34-R1	936	Arulogun Alaja, By Ona-Iwa Mimo C& S Church, Railway line	Proposed	Box Culvert	2 Cv (7.5 x 2.5)	Dar	10	275	71500	34.375	53487.5	200,000		Concrete	16	2	24	199	6368	63680	746.3	179,100	29.85	46,447	225,547	289,000
		34-R2	Size Change													Concrete	16	2	24	155	4960	49600	581.3	139,500	23.25	36,177	175,677	225,000
		34-R3	937	Olodo, Ogberi, Galili	Proposed	Box Culvert	3 Cv (6 x 3)	Dar	10	366	95160	45.75	71187	267,200		Concrete	18	2.5	28	501	23046	230460	2254.5	541,080	90.18	140,320	681,400	912,000
		34-R4	955	Olodo Area, Behind The Jewels Nursery & Pry School, Aba Baale	Proposed	Box Culvert	3 Cv (6 x 3)	Dar	10	366	95160	45.75	71187	267,200		Concrete	18	2.5	28	352	16192	161920	1584.0	380,160	63.36	98,588	478,748	641,000
		34-R5	992	Olodo Nla, Egberi, Olodo way	Proposed	Box Culvert	3 Cv (6 x 3)	Dar	10	366	95160	45.75	71187	267,200		Concrete	18	2.5	28	270	12420	124200	1215.0	291,600	48.60	75,622	367,222	491,000
		34-R6	104	Olodo Nla, Egberi, Olodo way	Proposed	Box Culvert	3 Cv (6 x 3)	Dar	20	606	157560	75.75	117867	441,600		Concrete	18	2.5	28	228	10488	104880	1026.0	246,240	41.04	63,858	310,098	415,000
		34-R7	991	Custom Area-Oki, Imorole, Imorole	Proposed	Box Culvert	3 Cv (6 x 3)	Dar	10	366	95160	45.75	71187	267,200		Concrete	18	2.5	28	1123	51658	516580	5053.5	1,212,840	202.14	314,530	1,527,370	2,044,000
		34-R8	938	Isale Custom-Oki, Idera, Idera Street	Proposed	Box Culvert	3 Cv (6 x 3)	Dar	10	366	95160	45.75	71187	267,200		Concrete	18	2.5	28	319	14674	146740	1435.5	344,520	57.42	89,346	433,866	581,000
		34-R9	1403	Majue, Egberi, Egberi	Proposed	Box Culvert	3 Cv (6.5 x 3)	Dar	10	390	101400	48.75	75855	284,800		Concrete	18	2.5	28	2448	112608	1126080	11016.0	2,643,840	440.64	685,636	3,329,476	4,456,000
		34-R10	Size Change													Concrete	18	2.5	28	192	8832	88320	864.0	207,360	34.56	53,775	261,135	349,000
		34-R11	34D2	PEACE ESTATE (ZONE 9) RESIDENTS ASSOCIATION OGUNGBADE, OFF NEW IFE ROAD EGBEDA LG, IBADAN	Proposed	Bridge	Br (30 x 10)	Dar	10						750,000	Concrete	20	2.5	30	153	7650	76500	734.4	176,256	29.38	45,709	221,965	298,000
		34-R12	Size Change													Concrete	20	2.5	30	24	1200	12000	115.2	27,648	4.61	7,170	34,818	47,000
34G	OM3 Upper Omi West	34G-R1	952	Oki, Olodo way	Proposed	Box Culvert	1 Cv (2 x 2)	Dar	10	56	14560	7	10892	41,600		Concrete	2	1.5	8	149	894	8940	201.2	48,276	8.05	12,520	60,796	70,000
		34G-R2	1523	Olodo, Sooto Street	Proposed	Box Culvert	1 Cv (2 x 2)	Dar	10	56	14560	7	10892	41,600		Concrete	2	1.5	8	330	1980	19800	445.5	106,920	17.82	27,728	134,648	154,000
		34G-R3	Size Change													Concrete	2	1.5	8	307	1842	18420	414.5	99,468	16.58	25,795	125,263	144,000
29	OM4 Upper Omi East	29-R1	1361	Baale-Ajinti, Keshinjo Road	Proposed	Box Culvert	1 Cv (5 x 2)	Dar	10	98	25480	12.25	19061	72,000		Concrete	5	1.5	11	1328	12748.8	127488	2390.4	573,696	95.62	148,778	722,474	850,000
		29-R2	Size Change													Concrete	5	1.5	11	870	8352	83520	1566.0	375,840	62.64	97,468	473,308	557,000
		29-R3	1360	Adeleye-Fatumo, Oloro, Oloro	Proposed	Box Culvert	2 Cv (4 x 2)	Dar	10	150	39000	18.75	29175	110,400		Concrete	6	1.5	12	96	1036.8	10368	187.2	44,928	7.49	11,651	56,579	67,000
		29-R4	Size Change													Concrete	6	1.5	12	179	1933.2	19332	349.1	83,772	13.96	21,725	105,497	125,000
		29-R5	1537	Erunmu, Adewumi Olosunde	Proposed	Box Culvert	2 Cv (4.5 x 2)	Dar	10	164	42640	20.5	31898	120,000		Concrete	8	1.5	14	316	4171.2	41712	711.0	170,640	28.44	44,253	214,893	257,000
		29-R6	1536	Olodo, Erunmu	Proposed	Box Culvert	2 Cv (4.5 x 2)	Dar	10	164	42640	20.5	31898	120,000		Concrete	8	1.5	14	331	4369.2	43692	744.8	178,740	29.79	46,353	225,093	269,000
		29-R7	1393	OKE-OMI, ODO-OKOKO, ALAAKA	Proposed	Box Culvert	2 Cv (4.5 x 2)	Dar	10	164	42640	20.5	31898	120,000		Concrete	8	1.5	14	435	5742	57420	978.8	234,900	39.15	60,917	295,817	353,000
		29-R8	Size Change													Concrete	8	1.5	14	322	4250.4	42504	724.5	173,880	28.98	45,093	218,973	261,000
		29-R9	1394	OKE-OMI, ESE-ONA, ESE-ONA/OLD ROAD	Proposed	Box Culvert	2 Cv (5 x 2)	Dar	10	178	46280	22.25	34621	129,600		Concrete	10	1.5	16	871	13587.6	135876	2221.1	533,052	88.84	138,238	671,290	807,000
		29-R10	1395	OKE-OMI, OMI, IWO-ROAD EXPRESS	Proposed	Box Culvert	2 Cv (5 x 2)	Dar	20	308	80080	38.5	59906	224,000		Concrete	10	1.5	16	108	1684.8	16848	275.4	66,096	11.02	17,141	83,237	100,000
		29-R11	Size Change													Concrete	10	1.5	16	572	8923.2	89232	1458.6	350,064	58.34	90,783	440,847	530,000
29B	OM4 Upper Omi East	29B-R1	Size Change													Concrete	4	1	8	138	662.4	6624	186.3	44,712	7.45	11,595	56,307	63,000
29E	OM4 Upper Omi East	29E-R1	1359	Baale-Ajinti, Ifelodun Road	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16900	8.125	12642.5	48,000		Concrete	3.5	1	7.5	487	2142.8	21428	584.4	140,256	23.38	36,373	176,629	198,000
		29E-R2	Size Change													Concrete	3.5	1	7.5	399	1755.6	17556	478.8	114,912	19.15	29,801	144,713	162,000
30	OM4 Upper Omi East	30-R1	1385	KOKOKO ESTATE, OMI, ARUBIEWE/OJUIRIN	Proposed	Bridge	Br (40 x 10)	Dar	10						1,000,000	Concrete Sides	28	3	40	399	32558.4	325584	1316.7	316,008	52.67	81,951	397,959	724,000
		30-R2	110	OGODU,	Proposed	Bridge	Br (40 x 10)	Dar	10						1,000,000	Concrete Sides	28	3	40	581	47409.6	474096	1917.3	460,152	76.69	119,333	579,485	1,054,000
		30-R3	Size Change													Concrete Sides	28	3	40	865	70584	705840	2854.5	685,080	114.18	177,664	862,744	1,569,000
		30-R4	1386	IKUMAPAYI-OLODO, OMI, IDI-OSAN/AREKE	Proposed	Bridge	Br (30 x 10)	Dar	10						750,000	Concrete	14	3	26	1118	53664	536640	4695.6	1,126,944	187.82	292,254	1,419,198	1,956,000
		30-R5	111	OKU OSEJU,	Proposed	Bridge	Br (30 x 10)	Dar	10						750,000	Concrete	14	3	26	789	37872	378720	3313.8	795,312	132.55	206,251	1,001,563	1,380,000
		30-R6	1400	Oke-omi/Ogundipe, Omi, Koojo	Proposed	Bridge	Br (30 x 10)	Dar	10						750,000	Concrete	14	3	26	948	45504	455040	3981.6	955,584	159.26	247,815	1,203,399	1,658,000
		30-R7	Size Change													Concrete	14	3	26	170	8160	81600	714.0	171,360	28.56	44,439	215,799	297,000
		30-R8	Size Change													Concrete Sides	31	3	43	758	67310.4	673104	2501.4	600,336	100.06	155,687	756,023	1,429,000
30D	OM4 Upper Omi East	30D-R1	1538	Kumapayi, Kumapayi Road	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3	1	7	139	556	5560	166.8	40,032	6.67	10,382	50,414	56,000
		30D-R2	Size Change													Concrete	3	1	7	2197	8788	87880	2636.4	632,736	105.46	164,090	796,826	885,000
30H	OM4 Upper Omi East	30H-R1	1378	AHOYAYA VILLAGE, ROAD 1	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16900	8.125	12642.5	48,000		Concrete	3.5	1	7.5	354	1557.6	15576	424.8	101,952	16.99	26,440	128,392	144,000
		30H-R2	Size Change													Concrete	3.5	1	7.5	85	374	3740	102.0	24,480	4.08	6,348	30,828	35,000
35	OM4 Upper Omi East	35-R1	34D1	PEACE ESTATE (ZONE 9) RESIDENTS ASSOCIATION OGUNGBADE, OFF NEW IFE ROAD EGBEDA LG, IBADAN	Proposed	Bridge	Br (45 x 10)	Dar	10						1,125,000	Concrete Sides	31	3	43	156	13852.8	138528	514.8	123,552	20.59	32,041	155,593	294,000
		35-R2	1401	Ogungbade, Omi, Agbede/Adesoji Road.A	Proposed	Bridge	Br (45 x 10)	Dar	10						1,125,000	Concrete Sides	31	3	43	573	50882.4	508824	1890.9	453,816	75.64	117,690	571,506	1,080,000
		35-R3	1025	Ikumoda, Oloro, Iso ege	Proposed	Bridge	Br (45 x 10)	Dar	10						1,125,000	Concrete Sides	31	3	43	1840	163392	1633920	6072.0	1,457,280	242.88	377,921	1,835,201	3,469,000
		35-R4	93	Ikumoda, By Buso rock hotel, Old Ife road	Existing											Concrete Sides	31	3	43	251	22288.8	222888	828.3	198,792	33.13	51,553	250,345	473,000
		35-R5	Size Change													Concrete Sides	31	3	43	206	18292.8	182928	679.8	163,152	27.19	42,311	205,463	388,000
		35-R6	Size Change													Concrete Sides	35	3	47	485	47724	477240	1600.5	384,120	64.02	99,615	483,735	961,000
39	OM5 Middle Omi East	39-R1	Size Change													Concrete	4.5	1.5	10.5	2748	24732	247320	4946.4	1,187,136	197.86	307,864	1,495,000	1,742,000
		39-R2	Size Change													Concrete	11	1.5	17	1493	25082.4	250824	4031.1	967,464	161.24	250,896	1,218,360	1,469,000
		39-R3	1413	Alapata, Alapata, Egbeda	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	10	230	59800	28.75	44735	168,000		Concrete	12	2	20	368	9420.8	94208	1159.2	278,208	46.37	72,149	350,357	445,000
		39-R4	1414	Ajoda, Ajoda, Road.3	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	10	230	59800	28.75	44735	168,000		Concrete	12	2	20	745	19072	190720	2346.8	563,220	93.87	146,062	709,282	900,000
		39-R5	94	AJODA-NEW TOWN IFE-IBADAN EXPRESS ROAD,	Proposed	Box Culvert	2 Cv (7 x 2.5)	Dar	40	793	206180	99.125	154238.5	577,600		Concrete	12	2	20	162	4147.2	41472	510.3	122,472	20.41	31,761	154,233	196,000
		39-R6	1415	Ifeoluwatedo, Zone 2	Proposed	Box Culvert	2 Cv (7 x 2.5)	Dar	10	260	67600	32.5	50570	190,400		Concrete	12	2	20	416	10649.6	106496	1310.4	314,496	52.42	81,559	396,055	503,000
		39-R7	1416	Ifeoluwatedo Estate, Ifeoluwatedo, Road.14	Proposed	Box Culvert	2 Cv (7 x 2.5)	Dar	10	260	67600	32.5	50570	190,400		Concrete	12	2	20	393	10060.8	100608	1238.0	297,108	49.52	77,050	374,158	475,000
		39-R8	52D1	PROGBESSIVE LANDLORDS/LANDLADIES ASSOCIATION OFF AKINBODE ROAD, OLUWO AREA EGBEDA LGA.	Proposed	Box Culvert	2 Cv (7 x 2.5)	Dar	10	260	67600	32.5	50570	190,400		Concrete	12	2	20	229	5862.4	58624	721.4	173,124	28.85	44,897	218,021	277,000
		39-R9	Size Change													Concrete	12	2	20	802	20531.2	205312	2526.3	606,312	101.05	157,237	763,549	969,000

Structure Data										Structure Cost						Channel Data					Channel Cost							
Channel ID	Subbasin	Reach ID	Structure No.	Location	Structure Status	Proposed Crossing Structure Type	Proposed Crossing Structure Dimensions	Designed by	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)	Lining Protection	Bed Width (m)	Design Depth (m)	Top Width (m)	Reach Length (m)	Excavation Volume (m3)	Cost of Excavation US$	Concrete Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Total Lining Cost (USD)	Total Cost of Channel US$
39D	OM5 Middle Omi East	39D-R1	Size Change													Concrete	4	1	8	1059	5083.2	50832	1429.7	343,116	57.19	88,981	432,097	483,000
39H	OM5 Middle Omi East	39H-R1	Size Change													Concrete	4.5	1	8.5	1926	10015.2	100152	2600.1	624,024	104.00	161,830	785,854	886,000
		39H-R2	Size Change													Concrete	5.5	1.5	11.5	657	6701.4	67014	1281.2	307,476	51.25	79,739	387,215	454,000
39H-6	OM5 Middle Omi East	39H-6-R1	Size Change													Concrete	4	1	8	1126	5404.8	54048	1520.1	364,824	60.80	94,611	459,435	513,000
39M	OM5 Middle Omi East	39M-R1	Size Change													Concrete	4.5	1	8.5	1507	7836.4	78364	2034.5	488,268	81.38	126,624	614,892	693,000
36	OM6 Middle Omi West	36-R1	960	Onibuore, Iwo road	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	20	115	29900	14.375	22367.5	84,800		Concrete	3.5	1	7.5	91	400.4	4004	109.2	26,208	4.37	6,797	33,005	37,000
		36-R2	962	Onibuore, Arowolo	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	350	2940	29400	577.5	138,600	23.10	35,944	174,544	204,000
		36-R3	1031	Ebenesary Area, Jinarere	Proposed	Box Culvert	1 Cv (5 x 2)	Dar	10	98	25480	12.25	19061	72,000		Concrete	5	1.5	11	1134	10886.4	108864	2041.2	489,888	81.65	127,044	616,932	726,000
		36-R4	1032	Ebenesary Area, Adogba Road	Proposed	Box Culvert	1 Cv (5 x 2)	Dar	10	98	25480	12.25	19061	72,000		Concrete	5	1.5	11	84	806.4	8064	151.2	36,288	6.05	9,411	45,699	54,000
		36-R5	1034	Ebenesary Area 3, Road A	Proposed	Box Culvert	1 Cv (5 x 2)	Dar	10	98	25480	12.25	19061	72,000		Concrete	5	1.5	11	86	825.6	8256	154.8	37,152	6.19	9,635	46,787	55,000
		36-R6	Size Change													Concrete	5	1.5	11	272	2611.2	26112	489.6	117,504	19.58	30,473	147,977	174,000
		36-R7	1035	Alakia, Isabo, Isabo	Proposed	Bridge	Br (15 x 37)	Pheman	37							Concrete	8	2	16	43	825.6	8256	109.7	26,316	4.39	6,825	33,141	41,000
		36-R8	1036	Seke, Comfort Memorial School, Comfort Memorial School	Proposed	Box Culvert	2 Cv (4 x 2.5)	Dar	10	170	44200	21.25	33065	124,800		Concrete	8	2	16	978	18777.6	187776	2493.9	598,536	99.76	155,220	753,756	942,000
		36-R9	1055	Seke Apomu, Lekan Hussein, Lekan Hussein Street	Proposed	Box Culvert	2 Cv (4 x 2.5)	Dar	10	170	44200	21.25	33065	124,800		Concrete	8	2	16	249	4780.8	47808	635.0	152,388	25.40	39,519	191,907	240,000
		36-R10	1033	Oke- Odo Alapata, Eternity Nursery & Primary School, Eternity Nursery & Primary School Road	Proposed	Box Culvert	2 Cv (4 x 2.5)	Dar	10	170	44200	21.25	33065	124,800		Concrete	8	2	16	715	13728	137280	1823.3	437,580	72.93	113,479	551,059	688,000
		36-R11	1049	Oke- Odo Alapata, Fimiiti Oluwa, Fimiiti Oluwa	Proposed	Box Culvert	2 Cv (4 x 2.5)	Dar	10	170	44200	21.25	33065	124,800		Concrete	8	2	16	450	8640	86400	1147.5	275,400	45.90	71,420	346,820	433,000
		36-R12	1037	Oke- Odo Alapata, Olosan, Olosan	Existing											Concrete	8	2	16	191	3667.2	36672	487.1	116,892	19.48	30,314	147,206	184,000
		36-R13	1038	Alakia, Oluwatedo Quarters, Oluwatedo Quarters	Proposed	Box Culvert	2 Cv (4 x 2.5)	Dar	10	170	44200	21.25	33065	124,800		Concrete	8	2	16	299	5740.8	57408	762.5	182,988	30.50	47,455	230,443	288,000
		36-R14	Size Change													Concrete	8	2	16	425	8160	81600	1083.8	260,100	43.35	67,453	327,553	409,000
		36-R15	1021	Adegbayi, Oloro, Abatiti Olode	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	10	230	59800	28.75	44735	168,000		Concrete	12	2	20	1664	42598.4	425984	5241.6	1,257,984	209.66	326,237	1,584,221	2,010,000
		36-R16	92	Celica, Oloro, Oloro	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	40	703	182780	87.875	136733.5	512,000		Concrete	12	2	20	461	11801.6	118016	1452.2	348,516	58.09	90,382	438,898	557,000
		36-R17	Size Change													Concrete	12	2	20	540	13824	138240	1701.0	408,240	68.04	105,870	514,110	652,000
36A	OM6 Middle Omi West	36A-R1	729	Agric, Iwo road	Existing											Concrete	2.5	1.5	8.5	265	1749	17490	397.5	95,400	15.90	24,740	120,140	138,000
		36A-R2	728	Agric bus stop, Gospel mission faith church road	Proposed	Box Culvert	1 Cv (3 x 2)	Dar	10	70	18200	8.75	13615	51,200		Concrete	3	1.5	9	142	1022.4	10224	213.0	51,120	8.52	13,257	64,377	75,000
		36A-R3	961	Onibuore, Odo eran	Proposed	Box Culvert	1 Cv (3 x 2)	Dar	10	70	18200	8.75	13615	51,200		Concrete	3	1.5	9	273	1965.6	19656	409.5	98,280	16.38	25,487	123,767	143,000
36D	OM6 Middle Omi West	36D-R1	812	AGORO/ MANATAN, AGORO STREET	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16900	8.125	12642.5	48,000		Concrete	3.5	1	7.5	25	110	1100	30.0	7,200	1.20	1,867	9,067	10,000
		36D-R2	1039	Aroko- Agoro, Zone 4	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16900	8.125	12642.5	48,000		Concrete	3.5	1	7.5	205	902	9020	246.0	59,040	9.84	15,311	74,351	83,000
		36D-R3	1040	Agoro, Adesina Street	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16900	8.125	12642.5	48,000		Concrete	3.5	1	7.5	153	673.2	6732	183.6	44,064	7.34	11,427	55,491	62,000
		36D-R4	1520	Adogba	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	317	2662.8	26628	523.1	125,532	20.92	32,555	158,087	185,000
		36D-R5	1043	Alalubosa, Ago Irapada	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	250	2100	21000	412.5	99,000	16.50	25,674	124,674	146,000
		36D-R6	Size Change													Concrete	4	1.5	10	884	7425.6	74256	1458.6	350,064	58.34	90,783	440,847	515,000
36D-5	OM6 Middle Omi West	36D-5-R1	1521	Adogba	Proposed	Box Culvert	1 Cv (2.5 x 1.5)	Dar	10	52	13520	6.5	10114	38,400		Concrete	2.5	1	6.5	24	86.4	864	25.2	6,048	1.01	1,568	7,616	8,000
		36D-5-R2	Size Change													Concrete	2.5	1	6.5	216	777.6	7776	226.8	54,432	9.07	14,116	68,548	76,000
36D-7	OM6 Middle Omi West	36D-7-R1	1045	Alalubosa, Mojawe	Proposed	Box Culvert	1 Cv (3 x 2)	Dar	10	70	18200	8.75	13615	51,200		Concrete	3	1.5	9	426	3067.2	30672	639.0	153,360	25.56	39,771	193,131	224,000
		36D-7-R2	Size Change													Concrete	3	1.5	9	628	4521.6	45216	942.0	226,080	37.68	58,630	284,710	330,000
36M	OM6 Middle Omi West	36M-R1	1028	Alakia Area, Amuro Onilu Temidire Zone D	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3	1	7	1122	4488	44880	1346.4	323,136	53.86	83,800	406,936	452,000
		36M-R2	1027	Alakia Area, Amuro Onilu Temidire Zone D	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3	1	7	147	588	5880	176.4	42,336	7.06	10,979	53,315	59,000
		36M-R3	Size Change													Concrete	3	1	7	58	232	2320	69.6	16,704	2.78	4,332	21,036	23,000
37	OM6 Middle Omi West	37-R1	998	Iyana Agbala, Old Ife road	Proposed	Box Culvert	1 Cv (2.5 x 1.5)	Dar	40	172	44720	21.5	33454	126,400		Concrete	2.5	1	6.5	35	126	1260	36.8	8,820	1.47	2,287	11,107	12,000
		37-R2	997	Iyana Agbala, Kuelu	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	580	4872	48720	957.0	229,680	38.28	59,564	289,244	338,000
		37-R3	996	Kuelu Area, Zone D	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	364	3057.6	30576	600.6	144,144	24.02	37,381	181,525	212,000
		37-R4	995	Omiri, Adekola road	Proposed	Box Culvert	3 Cv (3 x 3.5)	Pheman								Concrete	4.5	1.5	10.5	109	981	9810	196.2	47,088	7.85	12,211	59,299	69,000
		37-R5	994	Ogo Oluwa Community Zone B, Morning Star International School	Existing											Concrete	4.5	1.5	10.5	391	3519	35190	703.8	168,912	28.15	43,805	212,717	248,000
		37-R6	Size Change													Concrete	4.5	1.5	10.5	892	8028	80280	1605.6	385,344	64.22	99,933	485,277	566,000
		37-R7	Size Change													Concrete	6	1.5	12	671	7246.8	72468	1308.5	314,028	52.34	81,438	395,466	468,000
37D	OM6 Middle Omi West	37D-R1	1010	Adegbayi, Ikuogbolekun	Existing											Concrete	2.5	1.5	8.5	109	719.4	7194	163.5	39,240	6.54	10,176	49,416	57,000
		37D-R2	1008	Adegbayi, Off Ikuogbolekun	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	88	580.8	5808	132.0	31,680	5.28	8,216	39,896	46,000
		37D-R3	1007	Adegbayi, Akomolafe-Road C	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	212	1399.2	13992	318.0	76,320	12.72	19,792	96,112	110,000
		37D-R4	1006	Adegbayi, Aba Odan	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	192	1267.2	12672	288.0	69,120	11.52	17,925	87,045	100,000
		37D-R5	1005	Adegbayi, Ajia road	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	324	2138.4	21384	486.0	116,640	19.44	30,249	146,889	168,000
		37D-R6	1004	Adegbayi, Kuelu	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	54	356.4	3564	81.0	19,440	3.24	5,041	24,481	28,000
		37D-R7	Size Change													Concrete	2.5	1.5	8.5	238	1570.8	15708	357.0	85,680	14.28	22,220	107,900	124,000
38	OM6 Middle Omi West	38-R1	Size Change													Concrete Sides	40	3	52	647	71428.8	714288	2135.1	512,424	85.40	132,889	645,313	1,360,000
		38-R2	Size Change													Concrete Sides	45	3	57	814	99633.6	996336	2686.2	644,688	107.45	167,189	811,877	1,808,000
40	OM7 Middle Omi South	40-R1	1422	Egbeda/Iyana-Ajia, Ife/Ibadan Express Way	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	40	215	55900	26.875	41817.5	156,800		Concrete	3.5	1	7.5	82	360.8	3608	98.4	23,616	3.94	6,124	29,740	33,000
		40-R2	1423	Egbeda, Jekaoyinfa Road	Existing											Concrete	4	1	8	261	1252.8	12528	352.4	84,564	14.09	21,930	106,494	119,000
		40-R3	1424	Bethel Estate, Celestial Village	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	4	1	8	295	1416	14160	398.3	95,580	15.93	24,787	120,367	135,000
		40-R4	1425	Oke-odo, Agudu Road	Proposed	Box Culvert	1 Cv (5 x 1.5)	Dar	10	85	22100	10.625	16532.5	62,400		Concrete	5	1	9	442	2475.2	24752	663.0	159,120	26.52	41,265	200,385	225,000
		40-R5	1426	Moleke-Agudu, Road.5	Proposed	Box Culvert	1 Cv (5.5 x 1.5)	Dar	10	91	23660	11.375	17699.5	67,200		Concrete	5.5	1	9.5	367	2202	22020	550.5	132,120	22.02	34,263	166,383	188,000
		40-R6	1427	Wisdom estate, Edun villa	Proposed	Box Culvert	2 Cv (4 x 1.5)	Dar	10	131	34060	16.375	25479.5	96,000		Concrete	8	1	12	613	4904	49040	1195.4	286,884	47.81	74,399	361,283	410,000
		40-R7	1428	Olorunsogo, Akinjole Zone 2	Proposed	Box Culvert	2 Cv (4.5 x 1.5)	Dar	10	144	37440	18	28008	105,600		Concrete	9	1	13	330	2904	29040	693.0	166,320	27.72	43,132	209,452	238,000
		40-R8	1429	Akinjole/Omoloju, Akinjole Zone 2	Proposed	Box Culvert	1 Cv (5.5 x 2)	Dar	10	105	27300	13.125	20422.5	76,800		Concrete	5.5	1.5	11.5	197	2009.4	20094	384.2	92,196	15.37	23,909	116,105	136,000
		40-R9	Size Change													Concrete	5.5	1.5	11.5	179	1825.8	18258	349.1	83,772	13.96	21,725	105,497	124,000
		40-R10	1517	Logun, Odo Loogun, Road 3	Proposed	Box Culvert	2 Cv (3.5 x 2)	Dar	10	136	35360	17	26452	99,200		Concrete	6	1.5	12	191	2062.8	20628	372.5	89,388	14.90	23,181	112,569	133,000
		40-R11	1430	Olode/Ajamaro, Olode, Okewusi Road 1.A	Proposed	Box Culvert	2 Cv (4 x 2)	Dar	10	150	39000	18.75	29175	110,400		Concrete	6	1.5	12	743	8024.4	80244	1448.9	347,724	57.95	90,176	437,900	518,000
		40-R12	Size Change													Concrete	6	1.5	12	288	3110.4	31104	561.6	134,784	22.46	34,954	169,738	201,000
		40-R13	1516	Masopa estate, Road C, Lane 1	Proposed	Box Culvert	2 Cv (6 x 2)	Dar	10	206	53560	25.75	40067	150,400		Concrete	12	1.5	18	112	2016	20160	319.2	76,608	12.77	19,867	96,475	117,000
		40-R14	1441	Areokuta, Omi S.C., Wemimo	Proposed	Box Culvert	2 Cv (6 x 2)	Dar	10	206	53560	25.75	40067	150,400		Concrete	12	1.5	18	975	17550	175500	2778.8	666,900	111.15	172,949	839,849	1,015,000
		40-R15	1515	Oke Anu Alaro Ibadan, Ire Akari Str.	Proposed	Box Culvert	2 Cv (6 x 2)	Dar	10	206	53560	25.75	40067	150,400		Concrete	12	1.5	18	458	8244	82440	1305.3	313,272	52.21	81,242	394,514	477,000
		40-R16	1142	Komolafe Estate, Komolafe, Off Ajia Road	Proposed	Box Culvert	2 Cv (6 x 2)	Dar	10	206	53560	25.75	40067	150,400		Concrete	12	1.5	18	406	7308	73080	1157.1	277,704	46.28	72,018	349,722	423,000
		40-R17	Size Change													Concrete	12	1.5	18	363	6534	65340	1034.6	248,292	41.38	64,390	312,682	378,000

Structure Data										Structure Cost						Channel Data					Channel Cost							
Channel ID	Subbasin	Reach ID	Structure No.	Location	Structure Status	Proposed Crossing Structure Type	Proposed Crossing Structure Dimensions	Designed by	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)	Lining Protection	Bed Width (m)	Design Depth (m)	Top Width (m)	Reach Length (m)	Excavation Volume (m3)	Cost of Excavation US$	Concrete Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Total Lining Cost (USD)	Total Cost of Channel US$
40Q	OM7 Middle Omi South	40Q-R1	1437	Arinokuta, Wemimo/Alaro Estate	Proposed	Box Culvert	1 Cv (2.5 x 1.5)	Dar	10	52	13520	6.5	10114	38,400		Concrete	2.5	1	6.5	45	162	1620	47.3	11,340	1.89	2,941	14,281	16,000
		40Q-R2	Size Change													Concrete	2.5	1	6.5	258	928.8	9288	270.9	65,016	10.84	16,861	81,877	91,000
41	OM7 Middle Omi South	41-R1	1173	Araba Redeem, Oomi River, Redeem	Proposed	Bridge	Br (60 x 10)	Dar	10						1,500,000	Concrete Sides	45	3	57	370	45288	452880	1221.0	293,040	48.84	75,995	369,035	822,000
		41-R2	1141	Ejikeye Alaro, Oomi River, Ajia Road	Proposed	Bridge	Br (60 x 10)	Dar	10						1,500,000	Concrete Sides	45	3	57	2595	317628	3176280	8563.5	2,055,240	342.54	532,992	2,588,232	5,765,000
		41-R3	Size Change													Concrete Sides	45	3	57	1265	154836	1548360	4174.5	1,001,880	166.98	259,821	1,261,701	2,810,000
41B	OM7 Middle Omi South	41B-R1	Size Change													Concrete	3	1	7	681	2724	27240	817.2	196,128	32.69	50,863	246,991	274,000
42	OM7 Middle Omi South	42-R1	1170 Prime	Aiport, Perimeter fence road	Proposed	Box Culvert	1 Cv (2.5 x 1.5)	Dar	10	52	13520	6.5	10114	38,400		Concrete	2.5	1	6.5	212	763.2	7632	222.6	53,424	8.90	13,855	67,279	75,000
		42-R2	1170	Aiport, Off Perimeter fence road	Proposed	Box Culvert	1 Cv (2.5 x 1.5)	Dar	10	52	13520	6.5	10114	38,400		Concrete	2.5	1	6.5	62	223.2	2232	65.1	15,624	2.60	4,052	19,676	22,000
		42-R3	1130	Oke Ibukun, Road 1	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3	1	7	688	2752	27520	825.6	198,144	33.02	51,385	249,529	277,000
		42-R4	1132	Kobiowu Akintunde, Kobiowu Akintunde	Proposed	Box Culvert	1 Cv (4.5 x 1.5)	Dar	10	78	20280	9.75	15171	57,600		Concrete	4.5	1	8.5	865	4498	44980	1167.8	280,260	46.71	72,681	352,941	398,000
		42-R5	1133	Kobiowu Akintunde,	Proposed	Box Culvert	1 Cv (4.5 x 1.5)	Dar	10	78	20280	9.75	15171	57,600		Concrete	4.5	1	8.5	201	1045.2	10452	271.4	65,124	10.85	16,889	82,013	92,000
		42-R6	Size Change													Concrete	4.5	1	8.5	91	473.2	4732	122.9	29,484	4.91	7,646	37,130	42,000
		42-R7	Size Change													Concrete	8	1.5	14	775	10230	102300	1743.8	418,500	69.75	108,531	527,031	629,000
		42-R8	Size Change													Concrete	10	1.5	16	752	11731.2	117312	1917.6	460,224	76.70	119,351	579,575	697,000
		42-R9	Size Change													Concrete	12	1.5	18	302	5436	54360	860.7	206,568	34.43	53,570	260,138	314,000
42H	OM7 Middle Omi South	42H-R1	Size Change													Concrete	2.5	1	6.5	113	406.8	4068	118.7	28,476	4.75	7,385	35,861	40,000
42J	OM7 Middle Omi South	42J-R1	1139	Lato, Soobu Merin Street	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3	1	7	653	2612	26120	783.6	188,064	31.34	48,771	236,835	263,000
		42J-R2	90	AKINTUNDE	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	617	5182.8	51828	1018.1	244,332	40.72	63,363	307,695	360,000
		42J-R3	Size Change													Concrete	4	1.5	10	90	756	7560	148.5	35,640	5.94	9,243	44,883	52,000
43	OM7 Middle Omi South	43-R1	1174	Igbaotun, Oomi River, Aba Oloosa	Proposed	Bridge	Br (60 x 10)	Dar	10						1,500,000	Concrete Sides	45	3	57	1193	146023.2	1460232	3936.9	944,856	157.48	245,033	1,189,889	2,650,000
		43-R2	Size Change													Concrete Sides	45	3	57	857	104896.8	1048968	2828.1	678,744	113.12	176,021	854,765	1,904,000
44	OM7 Middle Omi South	44-R1	Size Change													Concrete	9	1	13	2442	21489.6	214896	5128.2	1,230,768	205.13	319,179	1,549,947	1,765,000
		44-R2	Size Change													Concrete	8	1.5	14	1125	14850	148500	2531.3	607,500	101.25	157,545	765,045	914,000
		44-R3	Size Change													Concrete	10	1.5	16	1105	17238	172380	2817.8	676,260	112.71	175,377	851,637	1,024,000
44J	OM7 Middle Omi South	44J-R1	Size Change													Concrete	3.5	1	7.5	850	3740	37400	1020.0	244,800	40.80	63,485	308,285	346,000
45	OM7 Middle Omi South	45-R1	Size Change													Concrete Sides	45	3	57	2570	314568	3145680	8481.0	2,035,440	339.24	527,857	2,563,297	5,709,000
		45-R2	1445	Ona-ara, Omi Br., Akanran	Proposed	Bridge	Br (60 x 20)	Dar	20						3,000,000	Concrete Sides	45	3.5	59	665	96824	968240	2394.0	574,560	95.76	149,003	723,563	1,692,000
		45-R3	Size Change													Concrete Sides	45	3.5	59	452	65811.2	658112	1627.2	390,528	65.09	101,277	491,805	1,150,000
45E	OM7 Middle Omi South	45E-R1	1164	Akindele Atea, Irepodun Estate	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3	1	7	59	236	2360	70.8	16,992	2.83	4,407	21,399	24,000
		45E-R2	1161	Aba Epo, Ayetuntun	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3	1	7	404	1616	16160	484.8	116,352	19.39	30,174	146,526	163,000
		45E-R3	1160	Aba Epo, Akanran	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16900	8.125	12642.5	48,000		Concrete	3.5	1	7.5	553	2433.2	24332	663.6	159,264	26.54	41,302	200,566	225,000
		45E-R4	1530	Oluwalogbon Community, Zone 1	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	4	1	8	483	2318.4	23184	652.1	156,492	26.08	40,584	197,076	220,000
		45E-R5	1159	Ogo Oluwa Estate, Zone G	Proposed	Box Culvert	1 Cv (3 x 2)	Dar	10	70	18200	8.75	13615	51,200		Concrete	3	1.5	9	142	1022.4	10224	213.0	51,120	8.52	13,257	64,377	75,000
		45E-R6	1158	Ogo Oluwa Estate, Road 2	Proposed	Box Culvert	1 Cv (3 x 2)	Dar	10	70	18200	8.75	13615	51,200		Concrete	3	1.5	9	135	972	9720	202.5	48,600	8.10	12,604	61,204	71,000
		45E-R7	1442	Idi-ose, Ogo-oluwa Estate zone.6	Proposed	Box Culvert	1 Cv (3 x 2)	Dar	10	70	18200	8.75	13615	51,200		Concrete	3	1.5	9	119	856.8	8568	178.5	42,840	7.14	11,110	53,950	63,000
		45E-R8	Size Change													Concrete	3	1.5	9	233	1677.6	16776	349.5	83,880	13.98	21,753	105,633	122,000
45H	OM7 Middle Omi South	45H-R1	1150	Oloya Area, Akaran	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3	1	7	413	1652	16520	495.6	118,944	19.82	30,846	149,790	166,000
		45H-R2	1154	Araromi, Oke-Odo	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	4	1	8	471	2260.8	22608	635.9	152,604	25.43	39,575	192,179	215,000
		45H-R3	1155	Ab a Eku, Irewole	Proposed	Box Culvert	1 Cv (3.5 x 2)	Dar	10	77	20020	9.625	14976.5	56,000		Concrete	3.5	1.5	9.5	635	4953	49530	1047.8	251,460	41.91	65,212	316,672	366,000
		45H-R4	1443	Idi-ose off Akanran Road, Ifelagba zone.5	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	743	6241.2	62412	1226.0	294,228	49.04	76,303	370,531	433,000
		45H-R5	1444	Idi-ose, Irewole	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	135	1134	11340	222.8	53,460	8.91	13,864	67,324	79,000
		45H-R6	Size Change													Concrete	4	1.5	10	474	3981.6	39816	782.1	187,704	31.28	48,678	236,382	276,000
66	ON6 Upper Ona West	66-R1	167	Onikankan-Onilu, Odo Onilu, Iyana Apete Road	Proposed	Bridge	Br (55 x 10)	Dar	10						1,375,000	Concrete Sides	40	3	52	230	25392	253920	759.0	182,160	30.36	47,240	229,400	483,000
		66-R2	186	Aba Onilu, Odo Onilu, Aba Onilu	Proposed	Bridge	Br (55 x 10)	Dar	10						1,375,000	Concrete Sides	40	3	52	553	61051.2	610512	1824.9	437,976	73.00	113,582	551,558	1,162,000
		66-R3	Size Change													Concrete Sides	40	3	52	1327	146500.8	1465008	4379.1	1,050,984	175.16	272,555	1,323,539	2,789,000
66C	ON6 Upper Ona West	66C-R1	178	Moniya, Old Oyo Road	Existing											Concrete	2.5	1.5	8.5	23	151.8	1518	34.5	8,280	1.38	2,147	10,427	12,000
		66C-R2	1578	Monya, Moniya Market	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	227	1498.2	14982	340.5	81,720	13.62	21,193	102,913	118,000
		66C-R3	184	Ayobomi Abiola (Moniya), Iseyin-Ibadan Road	Proposed	Box Culvert	1 Cv (3 x 2)	Dar	20	120	31200	15	23340	88,000		Concrete	3	1.5	9	354	2548.8	25488	531.0	127,440	21.24	33,049	160,489	186,000
		66C-R4	123B	Moniya, Isale-odo,Balogun Lane.3	Proposed	Box Culvert	1 Cv (3.5 x 2)	Dar	10	77	20020	9.625	14976.5	56,000		Concrete	3.5	1.5	9.5	305	2379	23790	503.3	120,780	20.13	31,322	152,102	176,000
		66C-R5	166	Balogun	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	195	1638	16380	321.8	77,220	12.87	20,026	97,246	114,000
		66C-R6	165	Balogun	Proposed	Box Culvert	1 Cv (4.5 x 2)	Dar	10	91	23660	11.375	17699.5	67,200		Concrete	4.5	1.5	10.5	151	1359	13590	271.8	65,232	10.87	16,917	82,149	96,000
		66C-R7	164	Onilu	Proposed	Box Culvert	1 Cv (4.5 x 2)	Dar	10	91	23660	11.375	17699.5	67,200		Concrete	4.5	1.5	10.5	745	6705	67050	1341.0	321,840	53.64	83,464	405,304	472,000
		66C-R8	35D3	ONILU LANDLORDS ASSOCIATION, MONIYA,IBADAN	Proposed	Box Culvert	1 Cv (4.5 x 2)	Dar	10	91	23660	11.375	17699.5	67,200		Concrete	4.5	1.5	10.5	297	2673	26730	534.6	128,304	21.38	33,274	161,578	188,000
		66C-R9	Size Change													Concrete	4.5	1.5	10.5	308	2772	27720	554.4	133,056	22.18	34,506	167,562	195,000
67	ON6 Upper Ona West	67-R1	Size Change													Concrete	5.5	1.5	11.5	2661	27142.2	271422	5189.0	1,245,348	207.56	322,960	1,568,308	1,840,000
		67-R2	Size Change													Concrete	7	1.5	13	1177	14124	141240	2471.7	593,208	98.87	153,839	747,047	888,000
68	ON6 Upper Ona West	68-R1	187	Guuwin - Lagbe, Odo Guumin, Guumin Road	Proposed	Bridge	Br (70 x 10)	Dar	10						1,750,000	Concrete Sides	60	2	68	655	67072	670720	1768.5	424,440	70.74	110,071	534,511	1,205,000
		68-R2	Size Change													Concrete Sides	60	2	68	6	614.4	6144	16.2	3,888	0.65	1,008	4,896	11,000
68A	ON6 Upper Ona West	68A-R1	173	Akingbile	Existing											Concrete	2.5	1	6.5	4	14.4	144	4.2	1,008	0.17	261	1,269	1,000
		68A-R2	172	Fatokun	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16900	8.125	12642.5	48,000		Concrete	3.5	1	7.5	434	1909.6	19096	520.8	124,992	20.83	32,415	157,407	177,000
		68A-R3	171	Fatokun	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	4	1	8	140	672	6720	189.0	45,360	7.56	11,763	57,123	64,000
		68A-R4	192	Ogunsinde	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	4	1	8	348	1670.4	16704	469.8	112,752	18.79	29,240	141,992	159,000
		68A-R5	191	Idiamu Akingbile	Proposed	Box Culvert	1 Cv (4.5 x 1.5)	Dar	10	78	20280	9.75	15171	57,600		Concrete	4.5	1	8.5	558	2901.6	29016	753.3	180,792	30.13	46,885	227,677	257,000
		68A-R6	Size Change													Concrete	4.5	1	8.5	368	1913.6	19136	496.8	119,232	19.87	30,921	150,153	169,000
68C	ON6 Upper Ona West	68C-R1	189	Agbe, Agbe Road	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	2024	17001.6	170016	3339.6	801,504	133.58	207,857	1,009,361	1,179,000
		68C-R2	Size Change													Concrete	4	1.5	10	51	428.4	4284	84.2	20,196	3.37	5,237	25,433	30,000
53G	ON7 Upper Ona East	53G-R1	1581	Arulogun, Arulogun Road	Proposed	Box Culvert	1 Cv (2.5 x 1.5)	Dar	20	92	23920	11.5	17894	67,200		Concrete	3	1	7	140	560	5600	168.0	40,320	6.72	10,456	50,776	56,000
		53G-R2	219	Ifesowapo community, Kole zone F	Proposed	Box Culvert	1 Cv (2.5 x 1.5)	Dar	10	52	13520	6.5	10114	38,400		Concrete	4	1	8	192	921.6	9216	259.2	62,208	10.37	16,133	78,341	88,000
		53G-R3	218	Kole Aroro, Kole road 6	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	4	1	8	582	2793.6	27936	785.7	188,568	31.43	48,902	237,470	265,000
		53G-R4	217	Kole	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	5.5	1	9.5	300	1800	18000	450.0	108,000	18.00	28,008	136,008	154,000
		53G-R5	Size Change													Concrete	5.5	1	9.5	93	558	5580	139.5	33,480	5.58	8,682	42,162	48,000

Structure Data										Structure Cost						Channel Data					Channel Cost							
Channel ID	Subbasin	Reach ID	Structure No.	Location	Structure Status	Proposed Crossing Structure Type	Proposed Crossing Structure Dimensions	Designed by	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)	Lining Protection	Bed Width (m)	Design Depth (m)	Top Width (m)	Reach Length (m)	Excavation Volume (m3)	Cost of Excavation US$	Concrete Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Total Lining Cost (USD)	Total Cost of Channel US$
53J	ON7 Upper Ona East	53J-R1	121B	KOLE OSHE , ARULOGUN ROAD	Proposed	Box Culvert	2 Cv (4 x 1.5)	Dar	20	234	60840	29.25	45513	171,200		Concrete	4	1	8	1630	7824	78240	2200.5	528,120	88.02	136,959	665,079	743,000
		53J-R2	214	Agrifamily Estate	Proposed	Box Culvert	2 Cv (4.5 x 1.5)	Dar	10	144	37440	18	28008	105,600		Concrete	6	1	10	747	4780.8	47808	1232.6	295,812	49.30	76,714	372,526	420,000
		53J-R3	Size Change													Concrete	6	1	10	210	1344	13440	346.5	83,160	13.86	21,566	104,726	118,000
53M	ON7 Upper Ona East	53M-R1	212	Oke funfun 2, Oke funfun Road	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	4	1	8	255	1224	12240	344.3	82,620	13.77	21,426	104,046	116,000
		53M-R2	211	Arulogun, Arulogun road	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	20	115	29900	14.375	22367.5	84,800		Concrete	6	1	10	330	2112	21120	544.5	130,680	21.78	33,890	164,570	186,000
		53M-R3	Size Change													Concrete	6	1	10	1644	10521.6	105216	2712.6	651,024	108.50	168,832	819,856	925,000
54	ON7 Upper Ona East	54-R1	222	Aiku, Aiku road	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	20	104	27040	13	20228	76,800		Concrete	3	1	7	293	1172	11720	351.6	84,384	14.06	21,884	106,268	118,000
		54-R2	Size Change													Concrete	3	1	7	1507	6028	60280	1808.4	434,016	72.34	112,555	546,571	607,000
		54-R3	220	Bagadaje-Baale, Odo Apon, Ogo oluwa	Proposed	Box Culvert	2 Cv (5 x 2)	Dar	10	178	46280	22.25	34621	129,600		Concrete	10	1.5	16	450	7020	70200	1147.5	275,400	45.90	71,420	346,820	417,000
		54-R4	Size Change													Concrete	10	1.5	16	390	6084	60840	994.5	238,680	39.78	61,898	300,578	361,000
54D	ON7 Upper Ona East	54D-R1	221	Orieni, Orieni road	Proposed	Box Culvert	1 Cv (4.5 x 1.5)	Dar	20							Concrete	3	1	7	855	3420	34200	1026.0	246,240	41.04	63,858	310,098	344,000
		54D-R2	Size Change													Concrete	3	1	7	180	720	7200	216.0	51,840	8.64	13,444	65,284	72,000
55	ON7 Upper Ona East	55-R1	204	Ajoda (Peace avenue), Ajoda	Proposed	Bridge	Br (45 x 10)	Dar	10						1,125,000	Concrete Sides	30	3	42	309	26697.6	266976	1019.7	244,728	40.79	63,466	308,194	575,000
		55-R2	203	Aroro Makinde, Makinde	Proposed	Bridge	Br (45 x 10)	Dar	10						1,125,000	Concrete Sides	30	3	42	355	30672	306720	1171.5	281,160	46.86	72,914	354,074	661,000
		55-R3	37D	AKINRINOLA, EWE INA, DIVINE FAVOUR WITH ARORO MAKINDE, ARULOGUN AREA TO IBADAN-ILORIN EXPRESSROAD AT IDI-OSE.	Proposed	Bridge	Br (45 x 10)	Dar	10						1,125,000	Concrete Sides	30	3	42	25	2160	21600	82.5	19,800	3.30	5,135	24,935	47,000
		55-R4	Size Change													Concrete Sides	30	3	42	713	61603.2	616032	2352.9	564,696	94.12	146,444	711,140	1,327,000
		55-R5	47D	AKINRINOLA COMMUNITY DEVELOPMENT ASSOCIATION OFF IDI-OSE OYO ROAD AKINYELE LGA	Proposed	Bridge	Br (45 x 10)	Dar	10						1,125,000	Concrete Sides	32	3	44	210	19152	191520	693.0	166,320	27.72	43,132	209,452	401,000
		55-R6	205	Akinrinola Village, Odo Ona, Akinrinola	Proposed	Bridge	Br (45 x 10)	Dar	10						1,125,000	Concrete Sides	32	3	44	116	10579.2	105792	382.8	91,872	15.31	23,825	115,697	221,000
		55-R7	Size Change													Concrete Sides	32	3	44	1494	136252.8	1362528	4930.2	1,183,248	197.21	306,856	1,490,104	2,853,000
55B	ON7 Upper Ona East	55B-R1	200	Apapa, Akuro-Apapa road	Existing											Concrete	4	1.5	10	284	2385.6	23856	468.6	112,464	18.74	29,166	141,630	165,000
		55B-R2	201	Apapa	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	6	1.5	12	231	2494.8	24948	450.5	108,108	18.02	28,036	136,144	161,000
		55B-R3	85D1	DAUDA ZONE COMMUNITY, BAGADAJE/OLOBI AREA. ARORO MAKINDE MONIYA ROAD	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	6	1.5	12	593	6404.4	64044	1156.4	277,524	46.25	71,971	349,495	414,000
		55B-R4	202	Bagadaje	Proposed	Box Culvert	1 Cv (3 x 2)	Dar	10	70	18200	8.75	13615	51,200		Concrete	6	1.5	12	518	5594.4	55944	1010.1	242,424	40.40	62,869	305,293	361,000
		55B-R5	Size Change													Concrete	6	1.5	12	126	1360.8	13608	245.7	58,968	9.83	15,292	74,260	88,000
55F	ON7 Upper Ona East	55F-R1	206		Proposed	Box Culvert	1 Cv (2.5 x 1.5)	Dar	10	52	13520	6.5	10114	38,400		Concrete	3	1	7	21	84	840	25.2	6,048	1.01	1,568	7,616	8,000
		55F-R2	Size Change													Concrete	3	1	7	181	724	7240	217.2	52,128	8.69	13,519	65,647	73,000
56	ON8 Upper Ona South	56-R1	210	Model City	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	3	1	7	396	1584	15840	475.2	114,048	19.01	29,576	143,624	159,000
		56-R2	209	Model City	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	4	1	8	253	1214.4	12144	341.6	81,972	13.66	21,258	103,230	115,000
		56-R3	560	Holiness Estate, Higher ground Road	Proposed	Box Culvert	1 Cv (5 x 2)	Dar	10	98	25480	12.25	19061	72,000		Concrete	4	1.5	10	675	5670	56700	1113.8	267,300	44.55	69,320	336,620	393,000
		56-R4	561	Omilabu, Omilabu-Olorunda Road	Proposed	Box Culvert	1 Cv (5 x 2)	Dar	10	98	25480	12.25	19061	72,000		Concrete	5.5	1.5	11.5	291	2968.2	29682	567.5	136,188	22.70	35,318	171,506	201,000
		56-R5	Size Change													Concrete	5.5	1.5	11.5	161	1642.2	16422	314.0	75,348	12.56	19,540	94,888	111,000
		56-R6	Size Change													Concrete	10	1.5	16	800	12480	124800	2040.0	489,600	81.60	126,970	616,570	741,000
		56-R7	1582	Ojoo, Alapata Street	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	10	230	59800	28.75	44735	168,000		Concrete	12	2	20	309	7910.4	79104	973.4	233,604	38.93	60,581	294,185	373,000
		56-R8	123A	ARULOGUN ROAD,	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	20	388	100880	48.5	75466	283,200		Concrete	12	2	20	563	14412.8	144128	1773.5	425,628	70.94	110,380	536,008	680,000
		56-R9	124A	ARORO , MAKINDE,	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	10	230	59800	28.75	44735	168,000		Concrete	12	2	20	502	12851.2	128512	1581.3	379,512	63.25	98,420	477,932	606,000
		56-R10	Size Change													Concrete	12	2	20	950	24320	243200	2992.5	718,200	119.70	186,253	904,453	1,148,000
56B	ON8 Upper Ona South	56B-R1	Size Change													Concrete	3	1	7	213	852	8520	255.6	61,344	10.22	15,909	77,253	86,000
56E	ON8 Upper Ona South	56E-R1	Size Change													Concrete	3	1	7	698	2792	27920	837.6	201,024	33.50	52,132	253,156	281,000
56H	ON8 Upper Ona South	56H-R1	555	Abutu	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	3	1.5	9	1832	13190.4	131904	2748.0	659,520	109.92	171,036	830,556	962,000
		56H-R2	Size Change													Concrete	3	1.5	9	224	1612.8	16128	336.0	80,640	13.44	20,913	101,553	118,000
56K	ON8 Upper Ona South	56K-R1	122A	ADELOLA ESTATE , ARULOGUN	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	4	1	8	116	556.8	5568	156.6	37,584	6.26	9,747	47,331	53,000
		56K-R2	536	Alapata, Alaafia road	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	6	1	10	784	5017.6	50176	1293.6	310,464	51.74	80,514	390,978	441,000
		56K-R3	537	Arulogun	Proposed	Box Culvert	1 Cv (4.5 x 1.5)	Dar	10	78	20280	9.75	15171	57,600		Concrete	6	1	10	263	1683.2	16832	434.0	104,148	17.36	27,009	131,157	148,000
		56K-R4	Size Change													Concrete	6	1	10	153	979.2	9792	252.5	60,588	10.10	15,712	76,300	86,000
58	ON8 Upper Ona South	58-R1	511	Akingbile, New Road	Proposed	Bridge	Br (55 x 10)	Dar	10						1,375,000	Concrete Sides	43	3	55	1501	176517.6	1765176	4953.3	1,188,792	198.13	308,293	1,497,085	3,262,000
		58-R2	Size Change													Concrete Sides	43	3	55	75	8820	88200	247.5	59,400	9.90	15,404	74,804	163,000
		58-R3	126A	Akingbile, New Road	Existing											Concrete Sides	40	3	52	20	2208	22080	66.0	15,840	2.64	4,108	19,948	42,000
		58-R4	127	IITA IDI DSE,	Proposed	Bridge	Br (55 x 20)	Dar	20						2,750,000	Concrete Sides	40	3	52	287	31684.8	316848	947.1	227,304	37.88	58,948	286,252	603,000
		58-R5	Size Change													Concrete Sides	40	3	52	1219	134577.6	1345776	4022.7	965,448	160.91	250,373	1,215,821	2,562,000
		58-R6	Size Change													Concrete Sides	40	3	52	798	88099.2	880992	2633.4	632,016	105.34	163,903	795,919	1,677,000
57	ON8 Upper Ona South	57-R1	551	Barack, Off Range road before cemetery	Proposed	Box Culvert	1 Cv (4.5 x 1.5)	Dar	10	78	20280	9.75	15171	57,600		Concrete	4.5	1	8.5	749	3894.8	38948	1011.2	242,676	40.45	62,934	305,610	345,000
		57-R2	550	Barack, KTJ Minimah	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	555	4662	46620	915.8	219,780	36.63	56,996	276,776	323,000
		57-R3	549	Barack, Range Road	Proposed	Box Culvert	1 Cv (5 x 2)	Dar	10	98	25480	12.25	19061	72,000		Concrete	5	1.5	11	778	7468.8	74688	1400.4	336,096	56.02	87,161	423,257	498,000
		57-R4	Size Change													Concrete	5	1.5	11	459	4406.4	44064	826.2	198,288	33.05	51,423	249,711	294,000
		57-R5	578	Ojoo, Jerusalem Cv., Arulogun/jerusalem junction	Proposed	Box Culvert	2 Cv (6 x 2)	Dar								Concrete	8	1.5	14	174	2296.8	22968	391.5	93,960	15.66	24,367	118,327	141,000
		57-R6	547	Ilupeju Community, Off Arulogun Road	Proposed	Box Culvert	2 Cv (4 x 2)	Dar	10	150	39000	18.75	29175	110,400		Concrete	8	1.5	14	193	2547.6	25476	434.3	104,220	17.37	27,028	131,248	157,000
		57-R7	546	Ilupeju Community, Off Arulogun Road	Proposed	Box Culvert	2 Cv (4 x 2)	Dar	10	150	39000	18.75	29175	110,400		Concrete	8	1.5	14	38	501.6	5016	85.5	20,520	3.42	5,322	25,842	31,000
		57-R8	545	Goodness Estate Ojoo, Jerusalem	Proposed	Box Culvert	2 Cv (4 x 2)	Dar	10	150	39000	18.75	29175	110,400		Concrete	8	1.5	14	244	3220.8	32208	549.0	131,760	21.96	34,170	165,930	198,000
		57-R9	544	Aba Eko Ojoo, L.A. Adisa-Aba eko road	Proposed	Box Culvert	2 Cv (4 x 2)	Dar	10	150	39000	18.75	29175	110,400		Concrete	8	1.5	14	347	4580.4	45804	780.8	187,380	31.23	48,594	235,974	282,000
		57-R10	Size Change													Concrete	8	1.5	14	484	6388.8	63888	1089.0	261,360	43.56	67,779	329,139	393,000

Structure Data										Structure Cost						Channel Data					Channel Cost							
Channel ID	Subbasin	Reach ID	Structure No.	Location	Structure Status	Proposed Crossing Structure Type	Proposed Crossing Structure Dimensions	Designed by	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)	Lining Protection	Bed Width (m)	Design Depth (m)	Top Width (m)	Reach Length (m)	Excavation Volume (m3)	Cost of Excavation US$	Concrete Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Total Lining Cost (USD)	Total Cost of Channel US$
70	ON9 Orogun	70-R1	567	Barack, Adekunle Fajuyi Central Mosque road	Existing											Concrete	3.5	1.5	9.5	850	6630	66300	1402.5	336,600	56.10	87,292	423,892	490,000
		70-R2	Size Change													Concrete	3.5	1.5	9.5	575	4485	44850	948.8	227,700	37.95	59,050	286,750	332,000
		70-R3	565	Barack, Commandant house road, Commandant house road	Proposed	Box Culvert	2 Cv (4 x 2)	Dar	30							Concrete	6	2	14	529								
		70-R4	678	Agbowo Express, Irepodun, Irepodun Street	Proposed	Box Culvert	2 Cv (6 x 2)	Dar	12							Concrete	6	2	14	434								
		70-R5	677	Irepodun Ojo road, Police Station, Police Station road	Proposed	Box Culvert	2 Cv (6 x 2)	Dar	65							Concrete	12	2	20	139								
		70-R6	634	Agbowo, Orogun River, Oriolowo street Junction	Proposed	Box Culvert	3 Cv (5 x 2)	Dar	13							Concrete	12	2	20	469								
		70-R7	633	Agbowo, Orogun Bridge Agbowo, Aba Apata Kekere street	Proposed	Box Culvert	3 Cv (6 x 2)	Dar	12							Concrete	15	2	23	425								
		70-R8	122B	OROGUN,	Proposed	Box Culvert	5 Cv (6 x 2)	Dar	28							Concrete Sides	32	2	40	824								
		70-R9	Size Change																	1221								
70J	ON9 Orogun	70J-R1	553	Barack, Command day secondary school road	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	20	104	27040	13	20228	76,800		Concrete	3	1	7	19	76	760	22.8	5,472	0.91	1,419	6,891	8,000
		70J-R2	Size Change													Concrete	3	1	7	1821	7284	72840	2185.2	524,448	87.41	136,007	660,455	733,000
70P	ON9 Orogun	70P-R1	552	Orogun Express	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16900	8.125	12642.5	48,000		Concrete	3.5	1	7.5	330	1452	14520	396.0	95,040	15.84	24,647	119,687	134,000
		70P-R2	681	Kajorepo Ojo, Kajorepo Secondary school road	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16900	8.125	12642.5	48,000		Concrete	3.5	1	7.5	338	1487.2	14872	405.6	97,344	16.22	25,245	122,589	137,000
		70P-R3	680	Kajola, Temidire Street	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	4	1	8	131	628.8	6288	176.9	42,444	7.07	11,007	53,451	60,000
		70P-R4	679	Kajola, Iwo road	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	40	264	68640	33	51348	192,000		Concrete	4	1.5	10	214	1797.6	17976	353.1	84,744	14.12	21,977	106,721	125,000
		70P-R5	1548	Agbowo, Fijabi Bus Stop	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	290	2436	24360	478.5	114,840	19.14	29,782	144,622	169,000
		70P-R6	Size Change													Concrete	4	1.5	10	126	1058.4	10584	207.9	49,896	8.32	12,940	62,836	73,000
70Q	ON9 Orogun	70Q-R1	636	Farayola Bodija, Farayola Street	Existing											Concrete	3	1	7	159	636	6360	190.8	45,792	7.63	11,875	57,667	64,000
		70Q-R2	128	MAJEOBAJE AGBOWO	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3	1	7	243	972	9720	291.6	69,984	11.66	18,149	88,133	98,000
		70Q-R3	125B	OMOTARA , AGBOWO	Proposed	Box Culvert	1 Cv (4.5 x 1.5)	Dar	10	78	20280	9.75	15171	57,600		Concrete	4.5	1	8.5	316	1643.2	16432	426.6	102,384	17.06	26,552	128,936	145,000
		70Q-R4	668	Agbowo, Adewumi Street	Proposed	Box Culvert	1 Cv (4.5 x 1.5)	Dar	10	78	20280	9.75	15171	57,600		Concrete	4.5	1	8.5	75	390	3900	101.3	24,300	4.05	6,302	30,602	35,000
		70Q-R5	1547	Agbowo, Adewunmi Street	Proposed	Box Culvert	1 Cv (4.5 x 1.5)	Dar	10	78	20280	9.75	15171	57,600		Concrete	4.5	1	8.5	61	317.2	3172	82.4	19,764	3.29	5,125	24,889	28,000
		70Q-R6	667	Agbowo, Adeoye Off Carpenter Street	Existing											Concrete	4	1.5	10	415	3486	34860	684.8	164,340	27.39	42,619	206,959	242,000
		70Q-R7	126B	Agbowo-Barika, Adegbite Estate/Majeroku street	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	345	2898	28980	569.3	136,620	22.77	35,430	172,050	201,000
		70Q-R8	Size Change													Concrete	4	1.5	10	212	1780.8	17808	349.8	83,952	13.99	21,772	105,724	124,000
69	ON10 Middle Ona North	69-R1	490	University of Ibadan, Ajibode Road	Existing											Concrete Sides	43	3	55	2555	300468	3004680	8431.5	2,023,560	337.26	524,777	2,548,337	5,553,000
		69-R2	Size Change													Concrete Sides	43	3	55	21	2469.6	24696	69.3	16,632	2.77	4,313	20,945	46,000
69C	ON10 Middle Ona North	69C-R1	502	University of Ibadan, Ajibode Road	Existing											Concrete	3	1.5	9	276	1987.2	19872	414.0	99,360	16.56	25,767	125,127	145,000
		69C-R2	Size Change													Concrete	3	1.5	9	163	1173.6	11736	244.5	58,680	9.78	15,218	73,898	86,000
71	ON10 Middle Ona North	71-R1	489	University of Ibadan, Ajibode Road	Existing											Concrete Sides	43	3	55	287	33751.2	337512	947.1	227,304	37.88	58,948	286,252	624,000
		71-R2	628	Ajibode, Aho River, Odo Ona way	Proposed	Bridge	Br (55 x 10)	Dar	10						1,375,000	Concrete Sides	43	3	55	665	78204	782040	2194.5	526,680	87.78	136,586	663,266	1,445,000
		71-R3	Size Change													Concrete Sides	66	3	78	1954	337651.2	3376512	6448.2	1,547,568	257.93	401,336	1,948,904	5,325,000
71C	ON10 Middle Ona North	71C-R1	481	Laniba	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16900	8.125	12642.5	48,000		Concrete	3.5	1	7.5	72	316.8	3168	86.4	20,736	3.46	5,378	26,114	29,000
		71C-R2	482	Ajibode, Ajibode Road	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16900	8.125	12642.5	48,000		Concrete	3.5	1	7.5	218	959.2	9592	261.6	62,784	10.46	16,282	79,066	89,000
		71C-R3	484	Area 3	Proposed	Box Culvert	1 Cv (5 x 2)	Dar	10	98	25480	12.25	19061	72,000		Concrete	5	1.5	11	1776	17049.6	170496	3196.8	767,232	127.87	198,969	966,201	1,137,000
		71C-R4	485	Ajibode (Lakoto), Lakoto Apete Road	Proposed	Box Culvert	1 Cv (5.5 x 2)	Dar	20	180	46800	22.5	35010	131,200		Concrete	5.5	1.5	11.5	300	3060	30600	585.0	140,400	23.40	36,410	176,810	207,000
		71C-R5	486	Ajibode, Ajibode Road	Proposed	Box Culvert	1 Cv (5.5 x 2)	Dar	10	105	27300	13.125	20422.5	76,800		Concrete	5.5	1.5	11.5	350	3570	35700	682.5	163,800	27.30	42,479	206,279	242,000
		71C-R6	Size Change													Concrete	5.5	1.5	11.5	281	2866.2	28662	548.0	131,508	21.92	34,104	165,612	194,000
72	ON10 Middle Ona North	72-R1	475	Balogun, Balogun Road	Proposed	Box Culvert	2 Cv (4.5 x 1.5)	Dar	10	144	37440	18	28008	105,600		Concrete	9	1	13	1724	15171.2	151712	3620.4	868,896	144.82	225,334	1,094,230	1,246,000
		72-R2	Size Change													Concrete	9	1	13	540	4752	47520	1134.0	272,160	45.36	70,580	342,740	390,000
		72-R3	474	Jamade, Odo Jamade, Jamade Road	Proposed	Box Culvert	2 Cv (6 x 2)	Dar	10	206	53560	25.75	40067	150,400		Concrete	12	1.5	18	721	12978	129780	2054.9	493,164	82.19	127,894	621,058	751,000
		72-R4	487	Jamade,	Proposed	Box Culvert	2 Cv (6 x 2)	Dar	10	206	53560	25.75	40067	150,400		Concrete	12	1.5	18	323	5814	58140	920.6	220,932	36.82	57,295	278,227	336,000
		72-R5	488	Osajin, odo ola-adua,	Proposed	Box Culvert	2 Cv (6 x 2)	Dar	10	206	53560	25.75	40067	150,400		Concrete	12	1.5	18	760	13680	136800	2166.0	519,840	86.64	134,812	654,652	791,000
		72-R6	625B	Ojoo-Ajibode, Laniba Cv., Laniba	Proposed	Box Culvert	Add 4 Cv (3 x 2)	Abfort	10	226	58760	28.25	43957	164,800		Concrete	12	1.5	18	310	5580	55800	883.5	212,040	35.34	54,989	267,029	323,000
		72-R7	625	Onigbodogi, Sasa River, Ajibode Raod	Proposed	Box Culvert	2 Cv (6 x 2)	Dar	20	356	92560	44.5	69242	259,200		Concrete	12	1.5	18	163	2934	29340	464.6	111,492	18.58	28,914	140,406	170,000
		72-R8	Size Change													Concrete	12	1.5	18	72	1296	12960	205.2	49,248	8.21	12,772	62,020	75,000
		72-R9	626	Onigbodogi, Apete River, Ola Adura Road	Proposed	Box Culvert	Add 3 Cv (3 x 2)	Abfort	10	174	45240	21.75	33843	128,000		Concrete	12	2	20	250	6400	64000	787.5	189,000	31.50	49,014	238,014	302,000
		72-R10	Size Change													Concrete	12	2	20	60	1536	15360	189.0	45,360	7.56	11,763	57,123	72,000
72F	ON10 Middle Ona North	72F-R1	Size Change													Concrete	3	1	7	312	1248	12480	374.4	89,856	14.98	23,303	113,159	126,000
72H	ON10 Middle Ona North	72H-R1	468	Onikoko	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3	1	7	261	1044	10440	313.2	75,168	12.53	19,494	94,662	105,000
		72H-R2	470	Ilupeju	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3	1	7	224	896	8960	268.8	64,512	10.75	16,730	81,242	90,000
		72H-R3	Size Change													Concrete	3	1	7	233	932	9320	279.6	67,104	11.18	17,402	84,506	94,000
73	ON10 Middle Ona North	73-R1	133	Apete, Apete Birdge, Apete	Existing											Concrete Sides	80	3	92	1005	207432	2074320	3316.5	795,960	132.66	206,419	1,002,379	3,077,000
		73-R2	Size Change													Concrete Sides	80	3	92	161	33230.4	332304	531.3	127,512	21.25	33,068	160,580	493,000
73D	ON10 Middle Ona North	73D-R1	623	Oloya Apete, Jeje road	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16900	8.125	12642.5	48,000		Concrete	3.5	1	7.5	242	1064.8	10648	290.4	69,696	11.62	18,074	87,770	98,000
		73D-R2	132	APETE , AWTAN ROAD	Proposed	Box Culvert	1 Cv (4 x 2)	Dar								Concrete	4.5	1	8.5	702	3650.4	36504	947.7	227,448	37.91	58,985	286,433	323,000
		73D-R3	599	Iyanamorubo Apete, Iyanamorubo	Proposed	Box Culvert	1 Cv (3.5 x 2)	Dar	10	77	20020	9.625	14976.5	56,000		Concrete	3.5	1.5	9.5	184	1435.2	14352	303.6	72,864	12.14	18,896	91,760	106,000
		73D-R4	Size Change													Concrete	3.5	1.5	9.5	107	834.6	8346	176.6	42,372	7.06	10,988	53,360	62,000
74	ON10 Middle Ona North	74-R1	659	Sango, Polytechnic road	Existing											Concrete	2.5	1.5	8.5	98	646.8	6468	147.0	35,280	5.88	9,149	44,429	51,000
		74-R2	676	Sango, Odugbemi Road	Proposed	Box Culvert	1 Cv (3 x 2)	Dar	10	70	18200	8.75	13615	51,200		Concrete	3	1.5	9	264	1900.8	19008	396.0	95,040	15.84	24,647	119,687	139,000
		74-R3	657	Sango, Alenuloke Street	Proposed	Box Culvert	1 Cv (3 x 2)	Dar	10	70	18200	8.75	13615	51,200		Concrete	3	1.5	9	140	1008	10080	210.0	50,400	8.40	13,070	63,470	74,000
		74-R4	1544	Eleyele, Elewure	Proposed	Box Culvert	1 Cv (3 x 2)	Dar	10	70	18200	8.75	13615	51,200		Concrete	3	1.5	9	71	511.2	5112	106.5	25,560	4.26	6,629	32,189	37,000
		74-R5	656	Sango, Idito road	Existing											Concrete	3	1.5	9	113	813.6	8136	169.5	40,680	6.78	10,550	51,230	59,000
		74-R6	647	Alaro, Alaro road	Existing											Concrete	3.5	1.5	9.5	240	1872	18720	396.0	95,040	15.84	24,647	119,687	138,000
		74-R7	137	Sango-Eleyele road, Eleyele road,Ijokodo	Proposed	Bridge	Br (10m)	Pheman								Concrete	5.5	1.5	11.5	440	4488	44880	858.0	205,920	34.32	53,402	259,322	304,000
		74-R8	651	Polytechnic Ibadan, Ijokodo Estate Road, Ibadan Poly	Proposed	Box Culvert	1 Cv (6 x 2)	Dar	10	112	29120	14	21784	81,600		Concrete	6	1.5	12	804	8683.2	86832	1567.8	376,272	62.71	97,580	473,852	561,000
		74-R9	Size Change													Concrete	6	1.5	12	230	2484	24840	448.5	107,640	17.94	27,915	135,555	160,000

Structure Data										Structure Cost						Channel Data					Channel Cost							
Channel ID	Subbasin	Reach ID	Structure No.	Location	Structure Status	Proposed Crossing Structure Type	Proposed Crossing Structure Dimensions	Designed by	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)	Lining Protection	Bed Width (m)	Design Depth (m)	Top Width (m)	Reach Length (m)	Excavation Volume (m3)	Cost of Excavation US$	Concrete Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Total Lining Cost (USD)	Total Cost of Channel US$
74N	ON10 Middle Ona North	74N-R1	654	UI, Zik Road	Proposed	Box Culvert	1 Cv (3 x 2)	Dar	10	70	18200	8.75	13615	51,200		Concrete	3	1.5	9	173	1245.6	12456	259.5	62,280	10.38	16,151	78,431	91,000
		74N-R2	1545	UI, Zoo	Existing											Concrete	3	1.5	9	469	3376.8	33768	703.5	168,840	28.14	43,786	212,626	246,000
		74N-R3	1546	UI, Zoo	Existing											Concrete	3	1.5	9	55	396	3960	82.5	19,800	3.30	5,135	24,935	29,000
		74N-R4	653	UI, Tech Road	Existing											Concrete	3	1.5	9	1059	7624.8	76248	1588.5	381,240	63.54	98,868	480,108	556,000
		74N-R5	652	Polytechnic Ibadan, Bookshop Road	Proposed	Box Culvert	1 Cv (5.5 x 2)	Dar	10	105	27300	13.125	20422.5	76,800		Concrete	5.5	1.5	11.5	534	5446.8	54468	1041.3	249,912	41.65	64,811	314,723	369,000
		74N-R6	135	IJOKODO , APETE ROAD	Proposed	Box Culvert	Add 1 Cv (4 x 2)	Others	20	144	37440	18	28008	105,600		Concrete	5.5	1.5	11.5	245	2499	24990	477.8	114,660	19.11	29,735	144,395	169,000
		74N-R7	Size Change													Concrete	5.5	1.5	11.5	534	5446.8	54468	1041.3	249,912	41.65	64,811	314,723	369,000
75E	ON10 Middle Ona North	75E-R1	611	Alakuta Idimango, Alakuta/Papa Ajisafe road	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16900	8.125	12642.5	48,000		Concrete	3.5	1	7.5	355	1562	15620	426.0	102,240	17.04	26,514	128,754	144,000
		75E-R2	Size Change													Concrete	3.5	1	7.5	45	198	1980	54.0	12,960	2.16	3,361	16,321	18,000
79	ON11 Alapata South	79-R1	458	Peace Estate, Peace Estate	Proposed	Bridge	Br (30 x 10)	Dar	10						750,000	Concrete	18	2	26	413	14537.6	145376	1672.7	401,436	66.91	104,106	505,542	651,000
		79-R2	459	Peace Estate, Peace Estate	Proposed	Bridge	Br (30 x 10)	Dar	10						750,000	Concrete	18	2	26	166	5843.2	58432	672.3	161,352	26.89	41,844	203,196	262,000
		79-R3	460	Alapata, Alapa	Proposed	Bridge	Br (30 x 10)	Dar	10						750,000	Concrete	18	2	26	225	7920	79200	911.3	218,700	36.45	56,716	275,416	355,000
		79-R4	476	Akowo Idi Osan, Odo Oteru, Akowo	Proposed	Bridge	Br (30 x 10)	Dar	10						750,000	Concrete	18	2	26	848	29849.6	298496	3434.4	824,256	137.38	213,757	1,038,013	1,337,000
		79-R5	1507	Akowojo -Ijokodo, Akowojo, Lane H	Proposed	Bridge	Br (30 x 10)	Dar	10						750,000	Concrete	18	2	26	321	11299.2	112992	1300.1	312,012	52.00	80,915	392,927	506,000
		79-R6	472	Akowo Idi Osan, Odo Oteru, Akowo Idi Osan	Proposed	Bridge	Br (30 x 10)	Dar	10						750,000	Concrete	18	2	26	251	8835.2	88352	1016.6	243,972	40.66	63,270	307,242	396,000
		79-R7	473	Akufo, Odo Oteru, Akufo Road	Proposed	Bridge	Br (30 x 10)	Dar	10						750,000	Concrete	18	2	26	184	6476.8	64768	745.2	178,848	29.81	46,381	225,229	290,000
		79-R8	Size Change													Concrete	18	2	26	191	6723.2	67232	773.6	185,652	30.94	48,146	233,798	301,000
		79-R9	594	Oke Odo Balogun Area, Oteru Stream, Akufo road	Proposed	Bridge	Br (30 x 10)	Dar	10						750,000	Concrete	22	2	30	380	15808	158080	1767.0	424,080	70.68	109,978	534,058	692,000
		79-R10	Size Change													Concrete	22	2	30	264	10982.4	109824	1227.6	294,624	49.10	76,406	371,030	481,000
		79-R11	598	Adeosun, Oteru Stream, Unity road	Proposed	Bridge	Br (35 x 10)	Dar	10						875,000	Concrete	22	2.5	32	687	37098	370980	3503.7	840,888	140.15	218,070	1,058,958	1,430,000
		79-R12	Size Change													Concrete	45	2.5	55	531	53100	531000	4540.1	1,089,612	181.60	282,573	1,372,185	1,903,000
79B	ON11 Alapata South	79B-R1	Size Change													Concrete	3.5	1	7.5	1535	6754	67540	1842.0	442,080	73.68	114,646	556,726	624,000
79D	ON11 Alapata South	79D-R1	461	Alapata, Akufo Road	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	20	104	27040	13	20228	76,800		Concrete	3	1	7	515	2060	20600	618.0	148,320	24.72	38,464	186,784	207,000
		79D-R2	Size Change													Concrete	3	1	7	219	876	8760	262.8	63,072	10.51	16,357	79,429	88,000
79G	ON11 Alapata South	79G-R1	604	Alatare Zone C, Olonde Estate road	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	4	1	8	367	1761.6	17616	495.5	118,908	19.82	30,837	149,745	167,000
		79G-R2	Size Change													Concrete	4	1	8	2032	9753.6	97536	2743.2	658,368	109.73	170,737	829,105	927,000
79L	ON11 Alapata South	79L-R1	463	Adaba Co-operative	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3	1	7	83	332	3320	99.6	23,904	3.98	6,199	30,103	33,000
		79L-R2	1539	Happy people Community, Road 11	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3	1	7	238	952	9520	285.6	68,544	11.42	17,776	86,320	96,000
		79L-R3	609	Jeje Powerline, Unity Quarters Street	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16900	8.125	12642.5	48,000		Concrete	3.5	1	7.5	287	1262.8	12628	344.4	82,656	13.78	21,435	104,091	117,000
		79L-R4	130	LIFEORTR ROAD	Proposed	Box Culvert	1 Cv (3.5 x 2)	Dar	20	132	34320	16.5	25674	96,000		Concrete	3.5	1.5	9.5	788	6146.4	61464	1300.2	312,048	52.01	80,924	392,972	454,000
		79L-R5	131	LIFE FORTE	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	500	4200	42000	825.0	198,000	33.00	51,348	249,348	291,000
		79L-R6	Size Change													Concrete	4	1.5	10	483	4057.2	40572	797.0	191,268	31.88	49,602	240,870	281,000
79M	ON11 Alapata South	79M-R1	Size Change													Concrete	4	1	8	1206	5788.8	57888	1628.1	390,744	65.12	101,333	492,077	550,000
81	ON12 Middle Ona West	81-R1	593	Harmony Gold Estate Olounde, Lorikem College	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	4	1	8	506	2428.8	24288	683.1	163,944	27.32	42,516	206,460	231,000
		81-R2	592	Aba Agbopa Ologuneru, Ogunremi Road	Proposed	Box Culvert	1 Cv (3.5 x 2)	Dar	10	77	20020	9.625	14976.5	56,000		Concrete	4	1	8	388	1862.4	18624	523.8	125,712	20.95	32,601	158,313	177,000
		81-R3	591	Ogunremi, Ogunremi Road	Proposed	Box Culvert	1 Cv (3.5 x 2)	Dar	10	77	20020	9.625	14976.5	56,000		Concrete	4.5	1	8.5	297	1544.4	15444	401.0	96,228	16.04	24,955	121,183	137,000
		81-R4	Size Change													Concrete	4.5	1	8.5	665	3458	34580	897.8	215,460	35.91	55,876	271,336	306,000
		81-R5	579	Alafara, Zone 2 Ayedade	Proposed	Box Culvert	2 Cv (4 x 2)	Dar	10	150	39000	18.75	29175	110,400		Concrete	8	1.5	14	980	12936	129360	2205.0	529,200	88.20	137,239	666,439	796,000
		81-R6	Size Change													Concrete	8	1.5	14	69	910.8	9108	155.3	37,260	6.21	9,663	46,923	56,000
		81-R7	580	Alafara, Alafara, Elenusonso Ido Road	Proposed	Box Culvert	2 Cv (5 x 2)	Dar	10	178	46280	22.25	34621	129,600		Concrete	10	1.5	16	519	8096.4	80964	1323.5	317,628	52.94	82,372	400,000	481,000
		81-R8	581	Alafara, Alafara, Off Elenusonso road	Proposed	Box Culvert	2 Cv (5 x 2)	Dar	10	178	46280	22.25	34621	129,600		Concrete	10	1.5	16	388	6052.8	60528	989.4	237,456	39.58	61,580	299,036	360,000
		81-R9	Size Change													Concrete	10	1.5	16	543	8470.8	84708	1384.7	332,316	55.39	86,181	418,497	503,000
		81-R10	621	Abela near Shallom Christian College, Abela Stream, Agbofi Eti road	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	10	230	59800	28.75	44735	168,000		Concrete	12	2	20	483	12364.8	123648	1521.5	365,148	60.86	94,695	459,843	583,000
		81-R11	741	Aba Asa- Iddo, Allahu Lateef, Aba Asa / Allahu Lateef road	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	10	230	59800	28.75	44735	168,000		Concrete	12	2	20	979	25062.4	250624	3083.9	740,124	123.35	191,939	932,063	1,183,000
		81-R12	742	Ifelodun Community, Odo Ona, Road 12	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	10	230	59800	28.75	44735	168,000		Concrete	12	2	20	261	6681.6	66816	822.2	197,316	32.89	51,171	248,487	315,000
		81-R13	743	Lasokun Araromi, Bokusoro, Lasokun Araromi	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	10	230	59800	28.75	44735	168,000		Concrete	12	2	20	1050	26880	268800	3307.5	793,800	132.30	205,859	999,659	1,268,000
		81-R14	1	LASOKUN OLUBODE , OFF GBEKUBA,	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	10	230	59800	28.75	44735	168,000		Concrete	12	2	20	415	10624	106240	1307.3	313,740	52.29	81,363	395,103	501,000
		81-R15	744	Lasokun Gbakuba Apata, Ile omo olugbade, Ile omo olugbade street	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	10	230	59800	28.75	44735	168,000		Concrete	12	2	20	223	5708.8	57088	702.5	168,588	28.10	43,720	212,308	269,000
		81-R16	2	OLUGBODE ESTATE , ALAFARA STREAM,	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	10	230	59800	28.75	44735	168,000		Concrete	12	2	20	206	5273.6	52736	648.9	155,736	25.96	40,388	196,124	249,000
		81-R17	Size Change													Concrete	12	2	20	108	2764.8	27648	340.2	81,648	13.61	21,174	102,822	130,000
81F	ON12 Middle Ona West	81F-R1	1541	Ifesowapo Area	Proposed	Box Culvert	1 Cv (3.5 x 2)	Dar	10	77	20020	9.625	14976.5	56,000		Concrete	3	1	7	524	2096	20960	628.8	150,912	25.15	39,137	190,049	211,000
		81F-R2	Size Change													Concrete	3	1	7	236	944	9440	283.2	67,968	11.33	17,626	85,594	95,000
81J	ON12 Middle Ona West	81J-R1	584	Itesiwaju estate-Ologuneru	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	4	1	8	114	547.2	5472	153.9	36,936	6.16	9,579	46,515	52,000
		81J-R2	583	Itesiwaju estate-Ologuneru, Alagutan road	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	4	1	8	198	950.4	9504	267.3	64,152	10.69	16,637	80,789	90,000
		81J-R3	Size Change													Concrete	4	1	8	428	2054.4	20544	577.8	138,672	23.11	35,962	174,634	195,000
82	ON12 Middle Ona West	82-R1	1117	Apata, All saint college road	Proposed	Box Culvert	1 Cv (5.5 x 2)	Dar	10	105	27300	13.125	20422.5	76,800		Concrete	3	1	7	2001	8004	80040	2401.2	576,288	96.05	149,451	725,739	806,000
		82-R2	Size Change													Concrete	3	1	7	552	2208	22080	662.4	158,976	26.50	41,228	200,204	222,000
		82-R3	1060	Apata, Behind NNPC, Behind NNPC	Proposed	Box Culvert	2 Cv (4.5 x 2)	Dar	10	164	42640	20.5	31898	120,000		Concrete	9	1.5	15	579	8337.6	83376	1389.6	333,504	55.58	86,489	419,993	503,000
		82-R4	1061	Apata, Ekun odebe, Ekun odebe	Proposed	Box Culvert	2 Cv (5.5 x 2)	Dar	10	192	49920	24	37344	140,800		Concrete	11	1.5	17	483	8114.4	81144	1304.1	312,984	52.16	81,167	394,151	475,000
		82-R5	Size Change													Concrete	11	1.5	17	433	7274.4	72744	1169.1	280,584	46.76	72,765	353,349	426,000
		82-R6	6	OLADELE NEW TOWN , GBEKUBA,	Proposed	Box Culvert	2 Cv (6 x 2)	Dar	10	206	53560	25.75	40067	150,400		Concrete	12	1.5	18	230	4140	41400	655.5	157,320	26.22	40,798	198,118	240,000
		82-R7	5	OLADELE NEW TOWN , GBEKUBA,	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	10	230	59800	28.75	44735	168,000		Concrete	12	2	20	285	7296	72960	897.8	215,460	35.91	55,876	271,336	344,000
		82-R8	4	OLADELE NEW IOWN , GBEKUBA APATA,	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	10	230	59800	28.75	44735	168,000		Concrete	12	2	20	309	7910.4	79104	973.4	233,604	38.93	60,581	294,185	373,000
		82-R9	3	ABA-ALFA GBEKUBA,	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	10	230	59800	28.75	44735	168,000		Concrete	12	2	20	460	11776	117760	1449.0	347,760	57.96	90,186	437,946	556,000
		82-R10	Size Change													Concrete	12	2	20	96	2457.6	24576	302.4	72,576	12.10	18,821	91,397	116,000
		82-R11	745	Gbekuba Apata, Bello Tade Layout, Bello Tade Layout	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	10	230	59800	28.75	44735	168,000		Concrete	12	2	20	350	8960	89600	1102.5	264,600	44.10	68,620	333,220	423,000
		82-R12	Size Change													Concrete	12	2	20	297	7603.2	76032	935.6	224,532	37.42	58,229	282,761	359,000

Structure Data										Structure Cost						Channel Data					Channel Cost							
Channel ID	Subbasin	Reach ID	Structure No.	Location	Structure Status	Proposed Crossing Structure Type	Proposed Crossing Structure Dimensions	Designed by	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)	Lining Protection	Bed Width (m)	Design Depth (m)	Top Width (m)	Reach Length (m)	Excavation Volume (m3)	Cost of Excavation US$	Concrete Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Total Lining Cost (USD)	Total Cost of Channel US$
82E	ON12 Middle Ona West	82E-R1	1572	Ilori village, Biodun Obisesan Av	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3	1	7	133	532	5320	159.6	38,304	6.38	9,934	48,238	54,000
		82E-R2	Size Change													Concrete	3	1	7	292	1168	11680	350.4	84,096	14.02	21,809	105,905	118,000
82J	ON12 Middle Ona West	82J-R1	1571	Isoka Area	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3	1	7	55	220	2200	66.0	15,840	2.64	4,108	19,948	22,000
		82J-R2	Size Change													Concrete	3	1	7	460	1840	18400	552.0	132,480	22.08	34,356	166,836	185,000
82M	ON12 Middle Ona West	82M-R1	1110 Prime	Apata, NNPC	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3.5	1.5	9.5	147	1146.6	11466	242.6	58,212	9.70	15,096	73,308	85,000
		82M-R2	1119	Apata, NNPC	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	3.5	1.5	9.5	801	6247.8	62478	1321.7	317,196	52.87	82,259	399,455	462,000
		82M-R3	1119 Prime	Apata, NNPC	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	5	1.5	11	140	1344	13440	252.0	60,480	10.08	15,684	76,164	90,000
		82M-R4	1109	Apata, NNPC	Proposed	Box Culvert	1 Cv (4.5 x 1.5)	Dar	10	78	20280	9.75	15171	57,600		Concrete	5	1.5	11	212	2035.2	20352	381.6	91,584	15.26	23,751	115,335	136,000
		82M-R5	1118	Apata Area, Temidire	Existing											Concrete	5	1.5	11	34	326.4	3264	61.2	14,688	2.45	3,809	18,497	22,000
		82M-R6	9	ADEBISI LAYOUT , OPPOSITE NNPC	Proposed	Box Culvert	1 Cv (4.5 x 1.5)	Dar	10	78	20280	9.75	15171	57,600		Concrete	5.5	1.5	11.5	151	1540.2	15402	294.5	70,668	11.78	18,327	88,995	104,000
		82M-R7	8	ADEBISI LAYOUT	Proposed	Box Culvert	1 Cv (4.5 x 1.5)	Dar	10	78	20280	9.75	15171	57,600		Concrete	5.5	1.5	11.5	171	1744.2	17442	333.5	80,028	13.34	20,754	100,782	118,000
		82M-R8	7	ISOKAN , GBEKUBA	Proposed	Box Culvert	1 Cv (4.5 x 2)	Dar	10	91	23660	11.375	17699.5	67,200		Concrete	5.5	1.5	11.5	198	2019.6	20196	386.1	92,664	15.44	24,031	116,695	137,000
		82M-R9	Size Change													Concrete	5.5	1.5	11.5	173	1764.6	17646	337.4	80,964	13.49	20,997	101,961	120,000
80	ON13 Middle Ona South	80-R1	138B	New Eleyele road, Eleyele Bridge, New Eleyele Road	Proposed	Bridge	Br (55 x 20)	Dar	20						2,750,000	Concrete Sides	40	3.5	54	703	92514.8	925148	2530.8	607,392	101.23	157,517	764,909	1,690,000
		80-R2	145A	Nihort, Ona, Nihort	Proposed	Bridge	Br (55 x 10)	Dar	10						1,375,000	Concrete Sides	40	3.5	54	2134	280834.4	2808344	7682.4	1,843,776	307.30	478,153	2,321,929	5,130,000
		80-R3	734	Lasokun-Baskol, Odubanjo, Odubanjo	Proposed	Bridge	Br (55 x 10)	Dar	10						1,375,000	Concrete Sides	40	3.5	54	1564	205822.4	2058224	5630.4	1,351,296	225.22	350,436	1,701,732	3,760,000
		80-R4	Size Change													Concrete Sides	40	3.5	54	1087	143049.2	1430492	3913.2	939,168	156.53	243,558	1,182,726	2,613,000
80A	ON13 Middle Ona South	80A-R1	619	Oba Ado, Oba Ado / Idiosan road	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16900	8.125	12642.5	48,000		Concrete	3.5	1	7.5	161	708.4	7084	193.2	46,368	7.73	12,025	58,393	65,000
		80A-R2	Size Change													Concrete	3.5	1	7.5	129	567.6	5676	154.8	37,152	6.19	9,635	46,787	52,000
80B	ON13 Middle Ona South	80B-R1	601	Benjamin Eleyele, Adeleke Street	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	645	5418	54180	1064.3	255,420	42.57	66,239	321,659	376,000
		80B-R2	595	Babalegba Eleyele, Sango-Eleyele road	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	20	144	37440	18	28008	105,600		Concrete	4	1.5	10	227	1906.8	19068	374.6	89,892	14.98	23,312	113,204	132,000
		80B-R3	Size Change													Concrete	4	1.5	10	236	1982.4	19824	389.4	93,456	15.58	24,236	117,692	138,000
80B-3	ON13 Middle Ona South	80B-3-R1	602	Eleyele, Ladeti Street	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3	1	7	4	16	160	4.8	1,152	0.19	299	1,451	2,000
		80B-3-R2	Size Change													Concrete	3	1	7	379	1516	15160	454.8	109,152	18.19	28,307	137,459	153,000
80K	ON13 Middle Ona South	80K-R1	1543	Elenusonso Iletuntun, Elufisayo Rd	Proposed	Box Culvert	1 Cv (4.5 x 1.5)	Dar	10	78	20280	9.75	15171	57,600		Concrete	4.5	1	8.5	507	2636.4	26364	684.5	164,268	27.38	42,600	206,868	233,000
		80K-R2	624	Ologuneru, Off Nihort / Elenusonso road Behind Olu Ojelabi close	Proposed	Box Culvert	1 Cv (4.5 x 1.5)	Dar	10	78	20280	9.75	15171	57,600		Concrete	4.5	1	8.5	238	1237.6	12376	321.3	77,112	12.85	19,998	97,110	109,000
		80K-R3	Size Change													Concrete	4.5	1	8.5	716	3723.2	37232	966.6	231,984	38.66	60,161	292,145	329,000
80L	ON13 Middle Ona South	80L-R1	749	Eleyele, Police Barack	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16900	8.125	12642.5	48,000		Concrete	3.5	1	7.5	82	360.8	3608	98.4	23,616	3.94	6,124	29,740	33,000
		80L-R2	751	NIHORT, Eleyele road	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	1331	11180.4	111804	2196.2	527,076	87.85	136,688	663,764	776,000
		80L-R3	Size Change													Concrete	4	1.5	10	1027	8626.8	86268	1694.6	406,692	67.78	105,469	512,161	598,000
80U	ON13 Middle Ona South	80U-R1	1540	Idi Isin Ajumose GRA, Ajumose GRA	Existing											Concrete	2.5	1.5	8.5	642	4237.2	42372	963.0	231,120	38.52	59,937	291,057	333,000
		80U-R2	Size Change													Concrete	2.5	1.5	8.5	163	1075.8	10758	244.5	58,680	9.78	15,218	73,898	85,000
83	ON14 Lower Ona North	83-R1	735	Peku, Railway, Railway line	Proposed	Bridge	Br (55 x 10)	Dar	10						1,375,000	Concrete Sides	40	3.5	54	480	63168	631680	1728.0	414,720	69.12	107,551	522,271	1,154,000
		83-R2	Size Change													Concrete Sides	40	3.5	54	657	86461.2	864612	2365.2	567,648	94.61	147,210	714,858	1,579,000
		83-R3	139B	ODO-ONA GADA , APATA,	Proposed	Bridge	Br (63 x 11)	Dar	11							Concrete Sides	40	3.5	54	1270									
		83-R4	Size Change													Concrete Sides	40	3.5	54	2733									
		83-R5	146B	Oluyole Extension, Beside Zion House, Owodu road	Proposed	Box Culvert	Add 4 Cv (7 x 5.1)	Dar								Concrete Sides	Var.	3.5	Var.	198									
		83-R6	Size Change													Concrete Sides	Var.	3.5	Var.	128									
		83-R7	147B	OLUYOLE ESTATE ROAD,	Proposed	Bridge	Br (48 x 13)	Dar	13							Concrete Sides	33	3.5	47	487									
		83-R8	Size Change													Concrete Sides	33	3.5	47	227									
		83-R9	816	Zartech, Ona, Zartech compound	Proposed	Bridge	Br (61 x 10)	Dar	10							Concrete Sides	40	3.5	54	690									
		83-R10	Size Change													Concrete Sides	40	3.5	54	545									
83F	ON14 Lower Ona North	83F-R1	756	Kuole by Emmanuel Baptist Church, Railway line	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	1666	13994.4	139944	2748.9	659,736	109.96	171,092	830,828	971,000
		83F-R2	757	Odo Ona Ayileka, Emmanuel Baptist Church	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	184	1545.6	15456	303.6	72,864	12.14	18,896	91,760	107,000
		83F-R3	758	Odo Ona, Adeola Street	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	218	1831.2	18312	359.7	86,328	14.39	22,388	108,716	127,000
		83F-R4	140	ODO-ONA OLUGBODE APATA	Proposed	Box Culvert	1 Cv (4.5 x 2)	Dar	10	91	23660	11.375	17699.5	67,200		Concrete	4.5	1.5	10.5	150	1350	13500	270.0	64,800	10.80	16,805	81,605	95,000
		83F-R5	Size Change													Concrete	4.5	1.5	10.5	305	2745	27450	549.0	131,760	21.96	34,170	165,930	193,000
83G	ON14 Lower Ona North	83G-R1	774	Ago Taylor, Ring road	Proposed	Box Culvert	1 Cv (2 x 2)	Dar	20	96	24960	12	18672	70,400		Concrete	2	1.5	8	61	366	3660	82.4	19,764	3.29	5,125	24,889	29,000
		83G-R2	775	Ago Taylor, Akinyemi way	Proposed	Box Culvert	1 Cv (2 x 2)	Dar	20	96	24960	12	18672	70,400		Concrete	2	1.5	8	123	738	7380	166.1	39,852	6.64	10,335	50,187	58,000
		83G-R3	776	Odo Ona, Abdullahi Street	Existing											Concrete	2	1.5	8	347	2082	20820	468.5	112,428	18.74	29,156	141,584	162,000
		83G-R4	777	Odo Ona, Off Fatimo Street	Existing											Concrete	2.5	1.5	8.5	300	1980	19800	450.0	108,000	18.00	28,008	136,008	156,000
		83G-R5	778	Oke Ayo-Odo Ona, Fatimo Street	Existing											Concrete	2.5	1.5	8.5	52	343.2	3432	78.0	18,720	3.12	4,855	23,575	27,000
		83G-R6	Size Change													Concrete	2.5	1.5	8.5	42	277.2	2772	63.0	15,120	2.52	3,921	19,041	22,000
83H	ON14 Lower Ona North	83H-R1	780	Federal college of Animal health & Production Technology	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3	1	7	256	1024	10240	307.2	73,728	12.29	19,120	92,848	103,000
		83H-R2	771	Federal college of Animal health & Production Technology, IA & RT road	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3	1	7	72	288	2880	86.4	20,736	3.46	5,378	26,114	29,000
		83H-R3	770	Federal college of Animal health & Production Technology, Main gate road	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3	1	7	129	516	5160	154.8	37,152	6.19	9,635	46,787	52,000
		83H-R4	Size Change													Concrete	3	1	7	574	2296	22960	688.8	165,312	27.55	42,871	208,183	231,000
83M	ON14 Lower Ona North	83M-R1	154	OLUAWO ROAD	Proposed	Box Culvert	1 Cv (3.5 x 2)	Dar	10	77	20020	9.625	14976.5	56,000		Concrete	3.5	1.5	9.5	530	4134	41340	874.5	209,880	34.98	54,429	264,309	306,000
		83M-R2	360	Jogor Centre	Proposed	Box Culvert	1 Cv (3.5 x 2)	Dar	10	77	20020	9.625	14976.5	56,000		Concrete	3.5	1.5	9.5	114	889.2	8892	188.1	45,144	7.52	11,707	56,851	66,000
		83M-R3	819	Ring Road	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	20	144	37440	18	28008	105,600		Concrete	4	1.5	10	636	5342.4	53424	1049.4	251,856	41.98	65,315	317,171	371,000
		83M-R4	818	Oluyole Estate, 14 Avenue	Proposed	Box Culvert	1 Cv (4 x 2.5)	Dar	10	98	25480	12.25	19061	72,000		Concrete	4	2	12	1208	15462.4	154624	2355.6	565,344	94.22	146,613	711,957	867,000
		83M-R5	Size Change													Concrete	4	2	12	131	1676.8	16768	255.5	61,308	10.22	15,899	77,207	94,000

Structure Data										Structure Cost						Channel Data					Channel Cost							
Channel ID	Subbasin	Reach ID	Structure No.	Location	Structure Status	Proposed Crossing Structure Type	Proposed Crossing Structure Dimensions	Designed by	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)	Lining Protection	Bed Width (m)	Design Depth (m)	Top Width (m)	Reach Length (m)	Excavation Volume (m3)	Cost of Excavation US$	Concrete Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Total Lining Cost (USD)	Total Cost of Channel US$
84	ON15 Alaro	84-R1	1289	OLU-OJO STRT,OFF IDI-AHUN	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	4	1	8	757	3633.6	36336	1022.0	245,268	40.88	63,606	308,874	345,000
		84-R2	1290	ODEGBAMI LAYOUT, OLUYOLE EXT. ELEBU	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	4	1	8	275	1320	13200	371.3	89,100	14.85	23,107	112,207	125,000
		84-R3	1322	OKE-IBUNKUN ALONG,PIPELINE ELEBU	Proposed	Box Culvert	1 Cv (4.5 x 1.5)	Dar	10	78	20280	9.75	15171	57,600		Concrete	4.5	1	8.5	185	962	9620	249.8	59,940	9.99	15,544	75,484	85,000
		84-R4	1291	IFELODUN, ABA- PANU,OFF DALE COLLEGE	Proposed	Box Culvert	1 Cv (4.5 x 1.5)	Dar	10	78	20280	9.75	15171	57,600		Concrete	4.5	1	8.5	149	774.8	7748	201.2	48,276	8.05	12,520	60,796	69,000
		84-R5	1298	IFELODUN, ABA- PANU	Proposed	Box Culvert	1 Cv (4.5 x 1.5)	Dar	10	78	20280	9.75	15171	57,600		Concrete	4.5	1	8.5	437	2272.4	22724	590.0	141,588	23.60	36,718	178,306	201,000
		84-R6	Size Change													Concrete	4.5	1	8.5	52	270.4	2704	70.2	16,848	2.81	4,369	21,217	24,000
		84-R7	1299	ORITA MERIN JUNCTION,OFF ELEBU, ODO ALAGBA, OLUYOLE EXTENSION, ELEBU	Proposed	Box Culvert	2 Cv (3.5 x 2)	Dar	10	136	35360	17	26452	99,200		Concrete	7	1.5	13	216	2592	25920	453.6	108,864	18.14	28,232	137,096	163,000
		84-R8	1300	OLADIPUPO GBOLAHAN STRT. ELEBU, ODO ALAGBA, LABUTA RD, ELEBU	Proposed	Box Culvert	2 Cv (3.5 x 2)	Dar	10	136	35360	17	26452	99,200		Concrete	7	1.5	13	443	5316	53160	930.3	223,272	37.21	57,902	281,174	334,000
		84-R9	Size Change													Concrete	7	1.5	13	941	11292	112920	1976.1	474,264	79.04	122,992	597,256	710,000
		84-R10	19	AKALA ROAD,	Proposed	Box Culvert	2 Cv (4.5 x 2)	Dar	20	284	73840	35.5	55238	208,000		Concrete	8	1.5	14	167	2204.4	22044	375.8	90,180	15.03	23,387	113,567	136,000
		84-R11	Size Change													Concrete	8	1.5	14	391	5161.2	51612	879.8	211,140	35.19	54,756	265,896	318,000
84D	ON15 Alaro	84D-R1	1293	JIM-ROCK BLOCK INDUSTRY RD, IDI-AHUN ELEBU	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	4	1	8	54	259.2	2592	72.9	17,496	2.92	4,537	22,033	25,000
		84D-R2	1294	BESIDE MAXWELL MONTESSORI SCH, ALONG IDI-AHUN	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	4	1	8	447	2145.6	21456	603.5	144,828	24.14	37,559	182,387	204,000
		84D-R3	1295	ARAROMI ALONG IDI-AHUN	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	4	1	8	80	384	3840	108.0	25,920	4.32	6,722	32,642	36,000
		84D-R4	1296	BEFORE GETHSEMAN CHURCH,ORITA -MERIN	Proposed	Box Culvert	1 Cv (4.5 x 1.5)	Dar	10	78	20280	9.75	15171	57,600		Concrete	4.5	1	8.5	420	2184	21840	567.0	136,080	22.68	35,290	171,370	193,000
		84D-R5	1297	ARAROMI ALONG , IDI-AHUN ROAD	Proposed	Box Culvert	1 Cv (4.5 x 1.5)	Dar	10	78	20280	9.75	15171	57,600		Concrete	4.5	1	8.5	63	327.6	3276	85.1	20,412	3.40	5,294	25,706	29,000
		84D-R6	Size Change													Concrete	4.5	1	8.5	207	1076.4	10764	279.5	67,068	11.18	17,393	84,461	95,000
85	ON15 Alaro	85-R1	1095	Apata	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	3.5	1.5	9.5	99	772.2	7722	163.4	39,204	6.53	10,167	49,371	57,000
		85-R2	1122	Apata	Proposed	Box Culvert	1 Cv (3.5 x 2)	Dar	10	77	20020	9.625	14976.5	56,000		Concrete	3.5	1.5	9.5	534	4165.2	41652	881.1	211,464	35.24	54,840	266,304	308,000
		85-R3	1096	Bembo Area	Proposed	Box Culvert	1 Cv (4.5 x 2)	Dar	10	91	23660	11.375	17699.5	67,200		Concrete	5	1.5	11	847	8131.2	81312	1524.6	365,904	60.98	94,891	460,795	542,000
		85-R4	1097	Oloruntumo	Proposed	Box Culvert	1 Cv (5 x 2)	Dar	10	98	25480	12.25	19061	72,000		Concrete	5	1.5	11	186	1785.6	17856	334.8	80,352	13.39	20,838	101,190	119,000
		85-R5	1098	Olakunle	Proposed	Box Culvert	1 Cv (5 x 2)	Dar	10	98	25480	12.25	19061	72,000		Concrete	5	1.5	11	130	1248	12480	234.0	56,160	9.36	14,564	70,724	83,000
		85-R6	1573	Olorun Tumo Road	Proposed	Box Culvert	1 Cv (5.5 x 2)	Dar	10	105	27300	13.125	20422.5	76,800		Concrete	5.5	1.5	11.5	99	1009.8	10098	193.1	46,332	7.72	12,015	58,347	68,000
		85-R7	1099	Apata	Proposed	Box Culvert	1 Cv (5.5 x 2)	Dar	10	105	27300	13.125	20422.5	76,800		Concrete	5.5	1.5	11.5	70	714	7140	136.5	32,760	5.46	8,496	41,256	48,000
		85-R8	1574	Olorun Tumo Road	Proposed	Box Culvert	1 Cv (5.5 x 2)	Dar	10	105	27300	13.125	20422.5	76,800		Concrete	5.5	1.5	11.5	143	1458.6	14586	278.9	66,924	11.15	17,356	84,280	99,000
		85-R9	1121	Oloruntumo	Proposed	Box Culvert	1 Cv (5.5 x 2)	Dar	10	105	27300	13.125	20422.5	76,800		Concrete	5.5	1.5	11.5	167	1703.4	17034	325.7	78,156	13.03	20,268	98,424	115,000
		85-R10	1575	Olorun Tumo Road	Proposed	Box Culvert	1 Cv (5.5 x 2)	Dar	10	105	27300	13.125	20422.5	76,800		Concrete	5.5	1.5	11.5	130	1326	13260	253.5	60,840	10.14	15,778	76,618	90,000
		85-R11	1062	Apata	Existing											Concrete	5.5	1.5	11.5	91	928.2	9282	177.5	42,588	7.10	11,044	53,632	63,000
		85-R12	Size Change													Concrete	5.5	1.5	11.5	73	744.6	7446	142.4	34,164	5.69	8,860	43,024	50,000
		85-R13	1063	Apata, Alafia Estate, Alafia Estate	Proposed	Box Culvert	1 Cv (6 x 2.5)	Dar	10	128	33280	16	24896	94,400		Concrete	6	2	14	336	5376	53760	756.0	181,440	30.24	47,053	228,493	282,000
		85-R14	1576	Onigele Apata, Apata, Onigele	Proposed	Box Culvert	1 Cv (6 x 2.5)	Dar	10	128	33280	16	24896	94,400		Concrete	6	2	14	141	2256	22560	317.3	76,140	12.69	19,746	95,886	118,000
		85-R15	1064	Iyana cele, Iyana cele, Off NNPC Road	Proposed	Box Culvert	1 Cv (6 x 2.5)	Dar	20	213	55380	26.625	41428.5	155,200		Concrete	6	2	14	132	2112	21120	297.0	71,280	11.88	18,485	89,765	111,000
		85-R16	1577	Cele Road Apata, Cele Road	Proposed	Box Culvert	1 Cv (6 x 2.5)	Dar	10	128	33280	16	24896	94,400		Concrete	6	2	14	95	1520	15200	213.8	51,300	8.55	13,304	64,604	80,000
		85-R17	10	BEMBU ROAD , ABA-ALAMU,	Proposed	Box Culvert	1 Cv (6 x 2.5)	Dar	20	213	55380	26.625	41428.5	155,200		Concrete	6	2	14	184	2944	29440	414.0	99,360	16.56	25,767	125,127	155,000
		85-R18	11	REPODUN , ALEXANDA AREA,	Proposed	Box Culvert	2 Cv (4.5 x 2.5)	Dar	10	185	48100	23.125	35982.5	136,000		Concrete	9	2	17	224	4659.2	46592	604.8	145,152	24.19	37,643	182,795	229,000
		85-R19	12	ILUPEJU , APATA,	Proposed	Box Culvert	2 Cv (4.5 x 2.5)	Dar	10	185	48100	23.125	35982.5	136,000		Concrete	9	2	17	322	6697.6	66976	869.4	208,656	34.78	54,111	262,767	330,000
		85-R20	Size Change													Concrete	9	2	17	545	11336	113360	1471.5	353,160	58.86	91,586	444,746	558,000
		85-R21	1065	Kuola Apata, Chief Awopeju Ogumbe, Chief Awopeju Ogumbe Street	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	10	230	59800	28.75	44735	168,000		Concrete	12	2	20	51	1305.6	13056	160.7	38,556	6.43	9,999	48,555	62,000
		85-R22	15	ABA ALADIE,	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	10	230	59800	28.75	44735	168,000		Concrete	12	2	20	348	8908.8	89088	1096.2	263,088	43.85	68,227	331,315	420,000
		85-R23	Size Change													Concrete	12	2	20	177	4531.2	45312	557.6	133,812	22.30	34,702	168,514	214,000
		85-R24	16	SHARP CORNER , OLUYOLE ESTATE,	Proposed	Box Culvert	2 Cv (6.5 x 2.5)	Dar	10	245	63700	30.625	47652.5	179,200		Concrete	13	2	21	199	5412.8	54128	656.7	157,608	26.27	40,873	198,481	253,000
		85-R25	17	OLUYOLE ESTATE (ABA OLU ODE STATE),	Proposed	Box Culvert	2 Cv (6.5 x 2.5)	Dar	10	245	63700	30.625	47652.5	179,200		Concrete	13	2	21	538	14633.6	146336	1775.4	426,096	71.02	110,501	536,597	683,000
		85-R26	Size Change													Concrete	13	2	21	229	6228.8	62288	755.7	181,368	30.23	47,035	228,403	291,000
85F	ON15 Alaro	85F-R1	1080	Apata, Oloruntumo Road	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3	1	7	339	1356	13560	406.8	97,632	16.27	25,319	122,951	137,000
		85F-R2	Size Change													Concrete	3	1	7	202	808	8080	242.4	58,176	9.70	15,087	73,263	81,000
85G	ON15 Alaro	85G-R1	1086	Apata, Tanimowo road,behind Krisbvow International hotel	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	146	963.6	9636	219.0	52,560	8.76	13,631	66,191	76,000
		85G-R3	19D5	APATA-PATE COMMUNITY												Concrete	2.5	1.5	8.5	277	1828.2	18282	415.5	99,720	16.62	25,861	125,581	144,000
		85G-R4	19D4	APATA-PATE COMMUNITY												Concrete	2.5	1.5	8.5	71	468.6	4686	106.5	25,560	4.26	6,629	32,189	37,000
		85G-R5	19D3	APATA-PATE COMMUNITY												Concrete	2.5	1.5	8.5	81	534.6	5346	121.5	29,160	4.86	7,562	36,722	42,000
		85G-R6	19D2	APATA-PATE COMMUNITY												Concrete	2.5	1.5	8.5	41	270.6	2706	61.5	14,760	2.46	3,828	18,588	21,000
		85G-R2	1087	APATA-PATE COMMUNITY	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	113	745.8	7458	169.5	40,680	6.78	10,550	51,230	59,000
		85G-R7	1088	Iyana cele, Prince Abayomi Oladeinde Street	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	142	937.2	9372	213.0	51,120	8.52	13,257	64,377	74,000
		85G-R8	1089	Aba Alamu Apata, Mosyln Royal International School Road	Proposed	Box Culvert	1 Cv (3 x 2)	Dar	10	70	18200	8.75	13615	51,200		Concrete	3	1.5	9	118	849.6	8496	177.0	42,480	7.08	11,016	53,496	62,000
		85G-R9	Size Change													Concrete	3	1.5	9	90	648	6480	135.0	32,400	5.40	8,402	40,802	47,000
85L	ON15 Alaro	85L-R1	1090	Kuola Apata, Aba Elesin	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	221	1458.6	14586	331.5	79,560	13.26	20,633	100,193	115,000
		85L-R2	1059	Kuola Apata,Jimoh Soyombo	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	330	2178	21780	495.0	118,800	19.80	30,809	149,609	171,000
		85L-R3	13	APATA , PIPE LINE	Existing											Concrete	3	1.5	9	238	1713.6	17136	357.0	85,680	14.28	22,220	107,900	125,000
		85L-R4	14	Kuola Apata, Off Confidence road	Proposed	Box Culvert	1 Cv (3 x 2)	Dar	10	70	18200	8.75	13615	51,200		Concrete	3	1.5	9	132	950.4	9504	198.0	47,520	7.92	12,324	59,844	69,000
		85L-R5	Size Change													Concrete	3	1.5	9	599	4312.8	43128	898.5	215,640	35.94	55,923	271,563	315,000
86	ON15 Alaro	86-R1	18	OLUSOJI COMMUNITY,	Proposed	Box Culvert	3 Cv (5.5 x 2.75)	Dar	10	326	84760	40.75	63407	238,400		Concrete	17	2.25	26	322	12461.4	124614	1352.4	324,576	54.10	84,173	408,749	533,000
		86-R2	20	ALARO AREA ONE COMMUNITY,	Proposed	Box Culvert	3 Cv (5.5 x 2.75)	Dar	10	326	84760	40.75	63407	238,400		Concrete	17	2.25	26	694	26857.8	268578	2914.8	699,552	116.59	181,417	880,969	1,150,000
		86-R3	Size Change													Concrete	17	2.25	26	318	12306.6	123066	1335.6	320,544	53.42	83,128	403,672	527,000
		86-R4	22	ABULEX ROAD ELEWURE,	Proposed	Box Culvert	3 Cv (6 x 2.75)	Dar	10	349	90740	43.625	67880.5	254,400		Concrete	18	2.25	27	180	7290	72900	783.0	187,920	31.32	48,734	236,654	310,000
		86-R5	827	Oluyole Extension, Off Zartech road, Off Zartech road	Proposed	Bridge	Br (15m)	Pheman								Concrete	18	2.25	27	530	21465	214650	2305.5	553,320	92.22	143,494	696,814	911,000
		86-R6	Size Change													Concrete	18	2.25	27	178	7209	72090	774.3	185,832	30.97	48,192	234,024	306,000
		86-R7	23	ZATECH ROAD METERS,	Proposed	Box Culvert	8 Cv (6 x 2)	Dar	17							Concrete Sides	48	2.25	57	299	28255.5	282555	897.0	215,280	35.88	55,829	271,109	554,000
		86-R8	Size Change													Concrete Sides	48	2.25	57	726	68607	686070	2178.0	522,720	87.12	135,559	658,279	1,344,000
86C	ON15 Alaro	86C-R1	25	AKURU SECOND BORE HOLE	Proposed	Box Culvert	1 Cv (2 x 2)	Dar	10	56	14560	7	10892	41,600		Concrete	2	1.5	8	108	648	6480	145.8	34,992	5.83	9,075	44,067	51,000
		86C-R2	825	Akuru, By Ishola Alarape close	Proposed	Box Culvert	1 Cv (2 x 2)	Dar	10	56	14560	7	10892	41,600		Concrete	2	1.5	8	484	2904	29040	653.4	156,816	26.14	40,668	197,484	227,000
		86C-R3	21	AKURU EXPRESS ROAD	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	20	108	28080	13.5	21006	80,000		Concrete	2.5	1.5	8.5	150	990	9900	225.0	54,000	9.00	14,004	68,004	78,000
		86C-R4	1570	Cherry Lane	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	248	1636.8	16368	372.0	89,280	14.88	23,153	112,433	129,000
		86C-R5	Size Change													Concrete	2.5	1.5	8.5	80	528	5280	120.0	28,800	4.80	7,469	36,269	42,000
86G	ON15 Alaro	86G-R1	24		Proposed	Box Culvert	1 Cv (2.5 x 1.5)	Dar	20	92	23920	11.5	17894	67,200		Concrete	2.5	1	6.5	162	583.2	5832	170.1	40,824	6.80	10,587	51,411	57,000
		86G-R2	1568	Oke Alaro Orelope Community, Oke Alaro Street	Proposed	Box Culvert	1 Cv (2.5 x 1.5)	Dar	10	52	13520	6.5	10114	38,400		Concrete	2.5	1	6.5	175	630	6300	183.8	44,100	7.35	11,437	55,537	62,000

Structure Data										Structure Cost						Channel Data					Channel Cost							
Channel ID	Subbasin	Reach ID	Structure No.	Location	Structure Status	Proposed Crossing Structure Type	Proposed Crossing Structure Dimensions	Designed by	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)	Lining Protection	Bed Width (m)	Design Depth (m)	Top Width (m)	Reach Length (m)	Excavation Volume (m3)	Cost of Excavation US$	Concrete Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Total Lining Cost (USD)	Total Cost of Channel US$
86G	ON15 Alaro	86G-R3	829	Orelope Community, Lane 17	Proposed	Box Culvert	1 Cv (2.5 x 1.5)	Dar	10	52	13520	6.5	10114	38,400		Concrete	2.5	1	6.5	80	288	2880	84.0	20,160	3.36	5,228	25,388	28,000
		86G-R4	830	Orelope Community-Oluyole, Zartech road	Proposed	Box Culvert	1 Cv (2.5 x 1.5)	Dar	10	52	13520	6.5	10114	38,400		Concrete	2.5	1	6.5	8	28.8	288	8.4	2,016	0.34	523	2,539	3,000
		86G-R5	Size Change													Concrete	2.5	1	6.5	274	986.4	9864	287.7	69,048	11.51	17,906	86,954	97,000
89	ON16 Agara Kasumu	89-R1	1304	BESIDE DANGOTE CEMENT DEPORT,ALAAKA IBUDO EST	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	986	8282.4	82824	1626.9	390,456	65.08	101,258	491,714	575,000
		89-R2	1306	FEDERAL HOUSING EST. AREA,ALONG HALLELUYAH HOUSE	Proposed	Box Culvert	1 Cv (6 x 2)	Dar	10	112	29120	14	21784	81,600		Concrete	6	1.5	12	780	8424	84240	1521.0	365,040	60.84	94,667	459,707	544,000
		89-R3	1308	AREA 1, BOTA EST LIBERTY ACADEMY	Proposed	Box Culvert	1 Cv (6 x 2)	Dar	10	112	29120	14	21784	81,600		Concrete	6	1.5	12	345	3726	37260	672.8	161,460	26.91	41,872	203,332	241,000
		89-R4	Size Change													Concrete	6	1.5	12	79	853.2	8532	154.1	36,972	6.16	9,588	46,560	55,000
		89-R5	1309	OFF JANEADEY WAY, FEDERAL LOW COST AREA, ODO LOW COST, BOTA ROAD, ODO-ONA ELEWE	Proposed	Box Culvert	2 Cv (4.5 x 2)	Dar	10	164	42640	20.5	31898	120,000		Concrete	9	1.5	15	99	1425.6	14256	237.6	57,024	9.50	14,788	71,812	86,000
		89-R6	1310	BESIDE ST.ANNE'S COMPREHENSIVE COLLEGE, ODO ST.ANNE'S, ODEKU, IDI-IROKO ODO-ONA ELEWE	Proposed	Box Culvert	2 Cv (4.5 x 2)	Dar	10	164	42640	20.5	31898	120,000		Concrete	9	1.5	15	431	6206.4	62064	1034.4	248,256	41.38	64,381	312,637	375,000
		89-R7	1311	BESIDE ILE AANU-MAJEMU,BEHIND ST.ANNE COMPREHENSIVE COLLEGE, ODO BESIDE ILE MAJEMU CHURCH, FEDERAL HOUSING RD ALONG IDI-IROKO	Proposed	Box Culvert	2 Cv (4.5 x 2)	Dar	10	164	42640	20.5	31898	120,000		Concrete	9	1.5	15	148	2131.2	21312	355.2	85,248	14.21	22,108	107,356	129,000
		89-R8	Size Change													Concrete	9	1.5	15	95	1368	13680	228.0	54,720	9.12	14,191	68,911	83,000
		89-R9	1318	ALONG TOM-TIN BLOCK INDUSTRY, ODEKU VILLAGE, ODO OLUWAWE,ODEKU, ODO-ONA ELEWE, ACADEMY.	Proposed	Box Culvert	2 Cv (6 x 2)	Dar	10	206	53560	25.75	40067	150,400		Concrete	12	1.5	18	157	2826	28260	447.5	107,388	17.90	27,849	135,237	163,000
		89-R10	1319	ALONG GOSPEL INT. CHURCH, ODEKU VILLAGE, ODO ODEKU, ODO-ONA ELEWE, ACADEMY.	Proposed	Box Culvert	2 Cv (6 x 2)	Dar	10	206	53560	25.75	40067	150,400		Concrete	12	1.5	18	184	3312	33120	524.4	125,856	20.98	32,639	158,495	192,000
		89-R11	1320	KOGUO AREA, ALONG IDI-IROKO, ODO ODEKU, IDI-IROKO,ODO-ONA ELEWE	Proposed	Box Culvert	2 Cv (6 x 2)	Dar	10	206	53560	25.75	40067	150,400		Concrete	12	1.5	18	183	3294	32940	521.6	125,172	20.86	32,461	157,633	191,000
		89-R12	Size Change													Concrete	12	1.5	18	358	6444	64440	1020.3	244,872	40.81	63,503	308,375	373,000
		89-R13	862	Oke Odo-Bola, Eri-Kalofih, Eri-Kalofih Street	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	10	230	59800	28.75	44735	168,000		Concrete	12	2	20	182	4659.2	46592	573.3	137,592	22.93	35,682	173,274	220,000
		89-R14	856	Odo Ona -Bola, Open heaven, Open heaven Avenue	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	10	230	59800	28.75	44735	168,000		Concrete	12	2	20	134	3430.4	34304	422.1	101,304	16.88	26,272	127,576	162,000
		89-R15	857	Oke Odo-Bola, Ogunse, Ogunse road	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	10	230	59800	28.75	44735	168,000		Concrete	12	2	20	219	5606.4	56064	689.9	165,564	27.59	42,936	208,500	265,000
		89-R16	858	Isale Olosan, Ifesowapo, Ifesowapo road	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	10	230	59800	28.75	44735	168,000		Concrete	12	2	20	436	11161.6	111616	1373.4	329,616	54.94	85,480	415,096	527,000
		89-R17	30	ASIPA ROAD,	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	10	230	59800	28.75	44735	168,000		Concrete	12	2	20	1046	26777.6	267776	3294.9	790,776	131.80	205,075	995,851	1,264,000
		89-R18	31	DALUTE,	Proposed	Box Culvert	Add 2 Cv (5 x 2)	Abfort	10	178	46280	22.25	34621	129,600		Concrete	12	2	20	929	23782.4	237824	2926.4	702,324	117.05	182,136	884,460	1,122,000
		89-R19	1214	KASUMU, AGARA KASUMU, ZONE B	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	10	230	59800	28.75	44735	168,000		Concrete	12	2	20	693	17740.8	177408	2183.0	523,908	87.32	135,867	659,775	837,000
		89-R20	Size Change													Concrete	12	2	20	383	9804.8	98048	1206.5	289,548	48.26	75,089	364,637	463,000
89L	ON16 Agara Kasumu	89L-R1	1312	OFF ALALADE FAMILY RD,BOTA EST AREA	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3	1	7	224	896	8960	268.8	64,512	10.75	16,730	81,242	90,000
		89L-R2	1313	BESIDE JIMI BLOCK INDUSTRY AREA, NNPC PIPELINE	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	4	1	8	660	3168	31680	891.0	213,840	35.64	55,456	269,296	301,000
		89L-R3	1316	ESTATE EXTENSION, LANE 6 PIPELINE AREA	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	4	1	8	302	1449.6	14496	407.7	97,848	16.31	25,375	123,223	138,000
		89L-R4	1317	BEHIND ILE AANU-MAJEMU,BEHIND ST.ANNE COMPREHENSIVE COLLEGE	Proposed	Box Culvert	1 Cv (5.5 x 1.5)	Dar	10	91	23660	11.375	17699.5	67,200		Concrete	5.5	1	9.5	696	4176	41760	1044.0	250,560	41.76	64,979	315,539	357,000
		89L-R5	Size Change													Concrete	5.5	1	9.5	92	552	5520	138.0	33,120	5.52	8,589	41,709	47,000
89M	ON16 Agara Kasumu	89M-R1	854	Bola Estate, Idi-Iroko road	Proposed	Box Culvert	1 Cv (3 x 1.5)	Dar	10	59	15340	7.375	11475.5	43,200		Concrete	3	1	7	192	768	7680	230.4	55,296	9.22	14,340	69,636	77,000
		89M-R2	Size Change													Concrete	3	1	7	39	156	1560	46.8	11,232	1.87	2,913	14,145	16,000
87	ON17 Lower Ona East	87-R1	870	CHALLENGE, RING ROAD	Proposed	Box Culvert	1 Cv (4.5 x 1.5)	Dar	20	138	35880	17.25	26841	100,800		Concrete	4.5	1	8.5	357	1856.4	18564	482.0	115,668	19.28	29,997	145,665	164,000
		87-R2	1567	Oluyole, Abiodun Tomori Avenue	Proposed	Box Culvert	1 Cv (4.5 x 1.5)	Dar	10	78	20280	9.75	15171	57,600		Concrete	4.5	1	8.5	175	910	9100	236.3	56,700	9.45	14,704	71,404	81,000
		87-R3	839	Elewura Challenge	Proposed	Box Culvert	1 Cv (4.5 x 1.5)	Dar	10	78	20280	9.75	15171	57,600		Concrete	4.5	1	8.5	242	1258.4	12584	326.7	78,408	13.07	20,334	98,742	111,000
		87-R4	1566	Kola Oyewuwo Street, Road 5	Proposed	Box Culvert	1 Cv (5 x 2)	Dar	10	98	25480	12.25	19061	72,000		Concrete	5	1.5	11	452	4339.2	43392	813.6	195,264	32.54	50,638	245,902	289,000
		87-R5	1560	Oke Odo Titun, Road 4	Proposed	Box Culvert	1 Cv (5 x 2)	Dar	10	98	25480	12.25	19061	72,000		Concrete	5	1.5	11	184	1766.4	17664	331.2	79,488	13.25	20,614	100,102	118,000
		87-R6	842	Orita Challenge, Oladapo Adesanya Street	Existing											Concrete	6	1.5	12	218	2354.4	23544	425.1	102,024	17.00	26,458	128,482	152,000
		87-R7	Size Change													Concrete	6	1.5	12	541	5842.8	58428	1055.0	253,188	42.20	65,660	318,848	377,000
		87-R8	Size Change													Concrete	6	1.5	12	938	10130.4	101304	1829.1	438,984	73.16	113,843	552,827	654,000
87E	ON17 Lower Ona East	87E-R1	836	Challenge ring road, Bolumole Street	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	194	1280.4	12804	291.0	69,840	11.64	18,112	87,952	101,000
		87E-R2	837	Challenge ring road ,Popoola Street	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	79	521.4	5214	118.5	28,440	4.74	7,375	35,815	41,000
		87E-R3	838	Fodacis Area ring road,	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	143	943.8	9438	214.5	51,480	8.58	13,350	64,830	74,000
		87E-R4	Size Change													Concrete	2.5	1.5	8.5	66	435.6	4356	99.0	23,760	3.96	6,162	29,922	34,000
88	ON17 Lower Ona East	88-R1	148B	ODO-ONA ELEWE,	Proposed	Bridge	Br (15m)	Pheman								Concrete Sides	50	3.5	67.5	1654								
		88-R2	149B	New Garage, Agara river, Akala road	Proposed	Bridge	Br (72m)	Dar								Concrete Sides	50	3.5	67.5	849								
		88-R3	1584	Akala, Ona River, Akala												Concrete Sides	50	3.5	67.5	220								
		88-R4	1215	OPERE, ODO ONA, ROAD 1, ZONE 2	Proposed	Bridge	Br (72 x 10)	Dar	10						1,800,000	Concrete Sides	50	3.5	67.5	902								
		88-R5	Size Change													Concrete Sides	50	3.5	67.5	268								
88D	ON17 Lower Ona East	88D-R1	843	Orita Challenge, Ogundipe Street	Proposed	Box Culvert	1 Cv (3.5 x 1.5)	Dar	10	65	16900	8.125	12642.5	48,000		Concrete	3.5	1	7.5	240	1056	10560	288.0	69,120	11.52	17,925	87,045	98,000
		88D-R2	844	Orita Challenge, Old lagos road	Existing											Concrete	3.5	1	7.5	408	1795.2	17952	489.6	117,504	19.58	30,473	147,977	166,000
		88D-R3	847	New Garage, Iteiwaju road	Proposed	Box Culvert	1 Cv (3.5 x 2)	Dar	10	77	20020	9.625	14976.5	56,000		Concrete	3.5	1.5	9.5	781	6091.8	60918	1288.7	309,276	51.55	80,206	389,482	450,000
		88D-R4	Size Change													Concrete	3.5	1.5	9.5	250	1950	19500	412.5	99,000	16.50	25,674	124,674	144,000
88E	ON17 Lower Ona East	88E-R1	1565	Iyana Agara, Zone 4	Existing											Concrete	4	1	8	294	1411.2	14112	396.9	95,256	15.88	24,703	119,959	134,000
		88E-R2	29	AGARRA ODO-EJA	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	4	1	8	81	388.8	3888	109.4	26,244	4.37	6,806	33,050	37,000
		88E-R3	1585	Akala Road, Omotosho Akanji Estate	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	4	1	8	240	1152	11520	324.0	77,760	12.96	20,166	97,926	109,000
88G	ON17 Lower Ona East	88G-R1	1186	OPERE/OLOGEDE, OFF ALHAJI ADEEYO STR.	Proposed	Box Culvert	1 Cv (2.5 x 1.5)	Dar	10	52	13520	6.5	10114	38,400		Concrete	2.5	1	6.5	179	644.4	6444	188.0	45,108	7.52	11,698	56,806	63,000
		88G-R2	Size Change													Concrete	2.5	1	6.5	350	1260	12600	367.5	88,200	14.70	22,873	111,073	124,000
91	ON18 Lower Ona South	91-R1	Size Change													Concrete Sides	50	3.5	64	782	124807.2	1248072	2815.2	675,648	112.61	175,218	850,866	2,099,000
		91-R2	1185	ONIPON COMMUNITY, ODO ONA, OFF AYODELE ALAKIJ ST.	Proposed	Bridge	Br (70 x 10)	Dar	10						1,750,000	Concrete Sides	54	3.5	68	329	56193.2	561932	1184.4	284,256	47.38	73,717	357,973	920,000
		91-R3	1216	ABA IBEJI, ODO ONA RIVER, IYANA COLLEGE	Proposed	Bridge	Br (70 x 10)	Dar	10						1,750,000	Concrete Sides	54	3.5	68	950	162260	1622600	3420.0	820,800	136.80	212,861	1,033,661	2,656,000
		91-R4	Size Change													Concrete Sides	54	3.5	68	145	24766	247660	522.0	125,280	20.88	32,489	157,769	405,000
		91-R5	150B	ODO ONA KEKERE, ODO ONA RIVER, OLD LAGOS ROAD	Proposed	Bridge	Br (86m)	Dar								Concrete Sides	67	3.5	81	1079	223568.8	2235688	3884.4	932,256	155.38	241,765	1,174,021	3,410,000
		91-R6	1196	AKERELE, ODO ONA, OLD LAGOS ROAD	Existing											Concrete Sides	67	3.5	81	113	23413.6	234136	406.8	97,632	16.27	25,319	122,951	357,000
		91-R7	151B	LAGOS/IBADAN EXPRESS WAY, ODO ONA RIVER, GURU AREA	Proposed	Bridge	Br (86 x 40)	Dar	40						8,600,000	Concrete Sides	67	3.5	81	348	72105.6	721056	1252.8	300,672	50.11	77,974	378,646	1,100,000
		91-R8	Size Change													Concrete Sides	67	3.5	81	372	77078.4	770784	1339.2	321,408	53.57	83,352	404,760	1,176,000

Structure Data										Structure Cost						Channel Data					Channel Cost							
Channel ID	Subbasin	Reach ID	Structure No.	Location	Structure Status	Proposed Crossing Structure Type	Proposed Crossing Structure Dimensions	Designed by	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)	Lining Protection	Bed Width (m)	Design Depth (m)	Top Width (m)	Reach Length (m)	Excavation Volume (m3)	Cost of Excavation US$	Concrete Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Total Lining Cost (USD)	Total Cost of Channel US$
91H	ON18 Lower Ona South	91H-R1	1204	ABAMBA AREA, ABORE STR.	Proposed	Box Culvert	1 Cv (4 x 1.5)	Dar	10	72	18720	9	14004	52,800		Concrete	4	1	8	613	2942.4	29424	827.6	198,612	33.10	51,507	250,119	280,000
		91H-R2	129	SIMISOLA FARM	Proposed	Box Culvert	1 Cv (4.5 x 1.5)	Dar	10	78	20280	9.75	15171	57,600		Concrete	4.5	1	8.5	147	764.4	7644	198.5	47,628	7.94	12,352	59,980	68,000
		91H-R3	1203	ARAPAJA, ALAFIA ESTATE RD.	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	334	2805.6	28056	551.1	132,264	22.04	34,300	166,564	195,000
		91H-R4	1202	ARAPAJA/ODO ONA KEKERE, ORISUNBARE STREET	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	113	949.2	9492	186.5	44,748	7.46	11,605	56,353	66,000
		91H-R5	1201	ARAPAJA, LOVE STREET	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	110	924	9240	181.5	43,560	7.26	11,297	54,857	64,000
		91H-R6	1200	RAINBOW ESTATE, RAINBOW RD.	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	229	1923.6	19236	377.9	90,684	15.11	23,517	114,201	133,000
		91H-R7	1199	RAINBOW ESTATE, RAINBOW RD.	Proposed	Box Culvert	1 Cv (4 x 2)	Dar	10	84	21840	10.5	16338	62,400		Concrete	4	1.5	10	48	403.2	4032	79.2	19,008	3.17	4,929	23,937	28,000
		91H-R8	1198	ABA IBEJI, ORE OFE ROAD	Proposed	Box Culvert	1 Cv (4.5 x 2)	Dar	10	91	23660	11.375	17699.5	67,200		Concrete	4.5	1.5	10.5	493	4437	44370	887.4	212,976	35.50	55,232	268,208	313,000
		91H-R9	Size Change													Concrete	4.5	1.5	10.5	525	4725	47250	945.0	226,800	37.80	58,817	285,617	333,000
90	ON19 Lower Ona West		1324	AYEGUN, AMULETIGBO ROAD	Proposed	Box Culvert	1 Cv (2 x 2)	Dar	10	56	14560	7	10892	41,600		Concrete	2	1.5	8									
		90-R1	1325	AYEGUN OLEYO, LAFIAJI ROAD	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	183	1207.8	12078	274.5	65,880	10.98	17,085	82,965	95,000
		90-R2	1329	OGO-OLUWA AYEGUN, AYEGUN ROAD	Proposed	Box Culvert	1 Cv (2.5 x 2)	Dar	10	63	16380	7.875	12253.5	46,400		Concrete	2.5	1.5	8.5	399	2633.4	26334	598.5	143,640	23.94	37,251	180,891	207,000
		90-R3	1330	ABADA, ABADA ROAD	Proposed	Box Culvert	1 Cv (4.5 x 2)	Dar	10	91	23660	11.375	17699.5	67,200		Concrete	4.5	1.5	10.5	1041	9369	93690	1873.8	449,712	74.95	116,625	566,337	660,000
		90-R4	1333	ABADA, ABADA ROAD	Proposed	Box Culvert	1 Cv (5.5 x 2)	Dar	10	105	27300	13.125	20422.5	76,800		Concrete	5.5	1.5	11.5	288	2937.6	29376	561.6	134,784	22.46	34,954	169,738	199,000
		90-R5	Size Change													Concrete	5.5	1.5	11.5	183	1866.6	18666	356.9	85,644	14.27	22,210	107,854	127,000
		90-R6	Size Change													Concrete	9	1.5	15	626	9014.4	90144	1502.4	360,576	60.10	93,509	454,085	544,000
		90-R7	Size Change													Concrete	12	1.5	18	448	8064	80640	1276.8	306,432	51.07	79,468	385,900	467,000
		90-R8	1180	ASUNLE AREA, ASUNLE CHANEL, OFF CHURCH CLOSE STREET	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	10	230	59800	28.75	44735	168,000		Concrete	12	2	20	1492	38195.2	381952	4699.8	1,127,952	187.99	292,516	1,420,468	1,802,000
		90-R9	32	Regent Estate/14 Acres, Asunle Cv., Atere/Ilugusi	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	10	230	59800	28.75	44735	168,000		Concrete	12	2	20	212	5427.2	54272	667.8	160,272	26.71	41,564	201,836	256,000
		90-R10	1181	KASUMU/ABA IBEJI, KASUMU CHANNEL, KASUMU	Proposed	Box Culvert	2 Cv (6 x 2.5)	Dar	10	230	59800	28.75	44735	168,000		Concrete	15	2	23	851	25870.4	258704	3063.6	735,264	122.54	190,678	925,942	1,185,000
		90-R11	Size Change													Concrete	15	2	23	471	14318.4	143184	1695.6	406,944	67.82	105,534	512,478	656,000
		90-R12	1182	ONIPON/ABA IBEJI, ONIKIN RIVER, ONIPON ESTATE RD.	Proposed	Box Culvert	3 Cv (5.5 x 2.5)	Dar	10	310	80600	38.75	60295	225,600		Concrete	17	2	25	136	4569.6	45696	530.4	127,296	21.22	33,012	160,308	206,000
		90-R13	Size Change													Concrete	17	2	25	214	7190.4	71904	834.6	200,304	33.38	51,946	252,250	324,000
90M	ON19 Lower Ona West	90M-R1	Size Change													Concrete	3.5	1	7.5	624	2745.6	27456	748.8	179,712	29.95	46,605	226,317	254,000
90N	ON19 Lower Ona West	90N-R1	Size Change													Concrete	3.5	1	7.5	419	1843.6	18436	502.8	120,672	20.11	31,294	151,966	170,000
														44,100,800	73,525,000												381,204,000

Annex

11

Assessment of Crossing Structures lying on Natural Streams

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1 Introduction

There are around 1615 crossing locations in Ibadan comprising of 46 Bridges, 1067 Culverts and 181 boardwalks and footpaths. The rest of these crossing locations (321) have yet still no structures. It is important to ensure that the sizes of these structures are sufficient to convey the flow through them without causing any constrictions or bottle necks.

As the number of Structures are very large, the Consultant divided them to:

- Division 1: Structures located on proposed channels
- Division II: Structures located on natural streams

In this respect, this annex (Annex 11) presents the 2nd Division of crossing locations lying on natural streams, while annex 8 presents the assessment of the 1st Division crossing locations lying on proposed channels. Other Annexes (Annex 9, 10 and 12) presents the design of these structures and channels along with their cost estimate.

This annex comprises of the following:

- Assessment Methodology
- Sample of Calculation for one of the structures
- Compiled table including assessment of all structures. The table is preceded by an introduction to define the terms of the table columns.

2 Assessment Methodology

The assessment of the different crossing structures investigated four main points:

- Location
- Configuration
- Structure Integrity
- Hydraulic adequacy.

To understand the application of the above points on each crossing location, the Consultant chose a pilot structure as an example. The pilot structure chosen is Ife Road Culvert with an Id. Structure no. 803. Sample of the Calculations for this structure is presented below.

2.1 Location

The location of each structure is identified by using different types of methods such as:

1- Address of the structure obtained from the site visit investigations
2- The Easting and Northing position of the Structure based on a WGS1984 - UTM Zone 31N Coordinate System.
3- Identity of the structure; this is identified in different methods:

a. Structure number; this is a coding number system given to each structure ranging from 1 to 1583. This includes all the crossing locations that were visited during the site visit investigations conducted between August 2016 and November 2017.
b. The Batch number; this is a group of around 40 to 50 structures that lie near each other and were visited altogether during the same period of site investigations.
c. Alternative Id; this is another identity given to the structure which was either identified lately or prior to the structure coding system, such as damaged structures. The Consultant received the damaged structures from the PIU and named them with alternative identities, then these structures were visited. It was later noticed that these structures were previously visited and had already identities based on the coding number system, yet the Consultant opted to leave both identities for references.
d. The PIU list and number of the structure within this list (for damaged structures identified by the PIU).

2.2 Configuration

The configuration of each structure is defined as follows:

1. The type of existing crossing structure such as culvert, bridge, footpath, boardwalk or left as a natural stream with no structure.
2. The existing crossing structure dimensions
3. The vertical distance between the road level and the culvert invert level
4. The contributing rainfall catchment area of each structure in km^2.
5. The crossroad classification such as expressway, highway, main road, secondary road or tertiary road.

2.3 Structure Integrity

The structure integrity of each structure was assessed using the following criteria:

1. Condition of the structure; this was based on the site visit investigations conducted between August 2016 and November 2017 along with the associated site visit pictures.
2. Structural Adequacy; this is the conclusion of the structural assessment defining the adequacy of this structure from the structural point of view. These are based on the visual assessment on the conditions of this structure during the site investigations and site visit pictures. The conclusion is stated as Adequate or Non-Adequate.

2.4 Hydraulic Adequacy

The hydraulic Adequacy is based on the following:

1- The estimated flow passing through the structure; the flow is extracted from the rainfall-runoff model (HEC-HMS) model for both a 25-, and a 100-year return period.
2- The stream's slope; this shows the longitudinal slope of the channel's profile. The slope has no units and is presented in percentage of the drop of the channel's bed with respective to its length. The topographic slope of the stream is extracted from the LiDAR Digital Elevation Model.
3- The Manning's roughness coefficient; this represents friction factor of the structure. This value is taken as n = 0.017 for existing concrete culverts.
4- The hydraulic capacity of the existing structure based on Manning's formula and using one of the commercial software programs such as Culvert Master by Bentley.
5- Remarks based on the survey conducted in 2017 such as previous history for a flooded location or a structure that needs urgent attention.
6- Hydraulic Adequacy; this is the conclusion of the hydraulic assessment defining the adequacy of this structure from the hydraulic point of view. This is based on:
    a. A comparison between the estimated flow passing through the structure and its hydraulic capacity.
    b. The remarks based on the survey conducted in 2017.

    The conclusion is stated as Adequate or Non-Adequate.

2.5 Final Assessment

The final assessment of a structure is concluded based on the structural and hydraulic adequacy of that structure. If one of these criteria is revealed as inadequate, then the structure is considered as a damaged structure and thus there is a necessity to rehabilitate this structure. In the contrary, if both criteria are proved adequate, then the structure is considered as undamaged and there is no necessity to rehabilitate that structure.

3. Sample of Calculation for one of the Structures

The locations and configuration details of the chosen structure no. 803 is presented below

- Structure no. 803 (27T)
- Location: Toun Memorial Hospital area, on new Ibadan - Ife dual carriage road.
- Easting: 604,385
- Northing: 818,311
- Structure: Circular Culvert
- Size: 2 Φ (0.9 m)
- Vertical Distance between the Road Level and the Culvert Invert Level is 3.5m
- Catchment Area: 0.68km^2

Plate 1: Location No. 803 (27T)

This structure is included in Lot 2 within the first pool of priority investments, it was visited during the survey to flood prone areas in Ibadan under "Batch 18". This structure is also one of the structures recommended by Oyo State Task Force no. 27. The crossing road of this culvert an express way, the catchment area of this crossing structure is 0.68 km2 and lying on natural stream, and thus considered as one of the crossing locations lying in the second division. Table 1 presents a tabularized form of the presented data above and similar data to other structures in the second division. Structure no. 803 indicated above is outlined in red.

Table 1 presents the following fields:

- Subbasin name and Id,
  e.g. Structure 803 lies in Upper Ogbere with Id no. Ob2
- Crossing number (Structure no.)
  e.g. this is structure no. 803
- Batch ID
  e.g. Structure no. 803 was visited in Ibadan under "Batch 18".
- The Address (Location)
  e.g. Structure no. 803 lies NEW IFE ROAD
- The Existing Crossing Structure Type
  e.g. Structure no. 803 is a culvert
- The Existing Crossing Structure Dimensions
  e.g. Structure no. 803 is 2 CC (0.9) which means 2 Circular Culvert with a diameter of 0.9m.

- The Vertical Distance between the Road Level and the Culvert Invert Level.
  e.g. for Structure no. 803; this distance is 3.5m which means that the overburden depth (earth cover) between road level and the top of the culvert is around 2.6m.
- The Easting and Northing in WGS 1984 coordinate system – UTM Zone 31N
  e.g. for Structure no. 803; the Easting position is 604,381m while the Northing position is 818,291m.
- The Condition of the structure
  e.g. for Structure no. 803; the condition of this culvert is good
- The contributing rainfall Catchment Area of each structure.
  e.g. Structure no. 803 has a contributing rainfall catchment area of 0.68km^2
- The Cross-Road Classification
  e.g. Structure no. 803 lies on an express way.

Structure no. 803 is assessed based on the hydraulic design criteria presented in Annex 14. The flow is extracted from the rainfall-runoff model (HEC-HMS) model for both a 25-, and a 100-year return period. The following data is extracted from the rainfall-runoff model:

- The 25-year flow for structure no. 803 is 12.14 m^3/s, while
- The 100-year flow for structure no. 803 is 17 m^3/s.

The topographic slope of the tributary is extracted from the LiDAR Digital Elevation Model. The slope of the tributary along the reach passing through Structure no. 803 is 0.3%.

To assess the capacity of Structure no. 803, the dimensions of the structure is inserted in the commercial software hydraulic model (Culvert Master). The existing dimensions of the structure is 2 Circular Culvert (0.9m) and topographic slope of the tributary (0.3%).

The analysis reveal that the capacity of this structure can accommodate a flow of 2.4 m^3/s which is far below the 25-year flow (12.14 m3/s). The culvert is considered hydraulically inadequate to convey the flow. Figure 1 presents the analysis of the structure no. 803 using (Culvert Master by Bentley).

The remarks based on survey conducted in 2017 reveals that this Culvert inlet is filled with sediments. While, since the structural condition of the culvert is good, the culvert is considered as structurally adequate.

Based on the above it is necessarily to rehabilitate this structure such that it may convey the design flow. This data is also added to the GIS geodatabase.

Table 2 presents some of the fields of Table 1 in addition to the following fields:

- Existing Crossing Structure Dimensions
  e.g. Structure no. 803 is 2 CC (0.9) which means 2 Circular Culvert with a diameter of 0.9m.
- The 25-year flow
  e.g. for structure no. 803, the 25-year flow is 12.14 m^3/s
- The 100-year flow
  e.g. for structure no. 803, the 100-year flow is 17 m^3/s
- Existing Flow Capacity.
  e.g. for structure no. 803, the existing flow capacity is 2.4 m^3/s based on the Culvert Master calculations.
- Hydraulic Adequacy
  e.g. Structure no. 803 is hydraulically inadequate because the capacity of this structure can accommodate a flow of 2.4 m^3/s which is far below the 25-year flow (12.14 m3/s).
- Structural Adequacy
  e.g. Structure no. 803 is structurally adequate.
- Necessity for a New structure
  e.g. for structure no. 803, it is necessary to rehabilitate this structure.

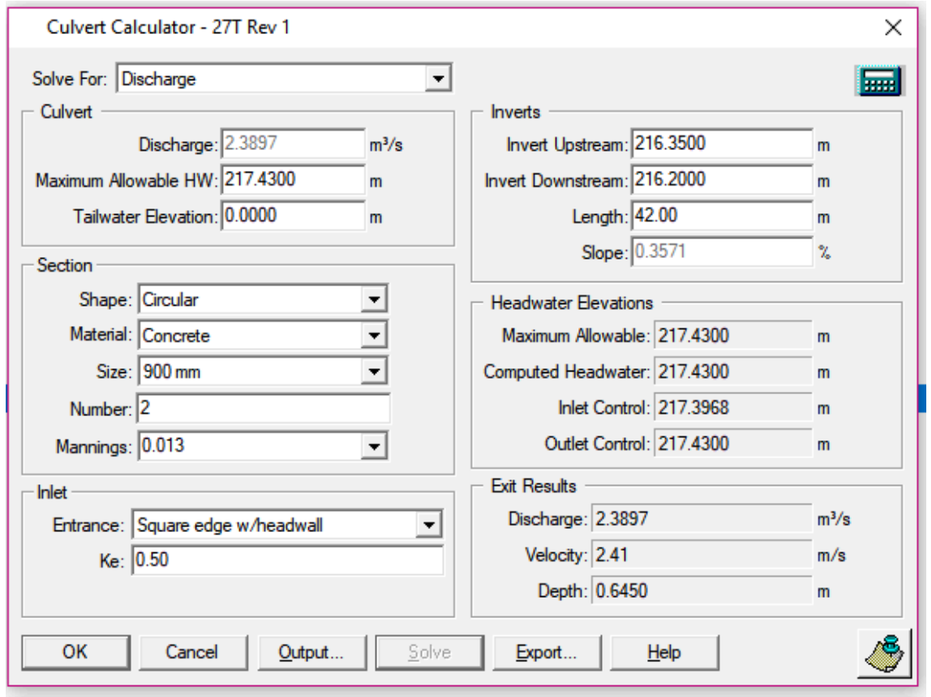

Figure 1: Assessment of the Existing Capacity of Crossing Structure No. 803 using Culvert Master

Table 1: Structure Data of Structure NO. 803

Subbasin	Structure No.	Batch_ID	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification
Subbasin	Structu_No	Batch_ID	Address	Ext_St_Typ	Ext_St_Dim	VD_RC	Easting	Northing	Condition	Cat_A_Km2	X_RoadClas
Ob2 Upper Ogbere	316	Core 2	Tujuka Area	Culvert	1 BC (3 x 1.7)	2.0	603730	815060	Good	0.46	Secondary
	791	Batch 18	BASORUN/IWO ROAD	Culvert	2 BC (2.2 x 1.75)	2.1	603412	818919	Good	0.53	Tertiary
	792	Batch 18	IWO ROAD	Culvert	2 BC (2.31 x 1.31)	1.5	603412	818905	Good	0.56	Tertiary
	793	Batch 18	AKERE/IWO RAOD	Culvert	1 BC (2.88 x 1.46)	1.7	603461	819470	Good	0.57	Tertiary
	88	Batch 0	SAWMILL / ALARERE	Culvert	2 CC (Dia 0.95)	2.1	604211	817085	Erosion	0.61	Tertiary
	794	Batch 18	AKERE/IWO RAOD	Culvert	1 BC (2.38 x 1.41)	1.7	603714	819457	Fair	0.63	Tertiary
	803	Batch 18	NEW IFE ROAD	Culvert	2 CC (Dia 0.9)	3.5	604381	818291	Good	0.68	Expressway
	308	Core 2	Akinyele	Culvert	2 CC (Dia 0.85)	1.3	604078	816930	Poor	0.72	Tertiary
	301	Core 2	Fagbamile Area	Culvert	2 BC (1.7 x 2.27)	2.4	602775	817841	Good	0.73	Tertiary
	423	Core 4	Olorunshogo	Culvert	3 BC (2.9 x 2.35)	2.7	603068	814305	Good	0.75	Tertiary
	85	Batch 0	MUFULANIMUN	Culvert	2 BC (2.17 x 1.57)	1.8	602991	816510	Erosion	0.75	Tertiary
	798	Batch 18	AMUDA OOJERE/IWO ROAD	Culvert	2 BC (2.86 x 1.87)	2.2	604364	819408	Good	0.88	Tertiary

Table 2: Structure Assessment of Structure NO. 803

Subbasin	Structure No.	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Condition	Catchment Area (km2)	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Design Flow (m3/s)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necessity for a New structure
Subbasin	Structu_No	Ext_St_Typ	Ext_St_Dim	Condition	Cat_A_Km2	Remarks			DsnFlowCMS	Ex_FlowCap	Hydr_Adeq	Struc_Adeq	Nec_New_st
Ob2 Upper Ogbere	316	Culvert	1 BC (3 x 1.7)	Good	0.46		6.90	9.20	9.20	10.9	Adequate	Adequate	No
	791	Culvert	2 BC (2.2 x 1.75)	Good	0.53		7.72	10.30	10.30	15.3	Adequate	Adequate	No
	792	Culvert	2 BC (2.31 x 1.31)	Good	0.56		7.95	10.60	10.60	10.9	Adequate	Adequate	No
	793	Culvert	1 BC (2.88 x 1.46)	Good	0.57	FLOODED ALWAYS NEED URGENT ATTENTION	8.02	10.70	10.70	8.3	Inadequate	Adequate	Yes
	88	Culvert	2 CC (Dia 0.95)	Erosion	0.61		8.33	11.10	11.10	1.7	Inadequate	Inadequate	Yes
	794	Culvert	1 BC (2.38 x 1.41)	Fair	0.63	FLOODED ALWAYS	8.47	11.30	11.30	6.3	Inadequate	Inadequate	Yes
	803	Culvert	2 CC (Dia 0.9)	Good	0.68	THE INLECT IS FILLED WITH SEDIMENTS	12.14	17.00	17.00	2.4	Inadequate	Adequate	Yes
	308	Culvert	2 CC (Dia 0.85)	Poor	0.72	The Area is always flooded during rain	9.15	12.20	12.20	1.3	Inadequate	Inadequate	Yes
	301	Culvert	2 BC (1.7 x 2.27)	Good	0.73	The area is flooded during rain	9.23	12.30	12.30	15.3	Adequate	Adequate	No
	423	Culvert	3 BC (2.9 x 2.35)	Good	0.75		9.38	12.50	12.50	49.3	Adequate	Adequate	No
	85	Culvert	2 BC (2.17 x 1.57)	Erosion	0.75		9.38	12.50	12.50	13.0	Adequate	Inadequate	Yes
	798	Culvert	2 BC (2.86 x 1.87)	Good	0.88		10.35	13.80	13.80	23.5	Adequate	Adequate	No

Structure Data												Structure Assessment						
Subbasin	Structure No.	Batch_ID	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Design Flow (m3/s)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
Subbasin	Structu_No	Batch_ID	Address	Ext_St_Typ	Ext_St_Dim	VD_RC	Easting	Northing	Condition	Cat_A_Km2	X_RoadClas	Remarks			DsnFlowCMS	Ex_FlowCap	Hydr_Adeq	Struc_Adeq	Nec_New_st
Ob1 Ogbere Headwaters	709	Batch 12	Alagbayun Akobo	Culvert	1 BC (2.16 x 0.93)	1.3	603322	821701	Good	0.25	Tertiary	Flooded the surrounding shops during heavy rain	3.75	5.00	5.00	3.0	Inadequate	Adequate	Yes
	714	Batch 12	Anifalaje	Culvert	2 CC (Dia 0.9)	1.3	604066	822261	Good	0.25	Tertiary		3.75	5.00	5.00	1.5	Inadequate	Adequate	Yes
	711	Batch 12	Kolapo Ishola GRA	Culvert	1 BC (2.2 x 1.93)	2.3	604811	820678	Good	0.27	Tertiary		4.05	5.40	5.40	8.8	Adequate	Adequate	No
	717	Batch 12	Oluwatedo estate	Culvert	1 BC (2.5 x 1.56)	1.9	604929	822202	Good	0.29	Secondary	Overflow into the surface during heavy rainfall	4.35	5.80	5.80	7.7	Adequate	Adequate	No
	710	Batch 12	Kolapo Ishola GRA	Culvert	1 BC (2.4 x 1.5)	1.8	604582	820564	Good	0.41	Tertiary		6.15	8.20	8.20	6.9	Inadequate	Adequate	Yes
	716	Batch 12	Omolayo	Culvert	1 BC (1.9 x 2.3)	6.0	604584	822215	Fair	0.47	Main		7.05	9.40	9.40	9.1	Adequate	Inadequate	Yes
	712	Batch 12	Abake estate-Akobo	Culvert	1 BC (2.9 x 2.09)	2.4	604404	821499	Good	0.49	Secondary		7.35	9.80	9.80	14.0	Adequate	Adequate	No
	715	Batch 12	Anifalaje	Culvert	2 CC (Dia 0.9)	1.1	604355	822178	Fair	0.69	Tertiary	Flooded the area during heavy rain fall	8.92	11.90	11.90	1.5	Inadequate	Inadequate	Yes
	708	Batch 12	Ajimututu Gas land	Culvert	1 BC (1.8 x 1.87)	3.4	603671	821266	Good	0.76	Main		9.45	12.60	12.60	6.4	Inadequate	Adequate	Yes
	707	Batch 12	Bashorun Estate Akobo	Natural Stream		1.1	603858	821182	Poor	0.88	Tertiary	The flood enter nearby houses during heavy rain	10.35	13.80	13.80	8.3	Inadequate	Inadequate	Yes
Ob2 Upper Ogbere	309	Core 2	Sawmill	Culvert	1 BC (1.3 x 0.89)	1.0	604041	816887	Poor	0.01	Tertiary		0.15	0.20	0.20	1.5	Adequate	Inadequate	Yes
	313	Core 2	Ido Oro Ayekale	Culvert	1 BC (1.3 x 0.9)	1.0	602862	815443	Fair	0.10	Tertiary	The area is flooded due to small culvet	1.50	2.00	2.00	1.6	Inadequate	Inadequate	Yes
	314	Core 2	Ayetoro Ifelodun Baba rere	Culvert	2 BC (2.38 x 1.95)	2.1	603149	814754	Good	0.12	Tertiary		1.80	2.40	2.40	19.7	Adequate	Adequate	No
	804	Batch 18	AYEPE	Culvert	1 BC (2.04 x 0.92)	1.3	604904	818459	Good	0.15	Tertiary		2.25	3.00	3.00	2.8	Adequate	Adequate	No
	702	Batch 12	Bashorun	Culvert	1 BC (2.53 x 1.15)	1.5	603129	819900	Good	0.17	Tertiary		2.55	3.40	3.40	5.0	Adequate	Adequate	No
	311	Core 2	Ogbere Idi osan Efun Kobiowu	Culvert	1 BC (1.2 x 1.07)	1.2	604359	816128	Poor	0.17	Tertiary		2.55	3.40	3.40	1.8	Inadequate	Inadequate	Yes
	706	Batch 12	Kajola	Natural Stream		0.5	604748	819690	Poor	0.20	Tertiary		3.00	4.00	4.00	1.9	Inadequate	Inadequate	Yes
	421	Core 4	Ona-Ara	Culvert	1 BC (0.84 x 1.69)	1.9	602658	814364	Fair	0.21	Tertiary		3.15	4.20	4.20	2.0	Inadequate	Inadequate	Yes
	315	Core 2	Olopo Meta	Culvert	2 BC (1.8 x 1.6)	1.8	602696	814665	Fair	0.23	Tertiary		3.45	4.60	4.60	10.4	Adequate	Inadequate	Yes
	307	Core 2	Old Ife Road	Culvert	1 BC (1.4 x 1.6)	1.8	604493	817356	Dilapidated	0.24	Tertiary		3.60	4.80	4.80	3.7	Inadequate	Inadequate	Yes
	705	Batch 12	Kajola Agric	Culvert	1 BC (1.8 x 1.9)	2.2	604659	819628	Fair	0.25	Tertiary	Flooded the street and enter houses	3.75	5.00	5.00	6.6	Adequate	Inadequate	Yes
	701 Prime	Batch 12	Bashorun	Culvert	2 CC (Dia 0.9)	1.3	603281	819691	Fair	0.29	Tertiary	overflow into the surounding during heavy rain	4.35	5.80	5.80	1.5	Inadequate	Inadequate	Yes
	351	Core 2	Agbakin	Culvert	1 BC (1.4 x 1.24)	1.4	602419	818191	Fair	0.29	Tertiary	The is usually overflow	4.35	5.80	5.80	2.7	Inadequate	Inadequate	Yes
	422	Core 4	Orisunbare	Culvert	2 BC (2.46 x 2.33)	2.7	602743	814529	Good	0.30	Tertiary		4.50	6.00	6.00	26.2	Adequate	Adequate	No
	312	Core 2	Maku	Culvert	1 BC (1.6 x 1.6)	2.0	604179	816267	Poor	0.32	Tertiary	The area is always flooded during rainn	4.80	6.40	6.40	4.5	Inadequate	Inadequate	Yes
	701	Batch 12	Bashorun	Natural Stream		1.0	603260	819649	Poor	0.34	Tertiary		5.10	6.80	6.80	6.5	Adequate	Inadequate	Yes
	300	Core 2	Agbakin	Culvert	1 CC (Dia 1.1)	1.4	602435	818097	Fair	0.35	Tertiary		5.25	7.00	7.00	1.3	Inadequate	Inadequate	Yes
	800	Batch 18	MANATAN/IWO ROAD	Culvert	1 BC (1.54 x 1.02)	1.3	604558	819325	Good	0.37	Tertiary	FLOODED ALWAYS	5.55	7.40	7.40	2.3	Inadequate	Adequate	Yes
	306	Core 2	Aromolaran	Culvert	2 BC (3 x 1.8)	2.2	602710	816869	Good	0.39	Secondary		5.85	7.80	7.80	23.7	Adequate	Adequate	No
	799	Batch 18	ACADEMY/IWO ROAD	Culvert	1 BC (1.52 x 1.64)	1.8	604490	819350	Good	0.42	Tertiary	FLOODED ALWAYS	6.30	8.40	8.40	4.3	Inadequate	Adequate	Yes
	700	Batch 12	Bashorun	Culvert	2 CC (Dia 0.7) + 1 BC (1.55 x 1.3)	1.5	603328	819626	Fair	0.44	Tertiary	Flooded the area during heavy rain	6.60	8.80	8.80	4.0	Inadequate	Inadequate	Yes
	316	Core 2	Tujuka Area	Culvert	1 BC (3 x 1.7)	2.0	603730	815060	Good	0.46	Secondary		6.90	9.20	9.20	10.9	Adequate	Adequate	No
	791	Batch 18	BASORUN/IWO ROAD	Culvert	2 BC (2.2 x 1.75)	2.1	603412	818919	Good	0.53	Tertiary		7.72	10.30	10.30	15.3	Adequate	Adequate	No
	792	Batch 18	IWO ROAD	Culvert	2 BC (2.31 x 1.31)	1.5	603412	818905	Good	0.56	Tertiary		7.95	10.60	10.60	10.9	Adequate	Adequate	No
	793	Batch 18	AKERE/IWO RAOD	Culvert	1 BC (2.88 x 1.46)	1.7	603461	819470	Good	0.57	Tertiary	FLOODED ALWAYS NEED URGENT ATTENTION	8.02	10.70	10.70	8.3	Inadequate	Adequate	Yes
	88	Batch 0	SAWMILL / ALARERE	Culvert	2 CC (Dia 0.95)	2.1	604211	817085	Erosion	0.61	Tertiary		8.33	11.10	11.10	1.7	Inadequate	Inadequate	Yes
	794	Batch 18	AKERE/IWO RAOD	Culvert	1 BC (2.38 x 1.41)	1.7	603714	819457	Fair	0.63	Tertiary	FLOODED ALWAYS	8.47	11.30	11.30	6.3	Inadequate	Inadequate	Yes
	803	Batch 18	NEW IFE ROAD		2 CC (Dia 0.9)	3.5	604381	818291	Good	0.68	Expressway	THE INLECT IS FILLED WITH SEDIMENTS	12.14	17.00	17.00	2.4	Inadequate	Adequate	Yes
	308	Core 2	Akinyele	Culvert	2 CC (Dia 0.85)	1.3	604078	816930	Poor	0.72	Tertiary	The Area is always flooded during rain	9.15	12.20	12.20	1.3	Inadequate	Inadequate	Yes
	301	Core 2	Fagbamile Area	Culvert	2 BC (1.7 x 2.27)	2.4	602775	817841	Good	0.73	Tertiary	The area is flooded during rain	9.23	12.30	12.30	15.3	Adequate	Adequate	No
	423	Core 4	Olorunshogo	Culvert	3 BC (2.9 x 2.35)	2.7	603068	814305	Good	0.75	Tertiary		9.38	12.50	12.50	49.3	Adequate	Adequate	No
	85	Batch 0	MUFULANIMUN	Culvert	2 BC (2.17 x 1.57)	1.8	602991	816510	Erosion	0.75	Tertiary		9.38	12.50	12.50	13.0	Adequate	Inadequate	Yes
	798	Batch 18	AMUDA OOJERE/IWO ROAD	Culvert	2 BC (2.86 x 1.87)	2.2	604364	819408	Good	0.88	Tertiary		10.35	13.80	13.80	23.5	Adequate	Adequate	No
	302	Core 2	Agbala Itura Fagbamila Area	Culvert	1 BC (3.2 x 1.77)	2.0	602912	817714	Fair	0.88	Tertiary	The area is flooded during rain	10.35	13.80	13.80	12.5	Inadequate	Inadequate	Yes
	424	Core 4	Ogbere	Culvert	3 BC (1.42 x 2.57)	3.0	603336	814237	Fair	0.89	Tertiary		10.42	13.90	13.90	20.9	Adequate	Inadequate	Yes
	303	Core 2	Agbala Itura	Footpath		4.0	603074	817667	Poor	0.94	Tertiary	The area is flooded during rain	10.80	14.40	14.40	125.0	Adequate	Inadequate	Yes
	305	Core 2	Oremeji C.A.C	Bridge	1 BC (1.8 x 1.5)	5.0	603140	816454	Good	0.99	Expressway		11.18	14.90	14.90	4.8	Inadequate	Adequate	Yes

Structure Data												Structure Assessment						
Subbasin	Structure No.	Batch_ID	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Design Flow (m3/s)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
Ob3 Middle Ogbere	908	Batch 24	OLOMI		1 CC (Dia 0.74)	0.9	602045	811343		0.11	Tertiary	FLOODED ALWAYS	1.65	2.20	2.20	0.4	Inadequate	Inadequate	Yes
	86D	PIU 4th List	Ogbere housing Estate, akanran road.	Pipe Culvert	1 CC (Dia 0.6)		603957	813041		0.11	Main	The culvert is inadequate therefore the sorounding is usually flooded.	1.71	2.27	2.27	0.3	Inadequate	Inadequate	Yes
	417	Core 4	Akanran	Culvert	1 CC (Dia 0.8)	1.2	601900	813186	Fair	0.13	Tertiary		1.95	2.60	2.60	0.6	Inadequate	Inadequate	Yes
	347	Core 2	Binukonu Zone	Footpath		1.2	604511	814697	Poor	0.14	Tertiary	The rim is damaged and the area is flooded during rain	2.10	2.80	2.80	8.4	Adequate	Inadequate	Yes
	416	Core 4	Akanran	Culvert	1 CC (Dia 0.8) + 1 BC (3.6 x 1.3)	1.3	602006	813307	Erosion	0.15	Tertiary		2.25	3.00	3.00	9.7	Adequate	Inadequate	Yes
	913	Batch 24	AYEDAADE/AGRIC/OLOMI	Natural Stream		1.3	602054	810648	Poor	0.19	Tertiary	FLOODED OCCASSIONALLY	2.85	3.80	3.80	16.7	Adequate	Inadequate	Yes
	905	Batch 24	OLORUNKEMI	Culvert	2 BC (2.99 x 2.7)	3.2	601688	811908	Good	0.20	Tertiary	FLOODED OCCASSIONALLY	3.00	4.00	4.00	41.3	Adequate	Adequate	No
	414	Core 4	Akanran	Natural Stream		0.4	602355	813534	Erosion	0.21	Tertiary		3.15	4.20	4.20	1.5	Inadequate	Inadequate	Yes
	435	Core 4	Orisunbare	Natural Stream		1.8	604253	813824	Poor	0.24	Tertiary	For Attention	3.60	4.80	4.80	19.1	Adequate	Inadequate	Yes
	411	Core 4	Irepodun Street	Culvert	1 BC (2 x 1.37)	1.6	602483	812915	Good	0.25	Tertiary		3.75	5.00	5.00	4.8	Adequate	Adequate	No
	912	Batch 24	MOBOLORUNDURO/OMIYALE	Footpath		2.5	602128	810931	Poor	0.26	Tertiary	FLOODED ALWAYS	3.90	5.20	5.20	48.4	Adequate	Inadequate	Yes
	86D1	PIU 4th List	Ogbere housing Estate, akanran road.	Box Culvert	1 BC (1 x 0.8)		603796	812750		0.27	Tertiary	Erosion and damaged channel box section / The culvert appears in a fair condition.	3.98	5.30	5.30	0.9	Inadequate	Inadequate	Yes
	86D2	PIU 4th List	Ogbere housing Estate, akanran road.	Box Culvert	1 BC (1.7 x 0.8)		603762	812686		0.27	Tertiary	The culvert appears in a fair condition. The request from the community is channelisation of this stream	3.98	5.30	5.30	1.8	Inadequate	Inadequate	Yes
	86D3	PIU 4th List	Ogbere housing Estate, akanran road.	Footpath			603706	812610		0.27	Tertiary	The request from the community is channelisation of this stream	3.98	5.30	5.30		Inadequate	Inadequate	Yes
	418	Core 4	Mushin	Footpath		2.1	601977	813460	Poor	0.27	Tertiary		4.05	5.40	5.40	45.1	Adequate	Inadequate	Yes
	410	Core 4	Ifelodun	Footpath		1.7	602762	812524	Erosion	0.28	Tertiary	For Attention	4.20	5.60	5.60	26.3	Adequate	Inadequate	Yes
	434	Core 4	Akilapa Ogbere	Culvert	2 CC (Dia 0.8)	1.1	604216	814450	Poor	0.37	Secondary	The area is always flooded whenever it rain	5.55	7.40	7.40	1.1	Inadequate	Inadequate	Yes
	429	Core 4	Oritamerrin road	Culvert	1 BC (2.6 x 1.3)	2.5	603974	813905	Poor	0.43	Secondary		6.45	8.60	8.60	6.2	Inadequate	Inadequate	Yes
	433	Core 4	Akilapa Okeogbere	Natural Stream		0.9	604142	814332	Erosion	0.49	Tertiary		7.35	9.80	9.80	5.2	Inadequate	Inadequate	Yes
	432	Core 4	Ogbere	Natural Stream		1.3	604102	814278	Erosion	0.50	Tertiary	Damaged culvert	7.50	10.00	10.00	8.7	Inadequate	Inadequate	Yes
	408	Core 4		Culvert	1 BC (1 x 1.1)	1.3	603566	812512	Poor	0.52	Tertiary	For Attention	7.65	10.20	10.20	1.4	Inadequate	Inadequate	Yes
	415	Core 4	Akanran	Footpath		1.2	602181	813390	Erosion	0.52	Tertiary		7.65	10.20	10.20	11.2	Adequate	Inadequate	Yes
	431	Core 4	Ogbere	Culvert	4 CC (Dia 0.77)	1.0	604032	814148	Poor	0.56	Tertiary		7.95	10.60	10.60	2.0	Inadequate	Inadequate	Yes
	409	Core 4		Footpath		2.1	603454	812408	Poor	0.57	Tertiary	The area is always flooded whenever it rain	8.02	10.70	10.70	41.5	Adequate	Inadequate	Yes
	86D4	PIU 4th List	Ogbere housing Estate, akanran road.	Box Culvert	1 BC (0.75 x 1)		603595	812535		0.57	Tertiary	New Box Culvert / Erosion in downstream channel	8.03	10.70	10.70	0.9	Inadequate	Inadequate	Yes
	430	Core 4	Ogbere	Culvert	2 BC (2.4 x 1.83)	2.1	604003	814025	Good	0.61	Tertiary		8.33	11.10	11.10	18.2	Adequate	Adequate	No
	75	Batch 0	ALABEDE OGBERETIOYA	Footpath		2.1	603931	813953	Dilapidated	0.66	Tertiary	Footstep	8.70	11.60	11.60	13.5	Adequate	Inadequate	Yes
	906	Batch 24	OLOMI/MOSFALA	Culvert	1 BC (2.7 x 1.92)	2.2	602158	811971	Good	0.68	Tertiary	FLOODED ALWAYS	8.85	11.80	11.80	11.3	Adequate	Adequate	No
	914	Batch 24	OLOMI	Culvert	1 BC (1.88 x 1.66)	1.9	602432	810728	Good	0.73	Tertiary	FLOODED OCCASSIONALLY	9.23	12.30	12.30	5.8	Inadequate	Adequate	Yes
	413	Core 4	Akanran	Footpath		1.6	602388	813360	Erosion	0.83	Tertiary		9.97	13.30	13.30	34.9	Adequate	Inadequate	Yes
	907	Batch 24	MOSFALA ZONE 2	Footpath		3.2	602326	811724	Poor	0.91	Tertiary	FLOODED ALWAYS	10.58	14.10	14.10	131.5	Adequate	Inadequate	Yes
	915	Batch 24	PAPA ELEYE	Culvert	1 BC (3 x 1.82)	2.1	602700	810639	Good	0.95	Tertiary	FLOODED OCCASSIONALLY	10.87	14.50	14.50	12.0	Inadequate	Adequate	Yes
	412	Core 4	Akanran	Culvert	2 BC (1.94 x 1.82)	2.0	602578	813249	Fair	0.95	Tertiary		10.87	14.50	14.50	13.7	Adequate	Inadequate	Yes
	1053	Batch 19	Airport Area	Natural Stream		1.1	607216	815052	Poor	0.10	Main		1.50	2.00	2.00	12.7	Adequate	Inadequate	Yes
	1123	Batch 25	Aiport -Alakia	Culvert	2 BC (1.66 x 1.45)	1.7	607021	814431	Good	0.12	Tertiary		1.80	2.40	2.40	8.2	Adequate	Adequate	No
	333	Core 2	Ifeolu IGEM	Footpath		1.3	607121	815009	Poor	0.12	Tertiary		1.80	2.40	2.40	7.7	Adequate	Inadequate	Yes
	343	Core 2	Akoka fast fast Area	Culvert	1 BC (1.3 x 0.8)	1.3	605230	816784	Fair	0.14	Tertiary	The drainage usually overflow	2.10	2.80	2.80	1.3	Inadequate	Inadequate	Yes
	921	Batch 24	PALUPO/ASOLO		1 CC (Dia 0.76)	1.1	605876	811276		0.15	Secondary	FLOODED ALWAYS	2.25	3.00	3.00	0.5	Inadequate	Inadequate	Yes
	346	Core 2	Irapada	Culvert	1 BC (1.8 x 1.53)	1.8	606354	816347	Good	0.17	Tertiary		2.55	3.40	3.40	4.9	Adequate	Adequate	No
	1125	Batch 25	Aiport	Culvert	1 BC (5.25 x 0)	2.4	607555	813548	Fair	0.19	Tertiary	No access to measure the crown level	2.85	3.80	3.80		Inadequate	Inadequate	Yes
	400	Core 4	Sogade Area	Culvert	1 BC (1.3 x 1.41)	1.7	604506	812173	Fair	0.19	Tertiary		2.85	3.80	3.80	2.9	Inadequate	Inadequate	Yes
	407	Core 4	Sogade	Culvert	1 CC (Dia 0.7)	1.9	605542	811846	Good	0.19	Main		2.85	3.80	3.80	0.4	Inadequate	Adequate	Yes
	1169	Batch 25	Aiport	Culvert	1 CC (Dia 0.6)	2.3	607431	813394	Fair	0.21	Tertiary	No access to measure crown level	3.15	4.20	4.20	0.3	Inadequate	Inadequate	Yes
	54D1	PIU 1st List	OREDEGBE LANDLORD/LANDLADY ASSOCIATION BIOKU ADEYELU OGBERE	Natural Stream			605235	814598		0.27	Tertiary	Gullies eroding the pathway between houses, primative footstep to pass the stream	4.05	5.40	5.40		Inadequate	Inadequate	Yes
	341	Core 2	Ogbere Idi Osan	Culvert	1 BC (3 x 1.7)	1.8	604941	816260	Fair	0.27	Secondary	The area is flooded during heavy rain	4.05	5.40	5.40	10.9	Adequate	Inadequate	Yes
	1126	Batch 25	Aiport	Culvert	1 CC (Dia 0.9)	1.4	606770	812534	Fair	0.28	Tertiary		4.20	5.60	5.60	0.8	Inadequate	Inadequate	Yes
	1124	Batch 25	Aiport -Alakia	Culvert	2 CC (Dia 0.8)	1.3	607143	814524	Good	0.29	Main		4.35	5.80	5.80	1.1	Inadequate	Adequate	Yes
	399	Core 4	Akanran	Culvert	1 BC (3.2 x 2.41)	2.7	604506	812887	Good	0.31	Tertiary		4.65	6.20	6.20	19.3	Adequate	Adequate	No
	444	Core 4	Melangbi -Aladi	Culvert	2 CC (Dia 0.8)	1.1	605762	812906	Dilapidated	0.31	Tertiary	For Attention	4.65	6.20	6.20	1.1	Inadequate	Inadequate	Yes
	920	Batch 24	AIRPORT AREA		1 CC (Dia 0.78)	1.1	606255	811916		0.33	Tertiary	FLOODED OCCASSIONALLY	4.95	6.60	6.60	0.5	Inadequate	Inadequate	Yes

Structure Data												Structure Assessment						
Subbasin	Structure No.	Batch_ID	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Design Flow (m3/s)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
Ob4 Foworogbun	336	Core 2	Akinfenwa	Culvert	1 CC (Dia 0.9)	1.3	606251	816194	Poor	0.35	Secondary		5.25	7.00	7.00	0.8	Inadequate	Inadequate	Yes
	332	Core 2	Gbaremu Idi Obi	Bridge	1 BC (4.4 x 2)	2.8	607046	815227	Good	0.37	Main	Some houses affected during heavy rain	5.55	7.40	7.40	22.1	Adequate	Adequate	No
	929	Batch 24	IDI OSAN/AMULOKO	Culvert	2 BC (1.2 x 1.23)	1.5	606130	810724	Good	0.40	Secondary		6.00	8.00	8.00	4.3	Inadequate	Adequate	Yes
	1058	Batch 19	Alakia	Culvert	3 CC (Dia 0.37)	2.1	607055	816323	Fair	0.43	Tertiary		6.45	8.60	8.60	0.2	Inadequate	Inadequate	Yes
	398	Core 4	Alare/Oke Jegede	Footpath		1.1	604651	812801	Poor	0.43	Tertiary	The area is always flooded whenever it rain	6.45	8.60	8.60	9.9	Adequate	Inadequate	Yes
	903	Batch 24	ABABO OLOYA	Culvert	1 BC (2.27 x 2.48)	2.7	604473	811472	Good	0.44	Tertiary	FLOODED OCCASSIONALLY	6.60	8.80	8.80	12.8	Adequate	Adequate	No
	339	Core 2	Ifewumi Esankigbe	Culvert	1 BC (1.42 x 1)	1.4	605141	815396	Good	0.44	Tertiary	Some houses are flooded during rain	6.60	8.80	8.80	2.0	Inadequate	Adequate	Yes
	807	Batch 18	JAGUN/ NEW GBAGI	Natural Stream		0.5	605937	816912	Poor	0.45	Tertiary	FLOODED ALWAYS. NEEDS ATTENTION	6.75	9.00	9.00	0.9	Inadequate	Inadequate	Yes
	919	Batch 24	AIRPORT AREA	Culvert	1 BC (0.88 x 0.88)	1.1	606116	812080	Good	0.45	Tertiary	FLOODED ALWAYS	6.75	9.00	9.00	0.9	Inadequate	Adequate	Yes
	340	Core 2	Olaba Kajola	Culvert	2 BC (2.2 x 1.9)	2.2	605096	816057	Good	0.45	Secondary		6.75	9.00	9.00	17.1	Adequate	Adequate	No
	436	Core 4	Fagbile Itamerin	Footpath		2.4	605182	813747	Poor	0.45	Tertiary	The area is always flooded whenever it rain	6.75	9.00	9.00	33.4	Adequate	Inadequate	Yes
	806	Batch 18	JAGUN NEW GBAGI	Culvert	1 BC (0.9 x 0.84)	1.5	605874	816887	Good	0.46	Tertiary	FLOODED OCCASSIONALLY	6.90	9.20	9.20	0.9	Inadequate	Adequate	Yes
	925	Batch 24	ALAAKA		1 CC (Dia 0.64)	0.8	604699	810444		0.46	Tertiary	FLOODED ALWAYS	6.90	9.20	9.20	0.3	Inadequate	Inadequate	Yes
	1168	Batch 25	Aiport -Alakia	Culvert	1 BC (2 x 1.07)	1.3	607048	814496	Good	0.49	Tertiary		7.35	9.80	9.80	3.4	Inadequate	Adequate	Yes
	338	Core 2	Ifewumi Esankigbe	Culvert	1 BC (2.3 x 1.27)	1.7	605220	815431	Fair	0.49	Secondary	The culvet is small and flowback to 339 culvet	7.35	9.80	9.80	5.2	Inadequate	Inadequate	Yes
	406	Core 4	Alawaye Area	Culvert	1 BC (0.7 x 1.08)	1.3	605133	811709	Fair	0.49	Tertiary	there are two culvert here, old and new. The old one has been diverted	7.35	9.80	9.80	0.9	Inadequate	Inadequate	Yes
	337	Core 2	Gbaremu Area	Culvert	1 BC (2.9 x 1.81)	2.0	605307	815473	Good	0.50	Main		7.50	10.00	10.00	11.4	Adequate	Adequate	No
	397	Core 4	Olunloyo Area	Footpath		1.4	604795	812678	Poor	0.50	Tertiary		7.50	10.00	10.00	10.6	Adequate	Inadequate	Yes
	331	Core 2	Ireakari	Culvert	2 CC (Dia 0.8)	1.2	607116	816057	Fair	0.53	Tertiary		7.72	10.30	10.30	1.1	Inadequate	Inadequate	Yes
	335	Core 2	Akinfenwa	Footpath		0.5	606179	815938	Poor	0.55	Tertiary	The Area is always flooded during rain	7.88	10.50	10.50	5.6	Inadequate	Inadequate	Yes
	405	Core 4	Alawaye Area	Footpath		1.1	605050	811714	Poor	0.56	Tertiary	The area is always flooded whenever it rain	7.95	10.60	10.60	5.0	Inadequate	Inadequate	Yes
	928	Batch 24	ONIYEFUN		2 CC (Dia 0.76)	1.0	605891	810257		0.64	Tertiary	FLOODED ALWAYS	8.55	11.40	11.40	1.0	Inadequate	Inadequate	Yes
	446	Core 4	Isale Olunloyo	Culvert	1 BC (2.3 x 2.13)	2.4	604941	812572	Good	0.64	Tertiary		8.55	11.40	11.40	10.6	Adequate	Adequate	No
	334	Core 2	Akinfenwa Aroye	Culvert	1 BC (1.7 x 1.3)	2.2	606231	815667	Good	0.70	Secondary		9.00	12.00	12.00	3.6	Inadequate	Adequate	Yes
	1525	Batch 31	Ife Akintunde Layout Alakia	Culvert	1 BC (2.4 x 0.96)	1.3	607061	815903	Fair	0.75	Tertiary		9.38	12.50	12.50	3.6	Inadequate	Inadequate	Yes
	927	Batch 24	ONIYEFUN	Natural Stream		0.7	605829	810185	Poor	0.79	Tertiary	FLOODED ALWAYS	9.68	12.90	12.90	2.9	Inadequate	Inadequate	Yes
	330	Core 2	Hope	Natural Stream			607022	815820	Fair	0.80	Tertiary		9.75	13.00	13.00	6.6	Inadequate	Inadequate	Yes
	403	Core 4	Mosa Olunloyo Akanran	Culvert	2 CC (Dia 0.8)	1.1	605757	812197	Fair	0.84	Tertiary	For Attention	10.05	13.40	13.40	1.1	Inadequate	Inadequate	Yes
	922	Batch 24	ALAAKA/IDI OSAN/ADEYORI	Natural Stream		1.0	604784	810946	Poor	0.89	Tertiary	FLOODED ALWAYS, THE Natural Stream IS HAS RING BUT NOT IN USE BECAUSE WATER NO LONGER FLOW THROUGH THE RING CHANNEL ALTHOUGH THE RING CHANNEL TOTALLY BLOCKED WITH SEDIMENTS AT THE OTHER SIDE AS SHOWN IN THE PICTURE	10.42	13.90	13.90	9.2	Inadequate	Inadequate	Yes
	345	Core 2	Akingbade Abaede	Culvert	1 BC (3.1 x 1.45)	1.9	605623	816709	Fair	0.90	Tertiary	The area is flooded during rain	10.50	14.00	14.00	9.0	Inadequate	Inadequate	Yes
	923	Batch 24	ALAAKA/IDI OSAN		4 CC (Dia 0.78)	1.1	604677	810923		0.96	Tertiary	FLOODED ALWAYS, THE INLECT WAS TOTALLY BLOCKED WITH SEDIMENTS	10.95	14.60	14.60	2.1	Inadequate	Inadequate	Yes
	77	Batch 0	AGIGBOTOLUWA	Culvert	1 BC (2.2 x 1.08)	1.3	605500	812163	Fair	0.97	Tertiary		11.03	14.70	14.70	3.9	Inadequate	Inadequate	Yes
Ob5 Lower Ogbere North	1264	Batch 30	21 DIAMOND EST. AREA, IDI-AGBADO	Culvert	1 CC (Dia 0.78)	1.1	603271	806946	Good		Tertiary	Get flooded when it rains heavily.				0.5	Adequate	Adequate	No
	917	Batch 24	OLUNDE AREA	Natural Stream		1.2	601817	809776	Poor	0.12	Tertiary	FLOODED OCCASSIONALLY	1.80	2.40	2.40	10.8	Adequate	Inadequate	Yes
	1251	Batch 29	OLUWANISOLA,AJIMASIN ONIREKE	Natural Stream		0.4	600441	807372	Fair	0.15	Tertiary	Get flooded when it rains heavily.	2.25	3.00	3.00	1.3	Inadequate	Inadequate	Yes
	918	Batch 24	OBIDERE	Natural Stream		0.8	601925	809834	Poor	0.16	Tertiary		2.40	3.20	3.20	2.8	Inadequate	Inadequate	Yes
	1273	Batch 30	OLORUNTOYIN,IFESOWAPO AREA	Culvert	1 CC (Dia 0.55)	1.2	602358	806299	Fair	0.19	Tertiary	Get flooded when it rains heavily	2.85	3.80	3.80	0.2	Inadequate	Inadequate	Yes
	1252	Batch 30	ALAPATA AYETORO ALONG ONULA	Natural Stream		0.4	605763	808767	Poor	0.21	Secondary	The level of erosion is expanding, also get flooded when it rains heavily.	3.15	4.20	4.20	2.2	Inadequate	Inadequate	Yes
	1257	Batch 30	FIRE FIRE AREA,AGRIC OLOMI	Culvert	1 CC (Dia 0.6)	0.9	603304	809374	Fair	0.24	Tertiary	Get flooded when it rains heavily.	3.60	4.80	4.80	0.3	Inadequate	Inadequate	Yes
	1271	Batch 30	JELE RD,OGORI OLOJUORO	Culvert	1 BC (0.6 x 1.48)	1.8	601851	807599	Fair	0.24	Tertiary	Outlet not accessible.	3.60	4.80	4.80	1.0	Inadequate	Inadequate	Yes
	1249	Batch 29	OKE-ELESHIN	Culvert	2 BC (0.9 x 1.82)	1.9	600587	807492	Fair	0.25	Tertiary	Get flooded when it rains heavily	3.75	5.00	5.00	4.7	Adequate	Inadequate	Yes
	1250	Batch 29	ONIREKE, AGO OLUNDE	Footpath		1.4	600555	807440	Fair	0.26	Tertiary	Get flooded when it rains heavily.	3.90	5.20	5.20	2.3	Inadequate	Inadequate	Yes

Structure Data												Structure Assessment						
Subbasin	Structure No.	Batch_ID	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Design Flow (m3/s)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
	1268	Batch 30	BEHIND GOD MERCY APOTOLIC CHURCH, FATUNSI AREA	Culvert	1 BC (1.75 x 0.89)	1.1	602413	807539	Poor	0.27	Tertiary	Get floode when it rains heavily.	4.05	5.40	5.40	2.2	Inadequate	Inadequate	Yes
	1241	Batch 29	ANU-OLUWAPO ARANNI, AYEGUN	Natural Stream		0.1	601126	806244	Fair	0.31	Tertiary	The stream flow normal	4.65	6.20	6.20	0.1	Inadequate	Inadequate	Yes
	1248	Batch 29	AMUERE IRE-AIKARI JOGBIN OLUNDE	Culvert	1 CC (Dia 0.7)	0.9	601338	807866	Fair	0.37	Tertiary		5.55	7.40	7.40	0.4	Inadequate	Inadequate	Yes
	1262	Batch 30	GBAKO ISOKAN OFF OLOJUORO	Culvert	1 CC (Dia 0.6)	0.9	603743	807905	Fair	0.38	Tertiary	Get flooded when it rains heavily.	5.70	7.60	7.60	0.3	Inadequate	Inadequate	Yes
	1269	Batch 30	ABA-ASA	Culvert	1 BC (0.6 x 1.48)	1.8	602156	807966	Fair	0.40	Tertiary	Get flooded when it rains heavily.	6.00	8.00	8.00	1.0	Inadequate	Inadequate	Yes
	1254	Batch 30	OJE-SANMI , AYETORO	Culvert	2 CC (Dia 0.7)	1.0	605373	808768	Fair	0.42	Tertiary		6.30	8.40	8.40	0.8	Inadequate	Inadequate	Yes
	1259	Batch 30	FADIPE, IFESOWAPO	Culvert	1 BC (1.2 x 0.87)	1.1	604555	807410	Fair	0.42	Tertiary	Get flooded when it rains heavily.	6.30	8.40	8.40	1.3	Inadequate	Inadequate	Yes
	1253	Batch 30	ORISUNBARE ALAPATA, AYETORO	Culvert	1 CC (Dia 0.72)	1.1	605556	808981	Fair	0.52	Secondary	Some part of the road has been cutoff due to erosion.	7.65	10.20	10.20	0.4	Inadequate	Inadequate	Yes
	1272	Batch 30	JELE RD,OGORI OLOJUORO	Culvert	2 CC (Dia 0.8)	1.2	601652	807512	Fair	0.59	Tertiary		8.17	10.90	10.90	1.1	Inadequate	Inadequate	Yes
Ob6 Lower Ogbere South	1279	Batch 30	IFEOLUWA RD,ARAROMI	Natural Stream		0.3	602731	804758	Fair	0.47	Tertiary		7.05	9.40	9.40	0.6	Inadequate	Inadequate	Yes
	1275	Batch 30	LANIOKA ONIKEKE, SAMOUNJU	Culvert	1 BC (0.97 x 0.89)	1.2	603932	806301	Fair	0.64	Tertiary	Some part is stream not all is covered with culvert	8.55	11.40	11.40	1.0	Inadequate	Inadequate	Yes
	1276	Batch 30	LAKODUN EST. LAKO	Culvert	1 CC (Dia 0.6)	0.3	603043	805580	Poor	1.54	Tertiary	Culvert blocked with sands. Get flooded.	15.30	20.40	20.40	0.3	Inadequate	Inadequate	Yes
	1277	Batch 30	JAGUN,ONAYE RD	Culvert	2 CC (Dia 0.69)	1.5	603950	805302	Fair	1.63	Tertiary	Get flooded when it rains heavily	15.97	21.30	21.30	0.7	Inadequate	Inadequate	Yes
	1278	Batch 30	ABOLOKE,ARAROMI RD	Culvert	2 BC (1.5 x 1.28)	1.6	602999	805063	Poor	4.29	Tertiary	Get flooded when it rains heavily	35.92	47.90	47.90	6.1	Inadequate	Inadequate	Yes
	1280	Batch 30	ALAPE RD, ARAROMI	Culvert	2 CC (Dia 0.8)	1.3	602405	804727	Good	5.23	Main	Outlet invisible . Get flooded .	42.50	56.67	56.67	1.1	Inadequate	Adequate	Yes
Og1 Upper Ogunpa	785	Batch 17	Secretariat	Natural Stream		0.3	600514	819368	Poor		Secondary	This is wall fence between the secretariat and adjoining property				0.1	Adequate	Inadequate	Yes
	26D2	PIU 1st List	LEKAN SALAMI ESTATE, BODIJA	Box Culvert	2 BC (0.5 x 0.5)		601648	820151		0.12	Tertiary	Undersized culverts, downstream erosion, used for diversion of a small drainage stream	1.80	2.40	2.40	0.4	Inadequate	Inadequate	Yes
	699	Batch 12	Oluwo Nla Estate	Culvert	2 BC (2.51 x 2.14)	2.4	602632	819614	Good	0.19	Tertiary		2.85	3.80	3.80	24.0	Adequate	Adequate	No
	790	Batch 18	BASORUN	Culvert	1 BC (3.08 x 1.78)	2.1	602169	819255	Good	0.22	Tertiary		3.30	4.40	4.40	12.0	Adequate	Adequate	No
	674	Batch 11	New Bodija	Culvert	3 CC (Dia 0.85)	2.1	600610	820152	Fair	0.24	Tertiary	INLET WAS BLOCKED BY SEDIMENTS	3.60	4.80	4.80	1.9	Inadequate	Inadequate	Yes
	694	Batch 12	Deeper life Ashi	Culvert	2 CC (Dia 0.9)	1.3	602487	821729	Good	0.26	Tertiary	Flooded during heavy rain	3.90	5.20	5.20	1.5	Inadequate	Adequate	Yes
	25D	PIU 1st List	LALA AVENUE NEAR GLORY VIEW HOTEL KONGI BODIJA	Box Culvert	2 BC (1.8 x 1.2)		600921	821208		0.37	Tertiary	Clogged Culvert, erosion downstream, used for diversion of a small drainage stream	5.55	7.40	7.40	7.0	Adequate	Inadequate	Yes
	646	Batch 11	Old Bodija Estate	Culvert	1 CC (Dia 0.9)	1.8	599610	820538	Good	0.39	Tertiary		5.85	7.80	7.80	0.8	Inadequate	Adequate	Yes
	696	Batch 12	Ashi	Culvert	1 BC (2.4 x 2.21)	2.9	602730	820938	Good	0.40	Tertiary		6.00	8.00	8.00	11.8	Adequate	Adequate	No
	731	Batch 12	Oluwo Kekere Estate	Culvert	2 BC (2.49 x 2.74)	3.1	602220	819721	Good	0.46	Tertiary		6.90	9.20	9.20	33.0	Adequate	Adequate	No
	789	Batch 18	AGODI GRA	Culvert	1 BC (2.04 x 1.64)	2.0	601699	818740	Good	0.46	Tertiary		6.90	9.20	9.20	6.4	Inadequate	Adequate	Yes
	697	Batch 12	Ikolaba	Culvert	2 BC (2.49 x 2.74)	3.1	601866	819666	Good	0.50	Tertiary		7.50	10.00	10.00	33.0	Adequate	Adequate	No
	48	Batch 0	DLADEJI , CLOSE	Culvert	3 CC (Dia 0.95)	1.3	601103	820976	Fair	0.53	Tertiary		7.72	10.30	10.30	2.6	Inadequate	Inadequate	Yes
	698	Batch 12	Oluwo Kekere Estate	Culvert	1 BC (2.9 x 1.52)	1.9	601909	819712	Good	0.56	Tertiary	Overflow during heavy road	7.95	10.60	10.60	8.9	Inadequate	Adequate	Yes
	645	Batch 11	Old Bodija Estate	Culvert	2 BC (2.4 x 0.63)	0.9	599294	820190	Good	0.62	Tertiary	OVER FLOW INTO ROAD DURING RAIN	8.40	11.20	11.20	3.8	Inadequate	Adequate	Yes
	695	Batch 12	Deeper life Ashi	Footpath		1.5	602361	820984	Poor	0.66	Tertiary		8.70	11.60	11.60	9.6	Inadequate	Inadequate	Yes
	49	Batch 0	ASHI ROAD, BODIJA (OJU ODO ASHI ASHI RIVER)	Culvert	3 CC (Dia 1.05)	1.6	602157	821128	Erosion	0.74	Secondary		9.30	12.40	12.40	3.4	Inadequate	Inadequate	Yes
	644	Batch 11	Bodija Adeyi Junction	Culvert	2 BC (1.2 x 0.62)	1.5	599280	820090	Good	0.79	Main	The inlet of the channel is filled with sediment andoverflow into the road during heavy rainfall	9.68	12.90	12.90	1.7	Inadequate	Adequate	Yes
	643	Batch 11	Adeyi Estate	Culvert	2 CC (Dia 0.9)	1.9	599272	820016	Fair	0.81	Tertiary		9.83	13.10	13.10	1.5	Inadequate	Inadequate	Yes
	50	Batch 0	IKOLABA , GRA	Culvert	1 BC (2 x 1.5)	3.7	601288	818929	Erosion	0.85	Tertiary		10.13	13.50	13.50	5.5	Inadequate	Inadequate	Yes
	47	Batch 0	ADENUGA STREET , KONGI LAYOUT	Culvert	1 BC (3.26 x 2.1)	2.6	601136	820852	Fair	0.90	Tertiary		10.50	14.00	14.00	16.3	Adequate	Inadequate	Yes
	637	Batch 11	Adebajo, New Bodija, Adebajo Street	Culvert	1 BC (3.8 x 1.35)	2.0	601144	820754	Good	1.00	Secondary		11.25	15.00	15.00	10.4	Inadequate	Adequate	Yes
	782	Batch 17	Mokola	Culvert	2 BC (2.45 x 1.52)	1.8	598149	819238	Good		Tertiary					14.4	Adequate	Adequate	No
	73D	PIU 2nd List	THE COMMUNITY OF FASOLA OREDEYIN SW4/902 OKE-ADO	Natural Stream			597543	814852		0.02	Tertiary	The area is always flooded, houses are blocking the main route for draining the runoff to Ogunpa River.	0.34	0.45	0.45		Inadequate	Inadequate	Yes
	73D1	PIU 2nd List	THE COMMUNITY OF FASOLA OREDEYIN SW4/902 OKE-ADO	Pipe Culvert	1 CC (Dia 0.6)		597487	814820		0.02	Tertiary	The area is always flooded, houses are blocking the main route for draining the runoff to Ogunpa River.	0.34	0.45	0.45	0.3	Inadequate	Inadequate	Yes

Structure Data												Structure Assessment						
Subbasin	Structure No.	Batch_ID	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Design Flow (m3/s)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
Og2 Middle Ogunpa	256	Core 1	Oke Seni	Culvert	1 BC (3.6 x 1.07)		598209	816274	Good	0.17	Tertiary		2.55	3.40	3.40	6.9	Adequate	Adequate	No
	240	Core 1	Amule Area	Culvert	1 BC (3.2 x 1.63)		597806	815734	Poor	0.18	Tertiary		2.70	3.60	3.60	11.1	Adequate	Inadequate	Yes
	239	Core 1	Foko Area	Culvert	1 BC (3.4 x 1.47)		597566	815782	Fair	0.24	Tertiary		3.60	4.80	4.80	10.3	Adequate	Inadequate	Yes
	781	Batch 17	Mokola Housing Estate	Culvert	2 CC (Dia 0.9)	1.4	597977	819228	Fair	0.26	Main	Overflow during heavy rain	3.90	5.20	5.20	1.5	Inadequate	Inadequate	Yes
	251	Core 1	Ayeye	Culvert	1 BC (14 x 4.7)		598660	815777	Good	0.27	Secondary		4.05	5.40	5.40	309.5	Adequate	Adequate	No
	296	Core 1	Surulere street Oke bola	Culvert	1 BC (1.3 x 1.17)		597091	815847	Poor	0.30	Tertiary		4.50	6.00	6.00	2.2	Inadequate	Inadequate	Yes
	257	Core 1	Abebi Area	Bridge	1 BC (5.77 x 2.94)		598442	816918	Fair	0.32	Secondary		4.80	6.40	6.40	53.7	Adequate	Inadequate	Yes
	254	Core 1	Awolowo way	Culvert	1 BC (3.4 x 1.82)		597235	816401	Fair	0.33	Secondary		4.95	6.60	6.60	14.0	Adequate	Inadequate	Yes
	293	Core 1	UCH	Culvert	2 BC (2.7 x 2.5)		599375	817901	Good	0.33	Tertiary		4.95	6.60	6.60	32.6	Adequate	Adequate	No
	234	Core 1	Oke Ado	Culvert	2 BC (1.3 x 0.95)		597258	815347	Good	0.35	Secondary		5.25	7.00	7.00	3.3	Inadequate	Adequate	Yes
	238	Core 1	Oke Bola	Natural Stream			597210	815788	Poor	0.36	Secondary		5.40	7.20	7.20	5.7	Inadequate	Inadequate	Yes
	252	Core 1	Oke Seni	Bridge	2 BC (1.7 x 1.77)	2.2	597651	816307	Good	0.36	Tertiary		5.40	7.20	7.20	11.1	Adequate	Adequate	No
	258	Core 1	Alawo Area	Footpath			598298	816992	Fair	0.43	Tertiary		6.45	8.60	8.60	55.8	Adequate	Inadequate	Yes
	255	Core 1	Ogunpa Market	Culvert	1 BC (3.1 x 1.42)		597478	816300	Fair	0.45	Tertiary		6.75	9.00	9.00	8.8	Adequate	Inadequate	Yes
	283	Core 1	Onireke GRA	Culvert	2 BC (2.4 x 2.96)		597447	818489	Fair	0.50	Tertiary		7.50	10.00	10.00	34.7	Adequate	Inadequate	Yes
	783	Batch 17	Mokola	Culvert	1 BC (1.2 x 0.99)	1.3	597999	819082	Fair	0.51	Tertiary		7.57	10.10	10.10	1.6	Inadequate	Inadequate	Yes
	784	Batch 17	Mokola	Culvert	2 CC (Dia 0.9) + 1 BC (2.8 x 1.9)	2.3	597992	819037	Good	0.54	Main		7.80	10.40	10.40	13.2	Adequate	Adequate	No
	237	Core 1	Oke Ado	Culvert	1 BC (2 x 0.95)		597389	814647	Good	0.55	Secondary		7.88	10.50	10.50	2.9	Inadequate	Adequate	Yes
	250	Core 1	Agbeni Market	Culvert	1 BC (4.6 x 3.18)		598375	815563	Fair	0.56	Main		7.95	10.60	10.60	45.2	Adequate	Inadequate	Yes
	1550	Batch 31	Oke Ado	Culvert	2 CC (Dia 0.8)	1.6	597539	814715	Good	0.59	Tertiary		8.17	10.90	10.90	1.1	Inadequate	Adequate	Yes
	36	Batch 0	ONIREKE AVENUE , ONIREKE ROAD	Culvert	1 BC (2 x 1.38)	3.0	597020	817433	Fair	0.63	Main		8.47	11.30	11.30	4.9	Inadequate	Inadequate	Yes
	1551	Batch 31	Gege	Culvert	2 BC (4.95 x 1.84)	2.8	598300	815452	Poor	0.64	Tertiary		8.55	11.40	11.40	44.9	Adequate	Inadequate	Yes
	259	Core 1	Alaawo	Footpath			598054	817009	Fair	0.68	Tertiary		8.85	11.80	11.80	16.0	Adequate	Inadequate	Yes
	292	Core 1	Jenbewon Area	Footpath			597997	818711	Erosion	0.72	Tertiary		9.15	12.20	12.20	9.0	Inadequate	Inadequate	Yes
	298	Core 1	Alaawo	Culvert	1 BC (3.2 x 2.7)		597958	817021	Good	0.73	Tertiary		9.23	12.30	12.30	22.6	Adequate	Adequate	No
	289	Core 1	Dandaru	Culvert	1 BC (2.5 x 1.01)		598932	818170	Good	0.75	Main		9.38	12.50	12.50	4.1	Inadequate	Adequate	Yes
	249	Core 1	Gege	Culvert	1 BC (13.1 x 2.2)		598171	815264	Fair	0.81	Secondary		9.83	13.10	13.10	89.2	Adequate	Inadequate	Yes
	39	Batch 0	PARLLAMENT ROAD	Culvert	2 BC (1.55 x 1.2)	1.5	599705	818792	Good	0.95	Main		10.87	14.50	14.50	5.8	Inadequate	Adequate	Yes
	247	Core 1	Secretariat	Culvert	1 BC (8.1 x 4.4)		599137	818550	Good	12.93	Tertiary		111.00	148.00	148.00	145.6	Adequate	Adequate	No
	144B	Batch 0	DANDARU	Culvert	1 BC (6.5 x 3.83)	4.8	598918	818202	Fair	13.23	Highway		111.00	148.00	148.00	90.9	Inadequate	Inadequate	Yes
Og3 Kudeti	392	Core 3	Olunloyo	Culvert	2 BC (2.9 x 2.5)	3.8	599220	814057	Poor		Secondary	One of the two cell is blocked				35.8	Adequate	Inadequate	Yes
	352	Core 2	Koloko Area	Culvert	1 BC (1.98 x 1.51)	1.8	602060	814901	Good	0.10	Tertiary		1.50	2.00	2.00	5.5	Adequate	Adequate	No
	387	Core 3	Ile Tuntun	Culvert	2 BC (1 x 1.11)	1.3	600431	813430	Good	0.11	Tertiary		1.65	2.20	2.20	2.9	Adequate	Adequate	No
	317	Core 2	Arikewuyo	Culvert	1 BC (2.5 x 1.34)	1.5	601997	814975	Poor	0.14	Tertiary		2.10	2.80	2.80	6.2	Adequate	Inadequate	Yes
	388	Core 3	Ile Tuntun	Culvert	1 BC (2.9 x 0.96)	1.1	600315	813540	Fair	0.14	Tertiary		2.10	2.80	2.80	4.5	Adequate	Inadequate	Yes
	321	Core 2	Ayekale Community	Culvert	1 BC (1.26 x 0.82)	1.1	602337	815570	Poor	0.17	Tertiary		2.55	3.40	3.40	1.3	Inadequate	Inadequate	Yes
	286	Core 1	Dugbe	Culvert	1 BC (3.5 x 1.8)		599822	815779	Poor	0.20	Main		3.00	4.00	4.00	14.3	Adequate	Inadequate	Yes
	299	Core 1	Ode Aje	Culvert	1 BC (2.6 x 1.14)		600770	815873	Good	0.21	Tertiary		3.15	4.20	4.20	5.1	Adequate	Adequate	No
	264	Core 1	Yemetu	Culvert	3 CC (Dia 1.2)		599714	817136	Good	0.24	Highway		3.60	4.80	4.80	4.9	Adequate	Adequate	No
	350	Core 2	Oluyoro	Culvert	1 BC (2 x 1.35)	1.6	601802	816613	Poor	0.24	Tertiary		3.60	4.80	4.80	4.7	Adequate	Inadequate	Yes
	280	Core 1	Ajegede	Culvert	2 CC (Dia 1.2)		600712	816127	Poor	0.26	Main		3.90	5.20	5.20	3.3	Inadequate	Inadequate	Yes
	282	Core 1	Irefin(Oje Area)	Culvert	1 BC (2.1 x 1.81)		600787	816910	Fair	0.26	Tertiary		3.90	5.20	5.20	7.6	Adequate	Inadequate	Yes
	318	Core 2	Adekile	Culvert	1 BC (3.4 x 1.4)	1.7	601851	815155	Fair	0.27	Tertiary		4.05	5.40	5.40	9.6	Adequate	Inadequate	Yes
	372	Core 3	Elekuro	Footpath		0.9	601139	813926	Good	0.27	Tertiary		4.05	5.40	5.40	14.7	Adequate	Adequate	No
	420	Core 4	Aperin	Culvert	1 BC (3 x 2.23)	3.4	601817	814337	Good	0.27	Main		4.05	5.40	5.40	16.0	Adequate	Adequate	No
	72	Batch 0	ODE-AYE , KOSODO	Culvert	1 BC (3.3 x 2.08)	2.6	600624	816008	Erosion	0.27	Secondary		4.05	5.40	5.40	16.4	Adequate	Inadequate	Yes
	288	Core 1	Yemetu	Footpath			599415	816559	Fair	0.32	Tertiary	the area is usually flooded whenever it rain	4.80	6.40	6.40	24.0	Adequate	Inadequate	Yes
	389	Core 3	Ile Tuntun (Mopu)	Culvert	1 CC (Dia 1.2) + 1 BC (2.7 x 1.13)	2.4	600252	813570	Fair	0.34	Main		5.10	6.80	6.80	6.9	Adequate	Inadequate	Yes
	320	Core 2	Koloko Area	Culvert	1 CC (Dia 1.2)	1.5	602194	815477	Poor	0.35	Tertiary		5.25	7.00	7.00	1.6	Inadequate	Inadequate	Yes
	349	Core 2	Oluyoro Oke Offa	Culvert	1 BC (1.8 x 1.54)	1.8	601545	816471	Poor	0.37	Secondary	The area is flooded during rain	5.55	7.40	7.40	5.0	Inadequate	Inadequate	Yes
	326	Core 2	Agugu	Footpath		0.8	601793	815952	Poor	0.38	Tertiary	The area is flooded during rain	5.70	7.60	7.60	2.3	Inadequate	Inadequate	Yes
	260	Core 1	Total Garden	Natural Stream			600608	817669	Poor	0.39	Tertiary		5.85	7.80	7.80	6.3	Inadequate	Inadequate	Yes
	281	Core 1	Oluyoro	Culvert	1 BC (2.8 x 1.51)		600544	816698	Fair	0.41	Tertiary		6.15	8.20	8.20	8.5	Adequate	Inadequate	Yes
	263	Core 1	Yemetu	Culvert	1 CC (Dia 0.9) + 1 BC (2.4 x 1.46)		599890	817442	Fair	0.42	Highway		6.30	8.40	8.40	7.4	Inadequate	Inadequate	Yes
	371	Core 3	Elekuro	Culvert	1 BC (1.2 x 1.2)	1.4	600846	813903	Poor	0.45	Tertiary		6.75	9.00	9.00	2.1	Inadequate	Inadequate	Yes
	390	Core 3	Yerokun	Culvert	1 BC (2.5 x 1.45)	2.0	599999	813466	Good	0.46	Tertiary		6.90	9.20	9.20	6.9	Inadequate	Adequate	Yes
	325	Core 2	Agugu	Culvert	2 BC (2.15 x 1.59)	2.2	601639	815858	Fair	0.47	Tertiary	The area is flooded during rain	7.05	9.40	9.40	13.0	Adequate	Inadequate	Yes
	285	Core 1	Oke -Offa Atipe	Culvert	2 BC (3 x 2.76)		600380	816549	Good	0.50	Main		7.50	10.00	10.00	42.8	Adequate	Adequate	No
	319	Core 2	Koloko	Culvert	1 BC (2.6 x 1.7)	1.9	601927	815391	Fair	0.52	Tertiary	The area is flooded during rain	7.65	10.20	10.20	9.1	Inadequate	Inadequate	Yes
	348	Core 2	Gate(Prison)	Culvert	1 BC (1.6 x 1.7)	2.2	601767	817433	Poor	0.54	Main	The area is usually flooded when it rains	7.80	10.40	10.40	4.8	Inadequate	Inadequate	Yes

Structure Data												Structure Assessment						
Subbasin	Structure No.	Batch_ID	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Design Flow (m3/s)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
	287	Core 1	Isale Alfa Oje	Culvert	1 BC (2.6 x 1.8)		599637	816307	Poor	0.57	Highway		8.02	10.70	10.70	9.9	Adequate	Inadequate	Yes
	284	Core 1	Onikokoro area	Footpath			600268	816403	Poor	0.59	Tertiary		8.17	10.90	10.90	72.1	Adequate	Inadequate	Yes
	1563	Batch 31	Goodwill	Footpath		1.7	601544	814659	Good	0.61	Tertiary		8.33	11.10	11.10	35.6	Adequate	Adequate	No
	1556	Batch 31	Isale Alfa	Footpath		1.3	599788	816269	Poor	0.63	Tertiary		8.47	11.30	11.30	41.9	Adequate	Inadequate	Yes
	268	Core 1	Aderogba	Culvert	1 BC (2.7 x 1.45)		599909	816264	Fair	0.65	Secondary		8.62	11.50	11.50	7.6	Inadequate	Inadequate	Yes
	1558	Batch 31	Oke Alfa Atipe	Footpath		2.8	600218	816253	Fair	0.65	Tertiary		8.62	11.50	11.50	104.0	Adequate	Inadequate	Yes
	295	Core 1	Ajegede	Culvert	2 BC (2.9 x 1.71)		600529	816017	Fair	0.67	Tertiary		8.78	11.70	11.70	21.1	Adequate	Inadequate	Yes
	294	Core 1	Adekile	Culvert	2 BC (1.9 x 1.12)		601360	814843	Fair	0.71	Tertiary		9.07	12.10	12.10	6.8	Inadequate	Inadequate	Yes
	370	Core 3	Odinjo	Culvert	1 BC (2.7 x 2.04)	2.5	600659	813907	Fair	0.72	Tertiary		9.15	12.20	12.20	12.3	Adequate	Inadequate	Yes
	1557	Batch 31	Oke Alfa Atipe	Footpath		1.7	600317	816013	Poor	0.74	Tertiary		9.30	12.40	12.40	39.7	Adequate	Inadequate	Yes
	362	Core 3	Akatapa	Footpath		2.8	600570	814032	Good	0.78	Tertiary		9.60	12.80	12.80	64.2	Adequate	Adequate	No
	95	Batch 0	ALAFARA	Culvert	2 BC (3 x 1.93)	2.5	600162	816043	Erosion	0.78	Secondary		9.60	12.80	12.80	26.1	Adequate	Inadequate	Yes
	391	Core 3	Odo Oba	Culvert	1 BC (1.4 x 0.93)	2.0	599540	813367	Good	0.83	Secondary		9.97	13.30	13.30	1.8	Inadequate	Adequate	Yes
	261	Core 1	Gbenla Area	Culvert	1 BC (3.4 x 2.18)		600434	817502	Good	0.84	Tertiary		10.05	13.40	13.40	18.2	Adequate	Adequate	No
	322	Core 2	Adekile	Culvert	2 BC (2.6 x 1.65)	2.1	601590	815351	Good	0.91	Tertiary		10.58	14.10	14.10	17.5	Adequate	Adequate	No
	262	Core 1	Oje Igosu	Culvert	1 BC (3.1 x 1.17)		600228	817528	Good	0.93	Main		10.73	14.30	14.30	6.6	Inadequate	Adequate	Yes
	890	Batch 23	SOKA/SANYO	Footpath			598919	810768	Poor		Tertiary	FLOODED				1.5	Adequate	Inadequate	Yes
	881	Batch 23	SOKA/SANYO		1 CC (Dia 0.72)	0.9	598852	810775	Fair	0.10	Tertiary	FLOODED ALWAYS	1.50	2.00	2.00	0.4	Inadequate	Inadequate	Yes
	1229	Batch 29	ALABA-KAN, AGBAMU SANYO AREA	Culvert	1 BC (0.9 x 1.25)	1.6	599878	808511	Good	0.13	Tertiary	Water flow normally	1.95	2.60	2.60	1.5	Inadequate	Adequate	Yes
	377	Core 3	Owode Academy	Culvert	1 BC (2.2 x 1.82)	2.0	601161	812568	Good	0.13	Tertiary		1.95	2.60	2.60	8.1	Adequate	Adequate	No
	380	Core 3	Owode Academy	Natural Stream			600980	812582	Poor	0.13	Tertiary		1.95	2.60	2.60		Inadequate	Inadequate	Yes
	900	Batch 23	OLOMI	Culvert	2 BC (1.22 x 0.92)	0.9	601224	809776	Poor	0.14	Tertiary	FLOODED ALWAYS	2.10	2.80	2.80	2.9	Adequate	Inadequate	Yes
	1235	Batch 29	OKE OLUWATEDO,KOSEUNTI JUCTION	Natural Stream		0.4	598764	809045	Fair	0.14	Tertiary	No visible water	2.10	2.80	2.80	0.7	Inadequate	Inadequate	Yes
	1222	Batch 29	RED ROOF AREA, TOLL GATE	Culvert	1 BC (2.7 x 2.44)	2.7	596789	809281	Fair	0.15	Tertiary	Get Flooded but flow	2.25	3.00	3.00	15.8	Adequate	Inadequate	Yes
	1228	Batch 29	SURULERE,FARIA OFF SANYO	Natural Stream		0.3	599958	808113	Fair	0.15	Tertiary		2.25	3.00	3.00	0.2	Inadequate	Inadequate	Yes
	1247	Batch 29	HERBERT MARCARULARY WAY, SURULERE	Natural Stream		0.2	597411	808085	Fair	0.15	Tertiary	Get flooded when it rains heavily.	2.25	3.00	3.00	0.5	Inadequate	Inadequate	Yes
	1236	Batch 29	ANU-OLUWAPO ZONE 28,SOKA	Natural Stream		0.7	598396	808943	Fair	0.16	Tertiary	Get flooded when it rains heavily	2.40	3.20	3.20	4.0	Adequate	Inadequate	Yes
	395	Core 3	Molete	Natural Stream		0.9	598829	812919	Poor	0.18	Tertiary		2.70	3.60	3.60	4.6	Adequate	Inadequate	Yes
	902	Batch 23	IDI MANGORO	Natural Stream		0.8	597776	809574	Poor	0.19	Tertiary	FLOODED OCCASSIONALLY	2.85	3.80	3.80	3.6	Adequate	Inadequate	Yes
	887	Batch 23	SANYO	Culvert	1 BC (2.1 x 1.98)	2.3	599396	810399	Good	0.20	Tertiary		3.00	4.00	4.00	8.5	Adequate	Adequate	No
	1194	Batch 28	ANTONIO VILLAGE	Culvert	4 CC (Dia 0.64)	2.8	596280	807382	Fair	0.20	Tertiary	FLOODED OCCASSIONALLY	3.00	4.00	4.00	1.2	Inadequate	Inadequate	Yes
	877	Batch 23	FELELE	Culvert	1 BC (2.98 x 1.7)	2.0	598232	811662	Good	0.24	Tertiary		3.60	4.80	4.80	10.8	Adequate	Adequate	No
	374	Core 3	Odinjo Area	Culvert	2 CC (Dia 0.8)	1.1	601254	813059	Good	0.24	Tertiary		3.60	4.80	4.80	1.1	Inadequate	Adequate	Yes
	879	Batch 23	SOKA		2 CC (Dia 0.84)	1.6	598497	810832	Fair	0.25	Secondary	THE INLECT IS COVERED BY CONCRETE AND FLOODED ALWAYS	3.75	5.00	5.00	1.3	Inadequate	Inadequate	Yes
	899	Batch 23	OLOMI/ABA AFAA	Culvert	1 BC (1.6 x 1.2)	1.5	601032	810396	Good	0.27	Tertiary	FLOODED ALWAYS	4.05	5.40	5.40	3.0	Inadequate	Adequate	Yes
	901	Batch 23	BOLUWAJI		1 CC (Dia 1.2)	1.7	600377	810002	Fair	0.27	Tertiary		4.05	5.40	5.40	1.6	Inadequate	Inadequate	Yes
	1244	Batch 29	AJAWALE RD,AGBON ESTATE	Culvert	1 BC (1.55 x 1.6)	1.9	598347	806918	Good	0.27	Tertiary	Newly constructed.	4.05	5.40	5.40	4.3	Inadequate	Adequate	Yes
	1223	Batch 29	AJOFEEBO, AGBAMU SANYO	Culvert	1 CC (Dia 0.76)	0.9	599669	809103	Poor	0.28	Tertiary	Get flooded when it rains heavily	4.20	5.60	5.60	0.5	Inadequate	Inadequate	Yes
	379	Core 3	Owode Academy	Culvert	1 BC (2.1 x 1.1)	1.3	601003	812592	Good	0.31	Tertiary		4.65	6.20	6.20	3.8	Inadequate	Adequate	Yes
Og4 Lower Ogunpa	396	Core 3	Ibadan Grammar School	Culvert	1 BC (3 x 1.61)	2.0	598493	812789	Fair	0.31	Secondary		4.65	6.20	6.20	10.1	Adequate	Inadequate	Yes
	1225	Batch 29	IREWOLE, AJIYO -OLUNDE	Natural Stream		1.2	600537	808450	Fair	0.32	Tertiary		4.80	6.40	6.40	5.0	Inadequate	Inadequate	Yes
	381	Core 3	Owode Academy	Culvert	2 BC (2.5 x 1.53)	2.1	600979	812646	Fair	0.32	Tertiary		4.80	6.40	6.40	15.0	Adequate	Inadequate	Yes
	892	Batch 23	ELERE	Footpath		2.8	600290	812005	Fair	0.34	Tertiary	FLOODED OCASSIONALLY	5.10	6.80	6.80	106.9	Adequate	Inadequate	Yes
	394	Core 3	Ibadan Grammar School	Culvert	3 CC (Dia 0.9)	1.8	598409	812745	Fair	0.35	Tertiary		5.25	7.00	7.00	2.3	Inadequate	Inadequate	Yes
	878	Batch 23	FELELE ONIGARI	Culvert	1 BC (2.34 x 2.44)	2.7	598236	811078	Good	0.36	Tertiary		5.40	7.20	7.20	13.0	Adequate	Adequate	No
	886	Batch 23	NEW FELELE	Culvert	1 BC (1.84 x 1.6)	1.9	599038	810174	Good	0.37	Tertiary	FLOODED OCASSIONALLY	5.55	7.40	7.40	5.4	Inadequate	Adequate	Yes
	893	Batch 23	ELERE	Culvert	1 BC (2.07 x 1.72)	2.0	600231	812002	Good	0.37	Tertiary	FLOODED OCASSIONALLY	5.55	7.40	7.40	6.9	Adequate	Adequate	No
	373	Core 3	Molete	Culvert	1 BC (2 x 2.2)	2.6	598148	812346	Good	0.37	Tertiary		5.55	7.40	7.40	9.2	Adequate	Adequate	No
	895	Batch 23	BOLUWAJI	Culvert	1 BC (1.34 x 1.54)	1.8	600460	811316	Good	0.40	Tertiary		6.00	8.00	8.00	3.3	Inadequate	Adequate	Yes
	896	Batch 23	BOLUWAJI	Culvert	1 BC (3.34 x 1.28)	1.5	600416	811283	Good	0.40	Tertiary	FLOODED ALWAYS	6.00	8.00	8.00	8.2	Adequate	Adequate	No
	1242	Batch 29	IDI-ORO IFESOWAPO, ASIWAJU	Natural Stream		0.2	598778	807475	Fair	0.43	Tertiary	Get flooded	6.45	8.60	8.60	0.8	Inadequate	Inadequate	Yes
	894	Batch 23	BOLUWAJI ELERE	Culvert	1 BC (3.12 x 1.8)	2.3	600007	811961	Good	0.44	Secondary		6.60	8.80	8.80	12.4	Adequate	Adequate	No
	897	Batch 23	BOLUWAJI	Culvert	1 BC (3.32 x 1.48)	1.8	600364	811230	Good	0.45	Tertiary	FLOODED ALWAYS	6.75	9.00	9.00	10.1	Adequate	Adequate	No
	378	Core 3	Molete	Culvert	1 BC (3.1 x 1.7)	2.0	598512	812226	Good	0.45	Secondary		6.75	9.00	9.00	11.4	Adequate	Adequate	No
	386	Core 3	Molete	Culvert			598449	812198	Poor	0.46	Tertiary	The inlet is blocked	6.90	9.20	9.20		Inadequate	Inadequate	Yes
	885	Batch 23	NEW FELELE	Culvert	1 BC (4.25 x 0)		598908	810069	Poor	0.48	Tertiary	IT HAS BEEN TOTALLY BLOCKED BY SANDS ON BOTHS SIDE AND FLOODED ALWAYS	7.20	9.60	9.60		Inadequate	Inadequate	Yes
	1238	Batch 29	ITESIWAJU RD, MAJE	Culvert	1 BC (2.64 x 1.35)	1.8	598358	808591	Good	0.48	Tertiary	Newly constructed.	7.20	9.60	9.60	6.7	Inadequate	Adequate	Yes
	375	Core 3	Owode Academy	Footpath		2.1	601094	812892	Dilapidated	0.52	Tertiary		7.65	10.20	10.20	65.7	Adequate	Inadequate	Yes
	898	Batch 23	BOLUWAJI	Culvert	1 BC (2.6 x 2.78)	3.0	600210	811127	Good	0.60	Tertiary		8.25	11.00	11.00	17.8	Adequate	Adequate	No
	1243	Batch 29	IDI-AGBON FELELE	Culvert	1 BC (1.5 x 1.7)	1.9	598515	807434	Good	0.63	Tertiary	Newly constructed.	8.47	11.30	11.30	4.4	Inadequate	Adequate	Yes

Structure Data												Structure Assessment						
Subbasin	Structure No.	Batch_ID	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Design Flow (m3/s)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
	1245	Batch 29	IDI-AGBON FELELE	Culvert	1 BC (0.65 x 0.7)	1.7	598105	807154	Good	0.63	Tertiary	Newly constructed.	8.47	11.30	11.30	0.4	Inadequate	Adequate	Yes
	62	Core 5	Owode	Bridge	2 BC (1.9 x 1.23)	1.9	600948	812764	Fair	0.64	Tertiary		8.55	11.40	11.40	7.8	Inadequate	Inadequate	Yes
	1227	Batch 29	ALABA-KAN, AGO -OLUNDE	Culvert	2 CC (Dia 0.75)	1.0	600070	808210	Fair	0.70	Tertiary	Get flooded when it rains heavily.	9.00	12.00	12.00	0.9	Inadequate	Inadequate	Yes
	1508	Batch 31	boluwaji	Culvert	1 BC (3.5 x 2.98)	3.3	600592	810813	Good	0.70	Tertiary		9.00	12.00	12.00	29.1	Adequate	Adequate	No
	1564	Batch 31	soka	Footpath		3.2	598681	810065	Poor	0.85	Tertiary		10.13	13.50	13.50	109.1	Adequate	Inadequate	Yes
	884	Batch 23	IDI MANGORO/SOKA	Culvert	1 BC (3 x 1.1)	1.4	598499	809993	Good	0.90	Tertiary	FLOODED ALWAYS	10.50	14.00	14.00	5.8	Inadequate	Adequate	Yes
Om1 Omi Headwaters North	452	Batch 3	Eniosa	Culvert	1 CC (Dia 0.75)	0.9	607766	830110	Good	0.14	Secondary		2.10	2.80	2.80	0.5	Inadequate	Adequate	Yes
	453	Batch 3	Arulogun	Culvert	1 CC (Dia 0.9)	1.2	608947	829995	Good	0.17	Main		2.55	3.40	3.40	0.8	Inadequate	Adequate	Yes
	1336	Batch 7	Ariyibi	Natural Stream		0.1	607155	828450	Poor	0.37	Tertiary	Flooded with heavy rainfall.	5.55	7.40	7.40	0.1	Inadequate	Inadequate	Yes
	448	Batch 3		Culvert	2 CC (Dia 0.9)	1.6	608930	830638	Fair	0.70	Main		9.00	12.00	12.00	1.5	Inadequate	Inadequate	Yes
	451	Batch 3	Olorunda	Culvert	1 BC (1.74 x 1.5)	2.0	608778	829559	Fair	1.53	Main	outlet is not accessible	15.22	20.30	20.30	4.6	Inadequate	Inadequate	Yes
	1337	Batch 7	Irepodun Estate	Culvert	1 CC (Dia 0.9)	1.2	608047	828156	Fair	1.69	Secondary	Always over topping with heavy rainfall.	16.43	21.90	21.90	0.8	Inadequate	Inadequate	Yes
	1339	Batch 7	Ladojo Vilaage	Culvert	2 CC (Dia 0.75)	1.3	609995	828814	Poor	3.44	Secondary	Always over topping with heavy rainfall.	29.55	39.40	39.40	0.9	Inadequate	Inadequate	Yes
	108	Batch 0	OLDRUNDA / ENIOSHA	Culvert	1 BC (1.67 x 1.62)	2.2	608615	828491	Poor	3.67	Main		31.28	41.70	41.70	4.8	Inadequate	Inadequate	Yes
	1338	Batch 7	Adedapo	Culvert	2 BC (1.79 x 1.23)	1.4	609870	828575	Poor	4.77	Secondary	Always over topping with heavy rainfall.	39.52	52.70	52.70	7.2	Inadequate	Inadequate	Yes
	1340	Batch 7	Akingbohun	Culvert	1 BC (2 x 1.4)	1.6	611390	829066	Poor	19.15	Tertiary	Flooded with heavy rainfall.	118.19	157.59	157.59	5.0	Inadequate	Inadequate	Yes
Om2 Omi Headwaters South	983	Batch 13	Keke	Culvert	1 CC (Dia 0.7)	1.1	609758	823238	Fair	0.11	Secondary		1.65	2.20	2.20	0.4	Inadequate	Inadequate	Yes
	1347	Batch 7	Orita-odan	Natural Stream		0.8	610645	825245	Poor	0.13	Secondary	collapsed culvert,flooded with heavy rainfall,needs urgent attention	1.95	2.60	2.60	1.8	Inadequate	Inadequate	Yes
	985	Batch 13	Olodo	Natural Stream		0.3	611333	823030	Poor	0.16	Tertiary		2.40	3.20	3.20	1.9	Inadequate	Inadequate	Yes
	1367	Batch 8	Pagun	Culvert	1 BC (0.92 x 0.42)	0.8	612792	825284	Poor	0.18	Tertiary	Generally flooded	2.70	3.60	3.60	0.3	Inadequate	Inadequate	Yes
	1368	Batch 8	Begidinan-fogun Village	Culvert	2 CC (Dia 0.26)	0.4	612391	824732	Poor	0.27	Tertiary	Generally flooded	4.05	5.40	5.40	0.1	Inadequate	Inadequate	Yes
	982	Batch 13	Bank Olodo Area	Culvert	1 CC (Dia 0.9)	0.9	610930	824099	Fair	0.29	Secondary		4.35	5.80	5.80	0.8	Inadequate	Inadequate	Yes
	1371	Batch 14	IDI-ORO VILLAGE	Natural Stream		0.2	611922	824216	Poor	0.36	Tertiary	SURROUNDED WITH VEGETATIONS,IT HAS PEBBLES,FLOODED WITH HEAVY RAINFALL.	5.40	7.20	7.20	0.5	Inadequate	Inadequate	Yes
	1366	Batch 8	Aloba Village	Culvert	1 CC (Dia 0.85)	1.0	612391	825793	Poor	0.47	Tertiary	Over top when it rains.	7.05	9.40	9.40	0.6	Inadequate	Inadequate	Yes
	1349	Batch 7	Niniola Estate	Natural Stream		0.3	608785	824865	Poor	0.49	Tertiary	Usually flooded during heavy rainfall	7.35	9.80	9.80	0.5	Inadequate	Inadequate	Yes
	984	Batch 13	Iyana Agandi-Olodo Area	Culvert	1 BC (1.8 x 1.53)	2.0	610694	823187	Good	0.61	Secondary		8.33	11.10	11.10	4.9	Inadequate	Adequate	Yes
	1364	Batch 8	Arounfayo	Culvert	1 CC (Dia 0.6)	1.4	612385	826481	Fair	0.68	Tertiary	The inlet is not accessible due to presence of tree	8.85	11.80	11.80	0.3	Inadequate	Inadequate	Yes
	1365	Batch 8	Onigbinde	Natural Stream		0.6	612311	826496	Poor	0.72	Tertiary	Flooded with heavy rainfall.	9.15	12.20	12.20	3.7	Inadequate	Inadequate	Yes
	1341	Batch 7	Olorunda Abaa	Culvert	2 CC (Dia 0.77)	1.2	608425	827075	Good	0.99	Tertiary	Flooded with heavy rainfall	11.18	14.90	14.90	1.0	Inadequate	Adequate	Yes
	944	Batch 13	Olodo	Culvert	1 CC (Dia 0.6)	1.7	609869	821304	Fair		Secondary					0.3	Adequate	Inadequate	Yes
	1354	Batch 7	Abada	Natural Stream		0.1	607729	825860	Poor	0.10	Tertiary	marshy,flooded with heavy rainfall.	1.50	2.00	2.00	0.2	Inadequate	Inadequate	Yes
	1051	Batch 19	Amero	Culvert	1 CC (Dia 0.75)	1.1	611403	818825	Fair	0.15	Tertiary		2.25	3.00	3.00	0.5	Inadequate	Inadequate	Yes
	954	Batch 13	kumapayi-Olodo	Culvert	1 BC (1.4 x 0.97)	1.0	611245	820320	Poor	0.18	Tertiary		2.70	3.60	3.60	1.9	Inadequate	Inadequate	Yes
	978	Batch 13	Jenriyin	Culvert	1 CC (Dia 0.9)	1.0	608965	823632	Fair	0.20	Tertiary		3.00	4.00	4.00	0.8	Inadequate	Inadequate	Yes
	988	Batch 13	Fidelity Estate	Natural Stream		0.4	607338	822984	Poor	0.20	Tertiary		3.00	4.00	4.00	0.4	Inadequate	Inadequate	Yes
	724	Batch 12	Akobo-Ojurin	Culvert	1 BC (1 x 0.5)	0.6	604924	823279	Poor	0.23	Tertiary	Surrounding shops usually flooded during heavy rain	3.45	4.60	4.60	0.5	Inadequate	Inadequate	Yes
	723	Batch 12	Akobo-Ojurin	Culvert	2 BC (1 x 0.4)	1.8	604962	823319	Poor	0.25	Tertiary	Blocked by sediments and total height cannot be measured only 1.75	3.75	5.00	5.00	0.7	Inadequate	Inadequate	Yes
	977	Batch 13	Jenriyin	Natural Stream		0.3	609046	823497	Poor	0.26	Tertiary		3.90	5.20	5.20	0.5	Inadequate	Inadequate	Yes
	968	Batch 13	Agbaja	Culvert	1 CC (Dia 0.8)	1.4	609667	821603	Poor	0.28	Tertiary		4.20	5.60	5.60	0.6	Inadequate	Inadequate	Yes
	976	Batch 13	Jenriyin	Natural Stream		0.5	608923	823519	Poor	0.29	Tertiary		4.35	5.80	5.80	0.3	Inadequate	Inadequate	Yes
	945	Batch 13	Wofun-Ayerenti	Culvert	1 CC (Dia 0.75)	1.0	609371	820220	Fair	0.30	Tertiary		4.50	6.00	6.00	0.5	Inadequate	Inadequate	Yes
	963	Batch 13	Iyana Church Cele	Culvert	1 BC (2.45 x 1.21)	1.5	607598	820410	Fair	0.30	Tertiary		4.50	6.00	6.00	5.2	Inadequate	Inadequate	Yes
	946	Batch 13	Wofun-Ayerenti	Culvert	1 CC (Dia 0.75)	0.5	609433	820239	Fair	0.31	Tertiary	Flooded the area during heavy rain	4.65	6.20	6.20	0.5	Inadequate	Inadequate	Yes
	942	Batch 13	Jenriyin	Culvert	1 CC (Dia 0.85)	1.0	608636	823836	Fair	0.32	Secondary		4.80	6.40	6.40	0.6	Inadequate	Inadequate	Yes
	953	Batch 13	Oki	Natural Stream	1 BC (7.75 x 3.4)	3.4	610827	819697	Poor	0.32	Secondary	Urgent attantion	4.80	6.40	6.40	94.9	Adequate	Inadequate	Yes
	967	Batch 13	Arulogun Alaja				609682	821519		0.33	Tertiary	Cannot be accessed	4.95	6.60	6.60		Inadequate	Inadequate	Yes
	1355	Batch 7	Ajara Estate	Natural Stream		0.4	607179	826049	Poor	0.33	Tertiary		4.95	6.60	6.60	0.7	Inadequate	Inadequate	Yes
	722	Batch 12	Akobo-Ojurin	Culvert	2 CC (Dia 0.9)	2.4	604995	823345	Poor	0.38	Main	Overflow into surrounding shops during heavy rain	5.70	7.60	7.60	1.5	Inadequate	Inadequate	Yes
	718	Batch 12	Ilupeju Estate	Culvert	2 CC (Dia 0.6)	0.9	605437	824495	Fair	0.39	Secondary	Flooded the area during heavy rain	5.85	7.80	7.80	0.5	Inadequate	Inadequate	Yes
	940	Batch 13	Iletuntun -Akobo Ojurin	Culvert	1 CC (Dia 0.65)	0.8	607131	823864	Poor	0.40	Tertiary		6.00	8.00	8.00	0.3	Inadequate	Inadequate	Yes
	964	Batch 13	Iyana Church Cele	Footpath		1.4	607695	820357	Fair	0.40	Tertiary		6.00	8.00	8.00	5.8	Inadequate	Inadequate	Yes
	725	Batch 12	Akobo-Ojurin	Culvert	1 BC (0.6 x 0.94)	7.0	606045	823017	Good	0.42	Tertiary		6.30	8.40	8.40	0.6	Inadequate	Adequate	Yes

Structure Data												Structure Assessment						
Subbasin	Structure No.	Batch_ID	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Design Flow (m3/s)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
Om3 Upper Omi West	1052	Batch 19	Aseyori - Sese	Footpath		2.2	611391	818416	Fair	0.43	Tertiary	Irish was constructed as alternative road for the collapsed bridge	6.45	8.60	8.60	12.0	Adequate	Inadequate	Yes
	965	Batch 13	Iyana Church Cele	Culvert	2 CC (Dia 0.9)	1.3	607764	820300	Good	0.45	Main		6.75	9.00	9.00	1.5	Inadequate	Adequate	Yes
	969	Batch 13	Agbaja	Culvert	1 CC (Dia 0.7)	1.3	609216	822253	Fair	0.45	Tertiary		6.75	9.00	9.00	0.4	Inadequate	Inadequate	Yes
	726	Batch 12	God city estate Akobo	Culvert	1 BC (0.88 x 0.91)	8.0	606279	822767	Good	0.46	Tertiary	the inlet is not accessible	6.90	9.20	9.20	0.9	Inadequate	Adequate	Yes
	970	Batch 13	Agbaja Olodo	Culvert	2 CC (Dia 0.76)	0.9	609110	822230	Fair	0.49	Tertiary		7.35	9.80	9.80	1.0	Inadequate	Inadequate	Yes
	941	Batch 13	Harmony Estate	Culvert	1 CC (Dia 0.65)	1.1	607390	823896	Poor	0.51	Tertiary	Overflow during heavy raing and prevent passage	7.57	10.10	10.10	0.3	Inadequate	Inadequate	Yes
	1350	Batch 7	Ajara	Natural Stream		0.2	606682	826868	Poor	0.52	Tertiary	Flooded with heavy rainfall.	7.65	10.20	10.20	0.2	Inadequate	Inadequate	Yes
	971	Batch 13	Agbaja Olodo	Footpath		0.8	608963	822207	Poor	0.54	Tertiary		7.80	10.40	10.40	3.0	Inadequate	Inadequate	Yes
	720	Batch 12	Idi Ishin- Akobo	Culvert	1 BC (2 x 2.02)	2.3	605874	823724	Good	0.56	Tertiary		7.95	10.60	10.60	8.2	Inadequate	Adequate	Yes
	947	Batch 13	Wakajaye	Footpath		1.8	609652	820288	Poor	0.56	Tertiary		7.95	10.60	10.60	6.8	Inadequate	Inadequate	Yes
	975	Batch 13	Akoka	Natural Stream		0.6	608813	823500	Poor	0.59	Tertiary		8.17	10.90	10.90	1.4	Inadequate	Inadequate	Yes
	574	Batch 18	After Elewuro junction	Culvert	2 CC (Dia 0.9)	1.4	605677	826139	Poor	0.60	Main	Usually over tops with heavy rainfall.	8.25	11.00	11.00	1.5	Inadequate	Inadequate	Yes
	721	Batch 12	Apata	Natural Stream		1.8	605372	823512	Poor	0.63	Tertiary	People cannot pass during heavy rain	8.47	11.30	11.30	30.1	Adequate	Inadequate	Yes
	959	Batch 13	Sawo	Culvert	2 BC (1.51 x 2.1)	2.5	607151	821351	Good	0.63	Tertiary		8.47	11.30	11.30	11.8	Adequate	Adequate	No
	948	Batch 13	Wakajaye	Culvert	1 BC (1.8 x 1.24)	1.2	609732	820286	Fair	0.68	Tertiary	Under construction	8.85	11.80	11.80	3.7	Inadequate	Inadequate	Yes
	554	Batch 6	Elewuro	Footpath		0.9	606411	825078	Poor	0.69	Tertiary		8.92	11.90	11.90	7.8	Inadequate	Inadequate	Yes
	949	Batch 13	Estate Oki-Agodi estate	Culvert	1 CC (Dia 0.9)	1.1	609811	820322	Fair	0.74	Tertiary		9.30	12.40	12.40	0.8	Inadequate	Inadequate	Yes
	958	Batch 13	Okebadan Estate	Natural Stream		0.9	607377	821542	Poor	0.81	Tertiary		9.83	13.10	13.10	3.2	Inadequate	Inadequate	Yes
	966	Batch 13	Iyana Church Cele	Culvert	1 BC (1.5 x 1.57)	2.1	608246	820107	Good	0.82	Tertiary		9.90	13.20	13.20	4.0	Inadequate	Adequate	Yes
	950	Batch 13	Wakajaye	Culvert	1 BC (1.45 x 1.53)	1.7	609898	820327	Fair	0.85	Tertiary		10.13	13.50	13.50	3.7	Inadequate	Inadequate	Yes
	1050	Batch 19	Orogbangba	Culvert	4 CC (Dia 0.75)	1.0	611105	819372	Fair	0.86	Secondary	The area is usually flooded during heavy rain	10.20	13.60	13.60	1.9	Inadequate	Inadequate	Yes
	573	Federal Housing	Barack	Culvert	1 BC (1.5 x 1.5)	1.8	605045	824384	Fair	0.87	Main		10.28	13.70	13.70	3.8	Inadequate	Inadequate	Yes
	1353	Batch 7	Alapata Estate	Culvert	2 CC (Dia 0.62)	0.9	606737	825062	Poor	0.90	Tertiary	Always over topping with heavy rainfall.	10.50	14.00	14.00	0.6	Inadequate	Inadequate	Yes
	951	Batch 13	J.K Ayinde Ori-Owo, Oki, J.K Ayinde Ori-Owo	Culvert	2 CC (Dia 0.9)	1.5	610084	820352	Fair	1.00	Tertiary		11.25	15.00	15.00	1.5	Inadequate	Inadequate	Yes
Om4 Upper Omi East	1374	Batch 14	SULE-OGANLA 2	Culvert	1 CC (Dia 0.61)	0.8	612010	822778	Poor		Tertiary	CULVERT DEPILATED AT INLET,VEGETATIONS AROUND INLET.				0.3	Adequate	Inadequate	Yes
	1357	Batch 8	Fatumo Area	Culvert	1 CC (Dia 0.6)	0.8	615153	825097	Poor	0.12	Tertiary	Broken ring,flooded with heavy rainfall.	1.80	2.40	2.40	0.3	Inadequate	Inadequate	Yes
	1406	Batch 20	Kulodi/ife-ibadan express way	Culvert	1 CC (Dia 0.9)	1.2	611614	816014	Poor	0.12	Tertiary	Always over topping when it rains heavy and floods.	1.80	2.40	2.40	0.8	Inadequate	Inadequate	Yes
	1382	Batch 14	IKUMAPAYI	Culvert	1 BC (1.18 x 1.13)	1.4	612284	820076	Fair	0.16	Tertiary	CHANNEL NOT STRAIGHT;OBSTRUCTED BY BUILDINGS,NOT FLOODED.	2.40	3.20	3.20	1.9	Inadequate	Inadequate	Yes
	1387	Batch 14	ADEWUNMI				613948	823657		0.19	Highway	No culvet	2.85	3.80	3.80		Inadequate	Inadequate	Yes
	1433	Batch 20	Ifelodun Estate/Ikumapayi	Culvert	1 CC (Dia 0.78)	1.3	612176	819497	Fair	0.19	Tertiary	Flooded with heavy rainfall and over flow it's bank.	2.85	3.80	3.80	0.5	Inadequate	Inadequate	Yes
	1391	Batch 14	ADELEYE	Culvert	1 CC (Dia 0.9)	4.6	613337	823429	Poor	0.21	Highway	OUTLET BLOCKED WITH SAND;NEEDS DREDGING,INLET DENSELY COVERE WITH VEGETATIONS.	3.15	4.20	4.20	0.8	Inadequate	Inadequate	Yes
	1402	Batch 20	Ikumapayi	Natural Stream		0.5	612333	818831	Poor	0.21	Tertiary	Flooded with heavy rainfall.	3.15	4.20	4.20	1.0	Inadequate	Inadequate	Yes
	1379	Batch 14	AHOYAYA-OLODO	Natural Stream		1.0	611629	820924	Poor	0.23	Tertiary	SUROUNDED WITH BUILDINGS.	3.45	4.60	4.60	3.5	Inadequate	Inadequate	Yes
	1405	Batch 20	Ogungbade	Culvert	1 CC (Dia 1.2)	1.4	611614	817564	Good	0.23	Secondary	Fairly ok.	3.45	4.60	4.60	1.6	Inadequate	Adequate	Yes
	1404	Batch 20	Ajoda	Culvert	1 CC (Dia 0.48)	1.0	612498	817435	Poor	0.30	Tertiary	Usually Flooded with heavy rainfall,culvert getting eroded at outlet.	4.50	6.00	6.00	0.1	Inadequate	Inadequate	Yes
	1392	Batch 14	IDI-OSAN	Culvert	1 CC (Dia 0.88)	1.1	613130	823575	Poor	0.32	Tertiary	INLET BLOCKD WITH SAND,FLOODED WITH HEAVY RAINFALL.	4.80	6.40	6.40	0.7	Inadequate	Inadequate	Yes
	989	Batch 13	Arubiewe Olodo	Culvert	2 CC (Dia 0.9)	1.4	611502	821871	Fair	0.34	Secondary	Flooded the area during heavy rain	5.10	6.80	6.80	1.5	Inadequate	Inadequate	Yes
	1388	Batch 14	ADEWUNMI	Culvert	1 CC (Dia 0.94)	1.2	613843	823819	Fair	0.34	Tertiary	HEAVILY FLOODED WITH RAINFALL,SURROUNDED WITH VEGETATIONS.	5.10	6.80	6.80	0.8	Inadequate	Inadequate	Yes
	1431	Batch 20	Ogundipe	Natural Stream		0.1	612929	819422	Poor	0.36	Tertiary	Flooded with heavy rainfall.	5.40	7.20	7.20	0.1	Inadequate	Inadequate	Yes
	1380	Batch 14	OLODO	Culvert	2 CC (Dia 0.73)	1.3	611853	820884	Fair	0.38	Tertiary	HEAVILY FLOODED WITH RAINFALL,INLET COVERED WITH DEBIS.	5.70	7.60	7.60	0.9	Inadequate	Inadequate	Yes
	986	Batch 13	Olodo	Culvert	2 CC (Dia 0.9)	7.5	611040	822448	Good	0.42	Highway		6.30	8.40	8.40	1.5	Inadequate	Adequate	Yes
	1375	Batch 14	OJOYEYE,OLODO	Culvert	2 CC (Dia 0.85)	1.4	611645	821678	Fair	0.44	Tertiary	INLET PATIALLY BLOCKED WITH DEBRIS,FLOODED WITH HEAVY RAINFALL.	6.60	8.80	8.80	1.3	Inadequate	Inadequate	Yes
	1389	Batch 14	OLODO	Natural Stream		0.8	613513	823871	Poor	0.45	Tertiary	SURROUNDED WITH BUILDINGS AND VEGETATIONS.	6.75	9.00	9.00	5.1	Inadequate	Inadequate	Yes

Structure Data												Structure Assessment						
Subbasin	Structure No.	Batch_ID	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Design Flow (m3/s)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
	1390	Batch 14	OKE-OMI	Culvert	2 CC (Dia 0.85)	1.1	613293	823870	Good	0.51	Tertiary	ONE RING BLOCKED WITH SAND AT INLET AND OUTLET,SURROUNDED WITH VEGETATIONS,HEAVILY FLOODED WITH RAINFALL.	7.57	10.10	10.10	1.3	Inadequate	Adequate	Yes
	987	Batch 13	Olufon-Olodo	Culvert	1 CC (Dia 0.9)	1.7	611269	822395	Fair	0.55	Tertiary		7.88	10.50	10.50	0.8	Inadequate	Inadequate	Yes
	1358	Batch 8	Agugu village	Culvert	1 CC (Dia 0.7)	1.0	615027	825385	Fair	0.57	Tertiary	Flooded with heaavy rainfall.	8.02	10.70	10.70	0.4	Inadequate	Inadequate	Yes
	1432	Batch 20	Idi-osan	Culvert	1 CC (Dia 0.45)	0.6	612692	819554	Poor	0.63	Tertiary	usually heavily flooded	8.47	11.30	11.30	0.1	Inadequate	Inadequate	Yes
	1376	Batch 14	ARUBIEWE	Natural Stream		1.0	611781	821544	Poor	0.66	Tertiary	SURROUNDED WITH VEGETATIONS,FLOODED WITH HEAVY RAINFALL.	8.70	11.60	11.60	10.6	Adequate	Inadequate	Yes
	1531	Batch 31	Olodo	Footpath		0.4	612853	820081	Poor	0.74	Tertiary		9.30	12.40	12.40	7.7	Inadequate	Inadequate	Yes
	1377	Batch 14	ALAGBEDE	Natural Stream		2.0	611989	821508	Poor	0.76	Tertiary	SURROUNDED WITH VEGETATIONS,DEPILATED CULVERT,FLOODED WITH HEAVY RAINFALL	9.45	12.60	12.60	25.7	Adequate	Inadequate	Yes
	1533	Batch 31	Olodo	Natural Stream		0.3	613788	822375	Poor	0.78	Tertiary		9.60	12.80	12.80	1.3	Inadequate	Inadequate	Yes
	1381	Batch 14	IKUMAPAYI	Footpath		0.3	612530	820163	Fair	0.87	Tertiary	HEAVILY FLOODED WITH RAINFALL,SURROUNDED WITH VEGETATIONS.	10.28	13.70	13.70	2.3	Inadequate	Inadequate	Yes
	1532	Batch 31	Olodo / Arubiewe	Natural Stream		0.3	612244	822383	Poor	0.92	Tertiary		10.65	14.20	14.20	0.5	Inadequate	Inadequate	Yes
Om5 Middle Omi East	1407	Batch 20	Ajoda Estate				613105	816148		0.10	Tertiary	No culvet	1.50	2.00	2.00		Inadequate	Inadequate	Yes
	1412	Batch 20	Ifeoluwatedo Estate	Natural Stream		0.7	612298	815242	Poor	0.11	Tertiary	some parts of Natural Stream lined with concrete,usually heavifly flooded.	1.65	2.20	2.20	3.1	Adequate	Inadequate	Yes
	1408	Batch 20	Ajoda Estate	Culvert	2 CC (Dia 0.74)	0.9	612776	816289	Poor	0.17	Tertiary	Depilated road around outlet,usually flood area.	2.55	3.40	3.40	0.9	Inadequate	Inadequate	Yes
	1409	Batch 20	Oluwo	Culvert	2 BC (0.69 x 1.34)	1.6	612898	815807	Fair	0.20	Tertiary	Heavy rainfall floods area.	3.00	4.00	4.00	2.2	Inadequate	Inadequate	Yes
	1411	Batch 20	Ifeoluwatedo Estate	Culvert	2 BC (1.5 x 1.02)	1.8	612419	815537	Fair	0.21	Tertiary		3.15	4.20	4.20	4.4	Adequate	Inadequate	Yes
	1410	Batch 20	Olorunsogo	Culvert	1 BC (1.12 x 0.86)	1.1	612672	815856	Fair	0.29	Tertiary	usually over tops when it rains heavy.	4.35	5.80	5.80	1.2	Inadequate	Inadequate	Yes
	1057	Batch 19	Adegbayi	Culvert	1 CC (Dia 0.75)	1.1	608489	815882	Fair		Tertiary					0.5	Adequate	Inadequate	Yes
	1011	Batch 19	Oluwakeyin				608306	816092		0.10	Tertiary	Pond	1.50	2.00	2.00		Inadequate	Inadequate	Yes
	1019	Batch 19	Olode	Culvert	1 BC (3.6 x 0.4)	0.7	610539	816060	Poor	0.10	Expressway		1.50	2.00	2.00	1.5	Inadequate	Inadequate	Yes
	1022	Batch 19	Olode	Culvert	1 BC (0.9 x 0.87)	1.2	610649	816700	Fair	0.10	Tertiary		1.50	2.00	2.00	0.9	Inadequate	Inadequate	Yes
	84D2	PIU 4th List	Jenrola road, oke odo alapata, femitoluwa quarters	Rectangular Section Channel			610163	818410		0.11	Tertiary	The area is facing serious gully erosion problem. Damaged Channel box section	1.58	2.10	2.10		Inadequate	Inadequate	Yes
	1003	Batch 19	Adegbayi	Culvert	1 CC (Dia 0.6)	0.7	608315	816783	Fair	0.11	Tertiary		1.65	2.20	2.20	0.3	Inadequate	Inadequate	Yes
	83D1	PIU 3rd List	IREPODUN LANDLORDS ASSOCIATION	Pipe Culvert	1 CC (Dia 0.85)		608449	815669		0.11	Tertiary	Damaged structure, overtopping occurs	1.65	2.20	2.20	0.6	Inadequate	Inadequate	Yes
	84D1	PIU 4th List	Jenrola road, oke odo alapata, femitoluwa quarters	Footpath			610223	818525		0.13	Tertiary	The area is facing serious gully erosion problem. Damaged Channel box section	1.92	2.56	2.56		Inadequate	Inadequate	Yes
	84D	PIU 4th List	Jenrola road, oke odo alapata, femitoluwa quarters	Rectangular Section Channel			610247	818502		0.13	Tertiary	Gully Erosion Problem / Damaged Channel box section	1.97	2.62	2.62		Inadequate	Inadequate	Yes
	1046	Batch 19	Isebo Alakia	Culvert	1 CC (Dia 0.8)	1.2	608365	818300	Fair	0.17	Tertiary		2.55	3.40	3.40	0.6	Inadequate	Inadequate	Yes
	1013	Batch 19	Olalere Zone D	Culvert	1 BC (1 x 0.3)	0.4	607913	815541	Poor	0.19	Tertiary		2.85	3.80	3.80	0.2	Inadequate	Inadequate	Yes
	1026	Batch 19	Alakia Area	Culvert	1 BC (1.2 x 1.56)	2.1	610817	817611	Fair	0.19	Tertiary		2.85	3.80	3.80	2.9	Inadequate	Inadequate	Yes
	809	Batch 18	MANATAN	Natural Stream		1.2	605630	819011	Poor	0.20	Tertiary		3.00	4.00	4.00	7.5	Adequate	Inadequate	Yes
	1047	Batch 19	Amosun	Culvert	1 CC (Dia 0.6)	0.9	609047	819200	Fair	0.22	Tertiary		3.30	4.40	4.40	0.3	Inadequate	Inadequate	Yes
	83D3	PIU 3rd List	IREPODUN LANDLORDS ASSOCIATION	Pipe Culvert	1 CC (Dia 1)		607995	815486		0.22	Tertiary	Damaged pipe culvert.	3.30	4.40	4.40	1.0	Inadequate	Inadequate	Yes
	1002	Batch 19	Adegbayi	Culvert	1 CC (Dia 0.75)	1.2	608685	816619	Fair	0.24	Tertiary		3.60	4.80	4.80	0.5	Inadequate	Inadequate	Yes
	1018	Batch 19	Ifesowapo	Culvert	1 CC (Dia 0.75)	0.8	610885	815938	Fair	0.24	Tertiary		3.60	4.80	4.80	0.5	Inadequate	Inadequate	Yes
	84D3	PIU 4th List	Jenrola road, oke odo alapata, femitoluwa quarters	Pipe Culvert	1 CC (Dia 0.8)		610218	818316		0.25	Tertiary	The area is facing serious gully erosion problem and require urgent attention	3.81	5.08	5.08	0.6	Inadequate	Inadequate	Yes
	808	Batch 18	ADELUBI	Footpath		1.2	606356	818370	Good	0.27	Tertiary	FLOODED ALWAYS	4.05	5.40	5.40	3.4	Inadequate	Adequate	Yes
	1015	Batch 19	Kuelu Area	Culvert	1 CC (Dia 0.9)	1.0	609347	815236	Poor	0.27	Secondary		4.05	5.40	5.40	0.8	Inadequate	Inadequate	Yes
	1030	Batch 19	Asipa Community	Culvert	1 BC (2.85 x 2)	2.0	608181	817495	Poor	0.29	Tertiary		4.35	5.80	5.80	12.9	Adequate	Inadequate	Yes
Om6 Middle Omi West	27D	PIU 1st List	KOLAPO ISHOLA ESTATE	Box Culvert	1 BC (2 x 1.5)		605747	821048		0.29	Tertiary	The drainage channel route is not defined. The culvert is located in between a parcel of land, as a result the fence on the parcel of land was damaged during the heavy rainfall in June, 2017.	4.35	5.80	5.80	5.5	Adequate	Inadequate	Yes
	1054	Batch 19	Isebo Alakia	Culvert	1 CC (Dia 0.8)	1.2	608440	818529	Fair	0.30	Tertiary		4.50	6.00	6.00	0.6	Inadequate	Inadequate	Yes
	1024	Batch 19	Olode	Culvert	1 BC (1.5 x 1.02)	1.3	610546	816828	Fair	0.31	Tertiary		4.65	6.20	6.20	2.2	Inadequate	Inadequate	Yes
	727	Batch 12	Kolapo Ishola GRA	Culvert	2 CC (Dia 0.9)	1.4	605947	821020	Fair	0.37	Tertiary		5.55	7.40	7.40	1.5	Inadequate	Inadequate	Yes
	730	Batch 12	Kolapo Ishola GRA	Culvert	1 BC (2.35 x 1.53)	1.8	605537	820373	Good	0.40	Tertiary		6.00	8.00	8.00	6.9	Inadequate	Adequate	Yes

Structure Data												Structure Assessment						
Subbasin	Structure No.	Batch_ID	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Design Flow (m3/s)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
	811	Batch 18	ADOGBA/ MANATAN	Culvert	1 BC (2.87 x 1.04)	1.3	605801	818942	Good	0.45	Tertiary	FLOODED ALWAYS	6.75	9.00	9.00	5.0	Inadequate	Adequate	Yes
	1020	Batch 19	Adegbayi	Culvert	1 BC (1.4 x 0.81)	1.1	610781	816440	Good	0.45	Tertiary		6.75	9.00	9.00	1.5	Inadequate	Adequate	Yes
	733	Batch 12	Carlton estate GRA	Culvert	2 BC (2.1 x 1.12)	1.8	606161	820977	Good	0.50	Tertiary		7.50	10.00	10.00	7.7	Inadequate	Adequate	Yes
	1023	Batch 19	Olode	Culvert	1 BC (1.6 x 1.24)	1.5	610765	816870	Good	0.51	Tertiary		7.57	10.10	10.10	3.2	Inadequate	Adequate	Yes
	1044	Batch 19	Nigeria Brewery	Culvert	3 BC (1.22 x 1.2)	1.3	607530	818050	Good	0.53	Tertiary	Tha Channel has been Blocked	7.72	10.30	10.30	6.4	Inadequate	Adequate	Yes
	1044A	Batch 19	Nigerian Brewery	Culvert	1 BC (1.55 x 1.23)	1.4	607561	818043		0.53	Tertiary		7.72	10.30	10.30	3.0	Inadequate	Inadequate	Yes
	1519	Batch 31	Ifesowapo commuity Aba Odan	Culvert	2 BC (0.85 x 0.96)	1.2	610184	818000	Poor	0.62	Tertiary		8.40	11.20	11.20	1.9	Inadequate	Inadequate	Yes
	1048	Batch 19	Amosun	Culvert	1 CC (Dia 0.6)	0.9	609335	818930	Fair	0.63	Tertiary		8.47	11.30	11.30	0.3	Inadequate	Inadequate	Yes
	1001	Batch 19	Adegbayi	Culvert	1 CC (Dia 0.7)	1.0	608862	816520	Poor	0.65	Tertiary	Flooded the area during heavy rain	8.62	11.50	11.50	0.4	Inadequate	Inadequate	Yes
	1518	Batch 31	Aba Odan	Culvert	2 BC (0.98 x 1.14)	1.3	610214	817907	Poor	0.65	Tertiary		8.62	11.50	11.50	2.9	Inadequate	Inadequate	Yes
	1014	Batch 19	Kuelu Area	Footpath		0.6	609780	815295	Poor	0.66	Tertiary		8.70	11.60	11.60	2.7	Inadequate	Inadequate	Yes
	1000	Batch 19	adegbayi	Culvert	1 BC (1.8 x 1.5)	2.2	609051	816514	Fair	0.73	Tertiary	Flooded the area during heavy rain	9.23	12.30	12.30	4.8	Inadequate	Inadequate	Yes
	112	Batch 0	AROLU AREA	Culvert	1 BC (1.5 x 1.36)	1.5	606105	819048	Erosion	0.75	Tertiary		9.38	12.50	12.50	3.3	Inadequate	Inadequate	Yes
	999	Batch 19	Adegbayi	Culvert	1 CC (Dia 0.65)	1.8	609232	816391	Fair	0.85	Secondary	Oveflow into surrounding area	10.13	13.50	13.50	0.3	Inadequate	Inadequate	Yes
	1029	Batch 19	Asipa-Laamo	Culvert	1 BC (2.2 x 1.56)	1.8	608892	817466	Fair	0.85	Tertiary		10.13	13.50	13.50	6.5	Inadequate	Inadequate	Yes
	1042	Batch 19	Oke- Odo -Alalubosa Zone A	Culvert	2 CC (Dia 0.85)	1.1	606662	818475	Fair	0.86	Tertiary		10.20	13.60	13.60	1.3	Inadequate	Inadequate	Yes
	1044B	Batch 19	Nigeria Brewery	Culvert	3 BC (1.37 x 1.32)	1.5	607581	818042		0.87	Tertiary	The Inlet of the channel has been fenced	10.28	13.70	13.70	8.4	Inadequate	Inadequate	Yes
	1012	Batch 19	Osun seni	Culvert	1 BC (2.1 x 1.2)	1.2	608210	815723	Fair	0.88	Tertiary	Culvert under construction	10.35	13.80	13.80	4.3	Inadequate	Inadequate	Yes
	1009	Batch 19	Osun Seni Zone B	Culvert	1 BC (2.1 x 1.52)	1.8	608383	815759	Good	0.94	Tertiary		10.80	14.40	14.40	5.9	Inadequate	Adequate	Yes
	1041	Batch 19	Aroko- Agoro	Culvert	2 CC (Dia 0.7)	1.0	606749	818607	Fair	0.95	Tertiary	Overflow during heavy rain	10.87	14.50	14.50	0.8	Inadequate	Inadequate	Yes
	1171	Batch 25	Aiport	Natural Stream		0.5	608370	813769	Poor		Tertiary					0.7	Adequate	Inadequate	Yes
	1171 Prime	Batch 25	Aiport	Culvert	2 BC (1.46 x 0.9)	1.1	608242	813795	Fair	0.10	Tertiary		1.50	2.00	2.00	3.6	Adequate	Inadequate	Yes
	1127	Batch 25	Kupo Zone 3	Footpath		1.2	609474	814119	Poor	0.11	Tertiary		1.65	2.20	2.20	4.5	Adequate	Inadequate	Yes
	1126 Prime	Batch 25	Airport				607496	812901		0.11	Tertiary	Erosion has divided the road	1.65	2.20	2.20		Inadequate	Inadequate	Yes
	1134	Batch 25	Akintunde	Natural Stream		0.5	608724	812689	Poor	0.12	Tertiary		1.80	2.40	2.40	1.3	Inadequate	Inadequate	Yes
	1151	Batch 25	Faosin	Culvert	1 CC (Dia 0.75)	1.4	608823	811061	Poor	0.12	Tertiary	For attention	1.80	2.40	2.40	0.5	Inadequate	Inadequate	Yes
	1128	Batch 25	Ona Ara	Footpath		0.4	609357	814144	Poor	0.13	Tertiary		1.95	2.60	2.60	3.7	Adequate	Inadequate	Yes
	1140	Batch 25	Irepodun	Culvert	1 CC (Dia 0.8)	1.1	610561	813330	Poor	0.13	Secondary		1.95	2.60	2.60	0.6	Inadequate	Inadequate	Yes
	1438	Batch 26	Ejikeye-Ajia	Culvert	1 BC (0.87 x 0.97)	1.2	611873	812515	Fair	0.13	Secondary	Always heavily flooded.	1.95	2.60	2.60	1.0	Inadequate	Inadequate	Yes
	1172 Prime	Batch 25	Aiport	Culvert	1 BC (1.1 x 0.8)	1.3	608107	813628	Fair	0.14	Tertiary		2.10	2.80	2.80	1.1	Inadequate	Inadequate	Yes
	1165	Batch 25	Akindele Atea	Culvert	1 BC (1.14 x 0.8)	1.1	609608	811088	Poor	0.15	Tertiary	Attention because of excessive overflow during rain	2.25	3.00	3.00	1.1	Inadequate	Inadequate	Yes
	1436	Batch 26	Akamo/masopa	Culvert	1 BC (0.9 x 0.94)	1.2	612537	814006	Fair	0.19	Tertiary		2.85	3.80	3.80	1.0	Inadequate	Inadequate	Yes
	1157	Batch 25	Kuledi Area	Culvert	1 BC (3.7 x 0.8)	0.8	610392	811023	Fair	0.20	Tertiary		3.00	4.00	4.00	4.5	Adequate	Inadequate	Yes
	1172	Batch 25	Aiport	Natural Stream		0.3	608432	813682	Poor	0.20	Tertiary		3.00	4.00	4.00	0.5	Inadequate	Inadequate	Yes
	1017	Batch 19	Poat	Culvert	2 CC (Dia 0.9)	1.3	610086	814595	Fair	0.21	Secondary		3.15	4.20	4.20	1.5	Inadequate	Inadequate	Yes
	1439	Batch 26	Ejikeye-Ajia	Culvert	1 CC (Dia 0.77)	1.0	611660	812506	Fair	0.21	Tertiary	Usually flooded.	3.15	4.20	4.20	0.5	Inadequate	Inadequate	Yes
	53D1	PIU 1st List	ROCK VIEW ESTATE RESIDENTS ASSOCIATION OFF IYANA AGBALA, NEW IFE EXPRESS WAY, BIOKU IBADAN	Gullies			609961	814671		0.21	Tertiary	Olorungunwa community postponed from 1st pool of works, Gullies eroding the steep pathway between the houses causing difficulty in accessibility and instability to houses. Needs a local drainage system	3.15	4.20	4.20		Inadequate	Inadequate	Yes
	53D2	PIU 1st List	ROCK VIEW ESTATE RESIDENTS ASSOCIATION OFF IYANA AGBALA, NEW IFE EXPRESS WAY, BIOKU IBADAN	Natural Stream			610041	814677		0.21	Secondary	Olorungunwa community postponed from 1st pool of works, Gullies eroding the steep pathway between the houses causing difficulty in accessibility and instability to houses. Needs a local drainage system	3.15	4.20	4.20		Inadequate	Inadequate	Yes
Om7 Middle Omi South	1163	Batch 25	Iderade	Culvert	2 CC (Dia 0.75)	1.1	609840	810545	Fair	0.22	Tertiary		3.30	4.40	4.40	0.9	Inadequate	Inadequate	Yes
	1152	Batch 25	Faosin	Culvert	1 BC (2.1 x 0.94)	1.1	608597	810920	Fair	0.24	Tertiary		3.60	4.80	4.80	3.0	Inadequate	Inadequate	Yes
	1162	Batch 25	Iderade	Natural Stream		1.4	609952	810556	Poor	0.24	Tertiary		3.60	4.80	4.80	5.8	Adequate	Inadequate	Yes
	1440	Batch 26	Ejikeye-Ajia	Natural Stream		0.5	611545	812531	Poor	0.24	Tertiary	Flooded with heavy rainfall.	3.60	4.80	4.80	0.8	Inadequate	Inadequate	Yes
	1137	Batch 25	Araromi-Kure	Culvert	1 BC (1.47 x 0.9)	1.0	608155	811532	Poor	0.26	Tertiary		3.90	5.20	5.20	1.8	Inadequate	Inadequate	Yes
	1156	Batch 25	Ifeoluwa Community	Footpath		1.1	610848	813763	Poor	0.31	Tertiary		4.65	6.20	6.20	3.2	Inadequate	Inadequate	Yes
	1125 Prime	Batch 25	Aiport	Culvert	2 CC (Dia 1.5)	1.3	608076	814503	Fair	0.35	Tertiary		5.25	7.00	7.00	5.9	Inadequate	Inadequate	Yes
	1138	Batch 25	Amuloko	Natural Stream		0.5	608238	811761	Poor	0.40	Tertiary		6.00	8.00	8.00	1.7	Inadequate	Inadequate	Yes
	1420	Batch 20	Egbeda	Culvert	2 CC (Dia 0.96)	1.4	616079	816049	Poor	0.40	Secondary	Flooded with heavy rainfall.	6.00	8.00	8.00	1.8	Inadequate	Inadequate	Yes
	1129	Batch 25	Ifesowapo Community	Culvert	1 CC (Dia 0.85)	1.5	609336	813983	Fair	0.43	Secondary		6.45	8.60	8.60	0.6	Inadequate	Inadequate	Yes
	1131	Batch 25	Amuloko	Footpath		1.4	609479	812647	Poor	0.48	Secondary		7.20	9.60	9.60	8.4	Inadequate	Inadequate	Yes
	1434	Batch 26	Oluwo	Natural Stream		0.4	613021	814359	Poor	0.51	Tertiary	Heavily flooded with rainfall.	7.57	10.10	10.10	0.8	Inadequate	Inadequate	Yes
	1148	Batch 25	Ifesowapo Area	Footpath		1.6	608128	810478	Fair	0.52	Tertiary		7.65	10.20	10.20	46.9	Adequate	Inadequate	Yes

Structure Data												Structure Assessment						
Subbasin	Structure No.	Batch_ID	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Design Flow (m3/s)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
	1417	Batch 20	Olorunsogo	Culvert	1 CC (Dia 0.84)		613635	815559	Fair	0.58	Expressway	One ring at inlet,two rings at outlet.	8.10	10.80	10.80	0.6	Inadequate	Inadequate	Yes
	1167	Batch 25	Fakayode Area	Natural Stream		1.3	609493	811575	Poor	0.59	Tertiary		8.17	10.90	10.90	10.7	Adequate	Inadequate	Yes
	1153	Batch 25	Araromi	Natural Stream		1.5	608840	810739	Poor	0.60	Tertiary		8.25	11.00	11.00	11.0	Adequate	Inadequate	Yes
	1135	Batch 25	Airport	Culvert	2 BC (1.41 x 0.95)	1.5	607908	812834	Fair	0.63	Tertiary		8.47	11.30	11.30	3.7	Inadequate	Inadequate	Yes
	1418	Batch 20	Olorunsogo community	Culvert	1 CC (Dia 0.67)	1.1	613616	815420	Good	0.65	Tertiary	Culvert newly constructed by community.	8.62	11.50	11.50	0.3	Inadequate	Adequate	Yes
	1419	Batch 20	Olorunsogo community	Natural Stream		0.1	613611	815267	Poor	0.71	Tertiary	Usually flooded Area.	9.07	12.10	12.10	0.5	Inadequate	Inadequate	Yes
	1435	Batch 26	Olode/Ajamoro	Culvert	1 CC (Dia 0.75)	1.1	612787	814363	Poor	0.75	Tertiary	Culvert sinking,usually flooded with heavy rainfall.	9.38	12.50	12.50	0.5	Inadequate	Inadequate	Yes
	1166	Batch 25	Akindele Atea	Culvert	1 BC (2.15 x 1.53)	1.8	609602	811367	Fair	0.77	Tertiary		9.52	12.70	12.70	6.2	Inadequate	Inadequate	Yes
	1421	Batch 20	Egbeda	Culvert	1 BC (2.4 x 1.82)	2.1	615905	815568	Fair	0.84	Tertiary	Flooded with heavy rainfall,Floor&wall of culvert becoming washed off and culert is filled with sand and refuse.	10.05	13.40	13.40	9.1	Inadequate	Inadequate	Yes
	1056	Batch 19	Bioku - Araba	Culvert	1 BC (2.81 x 2.47)	2.7	610603	814687	Good	0.87	Tertiary		10.28	13.70	13.70	16.9	Adequate	Adequate	No
	1136	Batch 25	Inuege	Culvert	1 BC (1.15 x 0.77)	1.0	608106	812468	Fair	0.88	Tertiary		10.35	13.80	13.80	1.1	Inadequate	Inadequate	Yes
	1016	Batch 19	Ogo Oluwa Zone F	Natural Stream		1.9	610708	814698	Poor	0.91	Tertiary		10.58	14.10	14.10	15.5	Adequate	Inadequate	Yes
	1149	Batch 25	Idi- Oro	Culvert	1 BC (2.1 x 1.95)	2.2	608421	810417	Fair	0.95	Tertiary		10.87	14.50	14.50	8.4	Inadequate	Inadequate	Yes
	14P	Batch 25	OLORUNGUNWA	Culvert	2 CC (Dia 0.9)	1.2	610002	814809	Poor	0.15	Secondary		2.25	3.00	3.00	1.5	Inadequate	Inadequate	Yes
	1447	Batch 31	Odeyale-Ifesowapo	Culvert	1 CC (Dia 1)	1.6	610854	808521	Poor		Main	Always over tops with heavy rainfall				1.0	Adequate	Inadequate	Yes
	1457	Batch 31	Oke-elesin	Natural Stream		0.5	607799	809393	Poor	0.16	Tertiary	Natural Stream drains water into a deep hole before flow.	2.40	3.20	3.20	1.2	Inadequate	Inadequate	Yes
	1145	Batch 25	Ifeloju	Culvert	2 BC (0.73 x 0.88)	1.4	607202	810060	Poor	0.18	Tertiary		2.70	3.60	3.60	1.4	Inadequate	Inadequate	Yes
	1450	Batch 31	Orisunmbare	Footpath		0.8	606872	808653	Poor	0.19	Tertiary	Floods when it rains heavy.	2.85	3.80	3.80	2.3	Inadequate	Inadequate	Yes
	1147	Batch 25	Oke-Elesin	Culvert	1 BC (2.3 x 1.84)	2.2	607597	809600	Good	0.20	Tertiary		3.00	4.00	4.00	8.7	Adequate	Adequate	No
	1459	Batch 31	Oke-odo/Olu-awo	Natural Stream		0.4	607817	808823	Poor	0.23	Tertiary	Heavily flooded with rainfall	3.45	4.60	4.60	1.7	Inadequate	Inadequate	Yes
	1146	Batch 25	Ifeloju	Natural Stream		0.7	607142	809806	Poor	0.24	Tertiary		3.60	4.80	4.80	1.7	Inadequate	Inadequate	Yes
	1456	Batch 31	Amuloko/Oke-elesin	Natural Stream		0.6	607613	809536	Poor	0.24	Tertiary	Flooded with heavy rainfall.	3.60	4.80	4.80	3.3	Inadequate	Inadequate	Yes
	1468	Batch 31	Olupo Estate	Natural Stream		0.4	607750	807855	Poor	0.25	Tertiary	Flooded with heavy rainfall	3.75	5.00	5.00	0.6	Inadequate	Inadequate	Yes
	1455	Batch 31	Araromi-Lapiti	Natural Stream		0.7	607162	809201	Poor	0.30	Tertiary	Always heavily flooded when it rains.	4.50	6.00	6.00	3.0	Inadequate	Inadequate	Yes
	1143	Batch 25	Oke-Odo	Natural Stream		0.5	606800	810452	Poor	0.34	Tertiary	Overflow during heavy raing	5.10	6.80	6.80	6.4	Adequate	Inadequate	Yes
	1465	Batch 31	Olokonla Road	Culvert	1 CC (Dia 0.8)	1.1	608716	807637	Poor	0.37	Secondary	Flooded with heavy rainfall.	5.55	7.40	7.40	0.6	Inadequate	Inadequate	Yes
	1469	Batch 31	Alagbede	Natural Stream		0.4	607715	807587	Poor	0.49	Tertiary	Floods area when it rains heavy	7.35	9.80	9.80	1.7	Inadequate	Inadequate	Yes
	1466	Batch 31	Egbeda-Atuba	Culvert	1 CC (Dia 1.15)	1.4	606554	807097	Fair	0.62	Secondary		8.40	11.20	11.20	1.5	Inadequate	Inadequate	Yes
	1470	Batch 31	Alagbede	Natural Stream		0.3	607638	807499	Poor	0.67	Tertiary	Always flooded with rainfall	8.78	11.70	11.70	0.9	Inadequate	Inadequate	Yes
	1471	Batch 31	Baale Village,Kobomoje Olomiyeye	Natural Stream		0.7	607546	807273	Poor	0.80	Tertiary	Over flow,floods area	9.75	13.00	13.00	3.2	Inadequate	Inadequate	Yes
	1144	Batch 25	Oke-Odo	Footpath		1.0	606983	809835	Poor	0.95	Tertiary	Overflow during heavy raing	10.87	14.50	14.50	19.5	Adequate	Inadequate	Yes
	1451	Batch 31	Thy-will	Culvert	1 BC (2 x 1.28)	1.7	607025	808688	Fair	0.97	Tertiary	Heavily flooded with rainfall,over flow area.	11.03	14.70	14.70	4.4	Inadequate	Inadequate	Yes
	1452	Batch 31	Gbenle Estate	Natural Stream		1.0	607220	808944		1.19	Tertiary	Heavily flooded with rainfall.	12.68	16.90	16.90	9.0	Inadequate	Inadequate	Yes
	1453	Batch 31	Gbenle Estate	Natural Stream		1.0	607255	808998	Poor	1.22	Tertiary	Heavily flooded with rainfall.	12.90	17.20	17.20	8.5	Inadequate	Inadequate	Yes
Om8 Lower Omi	1454	Batch 31	Thy-will	Natural Stream		0.4	607358	809055	Fair	1.25	Tertiary	Always heavily flooded when it rains.	13.13	17.50	17.50	2.5	Inadequate	Inadequate	Yes
	1467	Batch 31	Olomiyeye	Natural Stream		0.8	606954	807235	Dilapidated	1.28	Tertiary	Flooded with heavy rainfall	13.35	17.80	17.80	5.8	Inadequate	Inadequate	Yes
	1472	Batch 31	Orisunmbare/Olorire Estate	Footpath		1.9	607770	806938	Poor	3.04	Tertiary	Always heavily flooded with rainfall	26.55	35.40	35.40	14.2	Inadequate	Inadequate	Yes
	1528	Batch 31	Gbenle Estate	Culvert	2 BC (2.35 x 1.9)	2.4	607516	809208	Fair	3.45	Tertiary		29.63	39.50	39.50	18.7	Inadequate	Inadequate	Yes
	1458	Batch 31	Amuloko	Culvert	2 CC (Dia 0.75)	1.0	607859	809266	Poor	4.02	Tertiary	Over tops culvert when it rains heavy.	33.90	45.20	45.20	0.9	Inadequate	Inadequate	Yes
	69	Batch 0	OKE-ODO OLUAWO	Culvert	1 BC (2.45 x 1.33)	1.9	607985	809181	Poor	4.60	Tertiary		38.25	51.00	51.00	6.0	Inadequate	Inadequate	Yes
	1460	Batch 31	Olu-awo	Natural Stream		0.2	608379	809178	Fair	4.88	Tertiary	under construction by community.	40.35	53.80	53.80	0.7	Inadequate	Inadequate	Yes
	1461	Batch 31	Tokotaya Bus-stop	Natural Stream		1.0	608703	809290	Fair	5.27	Tertiary	Flooded with heavy rainfall.	42.72	56.96	56.96	11.2	Inadequate	Inadequate	Yes
	1462	Batch 31	Abonde	Natural Stream		0.6	608893	809152		5.39	Tertiary	Heavily flooded with rainfall,over flow and floods area.	43.37	57.83	57.83	5.7	Inadequate	Inadequate	Yes
	1462 Prime	Batch 31	Amuloko	Culvert	1 BC (2.2 x 1.7)	2.2	608930	809102	Good	5.51	Tertiary	Floods area wjen it rains heavy.	44.02	58.70	58.70	7.4	Inadequate	Adequate	Yes
	1529	Batch 31	Aba Okubiyi	Footpath		1.7	609155	808668	Good	5.82	Tertiary		45.71	60.95	60.95	29.3	Inadequate	Adequate	Yes
	1463	Batch 31	Gboro village/Idi-ose	Culvert	2 BC (1.93 x 1.3)	1.7	609375	808557	Poor	6.56	Secondary	Always over tops with heavy ranfall.	49.73	66.31	66.31	8.6	Inadequate	Inadequate	Yes
	1464	Batch 31	Olorungbebe	Natural Stream		1.2	609588	808305	Fair	6.89	Tertiary	Heavily flooded with rainfall	51.53	68.70	68.70	17.4	Inadequate	Inadequate	Yes
	1446	Batch 31	Odeyale-Ifesowapo	Culvert	1 CC (Dia 2.9)	2.5	611023	808391	Good	9.87	Main	Culvert is an arc not ring or celll,over flows when it rains heavy.	67.73	90.31	90.31	17.1	Inadequate	Adequate	Yes
	1448 Prime	Batch 31	Ifesowapo-Omolere Estate	Natural Stream		2.1	610898	808434	Good	10.29	Tertiary	Always heavily flooded	70.01	93.35	93.35	43.1	Inadequate	Adequate	Yes

Structure Data												Structure Assessment						
Subbasin	Structure No.	Batch_ID	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Design Flow (m3/s)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
	21D2	PIU 1st List	IFESOWAPO LANDLORD AND LANDLADIES ODEYALE IFESOWAPO COMMUNITY AKANRAN ROAD	Natural Stream			610901	808432		10.29	Tertiary	There is no structure	70.01	93.35	93.35		Inadequate	Inadequate	Yes
	1448	Batch 31	Ifesowapo-Omolere Estate	Natural Stream		1.4	610789	808467	Good	10.42	Tertiary	Always heavily flooded	70.72	94.30	94.30	26.4	Inadequate	Adequate	Yes
	1449	Batch 31	Ifelere/Agbena	Culvert	2 BC (1.75 x 2.3)	2.6	610581	808456	Fair	10.50	Tertiary	Heavy rainfall,overflow culvert.	71.16	94.88	94.88	16.2	Inadequate	Inadequate	Yes
	625B	Batch 18	Ojoo-Ajibode	Culvert	2 BC (3.02 x 1.9)	2.3	596804	824486	Good		Tertiary	Newly constructed bridge by state government.				25.8	Adequate	Adequate	No
	617	Batch 10	Aro-Meta Eleyele	Footpath		1.6	596438	820754	Poor	0.11	Tertiary		1.65	2.20	2.20	11.2	Adequate	Inadequate	Yes
	483	Batch 5	Abangbe Ajibode	Culvert	2 BC (1.4 x 1.75)	2.1	598524	825327	Good	0.12	Tertiary		1.80	2.40	2.40	8.4	Adequate	Adequate	No
	524	Batch 5	Apete	Culvert	1 CC (Dia 0.8)	1.2	597098	825240	Poor	0.12	Tertiary		1.80	2.40	2.40	0.6	Inadequate	Inadequate	Yes
	23D	PIU 1st List	ODO-BAALE, LOKOAREA SANGO	Pipe Culvert	1 CC (Dia 0.8)		598674	820615		0.12	Tertiary	Gullies eroding the steep pathway between the houses causing difficulty in accessibility and instability to houses. Needs a local drainage system / There is a difference between excel sheet dimensions and the pictures./ Pictures show that there is no cul	1.80	2.40	2.40	0.6	Inadequate	Inadequate	Yes
	55D1	PIU 1st List	OKE-ODAN-POLY QUARTERS LANDLORDS ASSOCIATION, APETE, IBADAN IDO LGA	Natural Stream			594943	826156		0.12	Main	The road is eroded, many signs of scour, erosion in the road	1.80	2.40	2.40		Inadequate	Inadequate	Yes
	527	Batch 5	University of Ibadan	Culvert	1 BC (1.42 x 1.44)	1.9	599133	826270	Good	0.16	Tertiary		2.40	3.20	3.20	3.3	Adequate	Adequate	No
	526	Batch 5	Ajibode	Culvert	1 CC (Dia 0.9)	1.0	598303	826395	Good	0.17	Tertiary		2.55	3.40	3.40	0.8	Inadequate	Adequate	Yes
	616	Batch 10	Agbaje Ijokodo	Footpath		1.2	596488	820864	Fair	0.21	Tertiary		3.15	4.20	4.20	12.7	Adequate	Inadequate	Yes
	495	Batch 5	Ojoo	Culvert	1 CC (Dia 0.7) + 1 BC (3.5 x 1.2)	1.6	600539	825765	Good	0.21	Tertiary		3.15	4.20	4.20	8.3	Adequate	Adequate	No
	610	Batch 10	Apete	Culvert	1 BC (1.35 x 1.83)	2.0	595850	823938	Fair	0.23	Tertiary		3.45	4.60	4.60	4.2	Adequate	Inadequate	Yes
	658	Batch 11	Sango	Footpath		1.1	598594	820943	Fair	0.23	Tertiary		3.45	4.60	4.60	8.8	Adequate	Inadequate	Yes
	501	Batch 5	Abatakan	Culvert	1 BC (1 x 0.9)	0.9	600092	826561	Poor	0.24	Tertiary		3.60	4.80	4.80	1.1	Inadequate	Inadequate	Yes
	466	Batch 4	Mojoda	Footpath		1.4	596202	825345	Erosion	0.25	Tertiary		3.75	5.00	5.00	7.9	Adequate	Inadequate	Yes
	134	Batch 31	Apete	Footpath		0.5	596251	823077	Poor	0.25	Tertiary		3.75	5.00	5.00	1.4	Inadequate	Inadequate	Yes
	494	Batch 5	Ojoo	Culvert	1 BC (3.5 x 1.2)	1.5	600404	825744	Good	0.26	Tertiary		3.90	5.20	5.20	7.9	Adequate	Adequate	No
	523	Batch 5		Natural Stream		1.5	596974	825153	Poor	0.27	Tertiary		4.05	5.40	5.40	11.8	Adequate	Inadequate	Yes
On10 Middle Ona North	496	Batch 5	Oguntula	Natural Stream		1.3	601204	826313	Erosion	0.29	Tertiary		4.35	5.80	5.80	10.3	Adequate	Inadequate	Yes
	661	Batch 11	Samanda	Culvert	2 BC (2.96 x 2.05)	2.5	599551	821206	Good	0.31	Highway		4.65	6.20	6.20	27.9	Adequate	Adequate	No
	522	Batch 5		Footpath		1.5	596914	825146	Poor	0.32	Tertiary		4.80	6.40	6.40	7.3	Adequate	Inadequate	Yes
	648	Batch 11	Alaro	Footpath		0.6	598123	820873	Poor	0.33	Tertiary		4.95	6.60	6.60	21.7	Adequate	Inadequate	Yes
	521	Batch 5		Culvert	2 CC (Dia 0.6)	0.9	596862	825147	Poor	0.33	Tertiary		4.95	6.60	6.60	0.5	Inadequate	Inadequate	Yes
	467	Batch 4	Anu Oluwa Quarters	Culvert	2 CC (Dia 0.8)	1.1	596378	825418	Poor	0.36	Tertiary		5.40	7.20	7.20	1.1	Inadequate	Inadequate	Yes
	55D2	PIU 1st List	OKE-ODAN-POLY QUARTERS LANDLORDS ASSOCIATION, APETE, IBADAN IDO LGA	Natural Stream			594858	826372		0.38	Tertiary	Low point in the road, no structure, accumualtion of water over the road	5.70	7.60	7.60		Inadequate	Inadequate	Yes
	660	Batch 11	Sango	Culvert	2 CC (Dia 0.78)	1.7	599416	821080	Fair	0.39	Tertiary		5.85	7.80	7.80	1.0	Inadequate	Inadequate	Yes
	497	Batch 5	Ojoo	Culvert	1 BC (2.7 x 1.36)	2.1	600984	826356	Good	0.39	Tertiary		5.85	7.80	7.80	7.0	Inadequate	Adequate	Yes
	520	Batch 5		Footpath		1.8	596752	825143	Poor	0.40	Tertiary		6.00	8.00	8.00	9.9	Adequate	Inadequate	Yes
	650	Batch 11	Okoro	Natural Stream		1.9	597841	820248	Poor	0.41	Tertiary		6.15	8.20	8.20	9.2	Adequate	Inadequate	Yes
	525	Batch 5	Sode-Jamade Apete	Footpath		0.7	596760	825939	Poor	0.43	Tertiary		6.45	8.60	8.60	1.8	Inadequate	Inadequate	Yes
	493	Batch 5	NISER	Culvert	2 BC (2.6 x 1.42)	2.3	599897	825695	Fair	0.46	Tertiary		6.90	9.20	9.20	14.1	Adequate	Inadequate	Yes
	498	Batch 18	Ojoo-Gospel/Total	Culvert	1 BC (2.5 x 1.51)	3.5	600903	826357	Good	0.54	Expressway		7.80	10.40	10.40	7.3	Inadequate	Adequate	Yes
	499	Batch 5	Old oyo Road	Culvert	2 BC (2.5 x 2.45)	4.6	600824	826356	Good	0.55	Highway		7.88	10.50	10.50	28.6	Adequate	Adequate	No
	649	Batch 11	Okoro	Footpath		1.8	597915	820439	Poor	0.56	Tertiary		7.95	10.60	10.60	33.0	Adequate	Inadequate	Yes
	464	Batch 4	Isale School the way	Natural Stream		1.3	595553	824753	Erosion	0.56	Tertiary		7.95	10.60	10.60	19.6	Adequate	Inadequate	Yes
	600	Batch 10	Eleyele	Culvert	2 BC (2.2 x 1.43)	1.7	596184	820843	Poor	0.57	Tertiary	Culvet outlet is sinking	8.02	10.70	10.70	11.6	Adequate	Inadequate	Yes
	492	Batch 5	University of Ibadan	Culvert	1 BC (3.2 x 1.54)	2.1	599846	825688	Good	0.57	Main		8.02	10.70	10.70	10.2	Adequate	Adequate	No
	469	Batch 4	Oke Odan	Culvert	2 BC (3 x 1.78)	2.7	595180	827026	Good	0.66	Tertiary		8.70	11.60	11.60	23.3	Adequate	Adequate	No
	500	Batch 5	Ojoo	Culvert	1 BC (4.3 x 1.6)	2.5	600523	826330	Good	0.71	Tertiary		9.07	12.10	12.10	15.4	Adequate	Adequate	No
	465	Batch 4	Ile Alli	Natural Stream		1.3	595614	824617	Poor	0.74	Tertiary		9.30	12.40	12.40	7.4	Inadequate	Inadequate	Yes
	603	Batch 10	Apete	Culvert	2 BC (1.28 x 1.27)	1.5	595607	824539	Fair	0.76	Tertiary	Urgent attention is needed here	9.45	12.60	12.60	4.9	Inadequate	Inadequate	Yes
	630	Batch 11	UI	Culvert	1 BC (3.04 x 3.03)	4.5	598515	823783	Good	0.76	Tertiary		9.45	12.60	12.60	24.7	Adequate	Adequate	No
	655	Batch 11	UI	Culvert	2 BC (3.2 x 2.07)	3.1	599687	822453	Good	0.79	Tertiary		9.68	12.90	12.90	31.3	Adequate	Adequate	No
	629	Batch 11	UI	Natural Stream		0.5	598236	824008	Good	0.92	Tertiary		10.65	14.20	14.20	1.9	Inadequate	Adequate	Yes
	136	Batch 0	IJOKODO , APETE ROAD	Culvert	1 BC (15.3 x 2.55)	3.6	597088	821805	Poor	5.11	Main		41.85	55.80	55.80	133.4	Adequate	Inadequate	Yes

Structure Data												Structure Assessment						
Subbasin	Structure No.	Batch_ID	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Design Flow (m3/s)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
On11 Alapata South	608	Batch 10	Awotan Apete-Life Forte	Culvert	1 CC (Dia 0.87)	1.0	594781	823625	Poor	0.20	Main	Culvet outlet is blocked	3.00	4.00	4.00	0.7	Inadequate	Inadequate	Yes
	612	Batch 10	Onigbaketun	Footpath		2.9	593734	824052	Poor	0.29	Secondary	Urgent attention is needed here	4.35	5.80	5.80	37.0	Adequate	Inadequate	Yes
	457	Batch 4	Alapata	Culvert	1 CC (Dia 0.7)	1.5	592873	826459	Poor	0.30	Main	Inlet is not accessible	4.50	6.00	6.00	0.4	Inadequate	Inadequate	Yes
	613	Batch 10	Alatare Zone C	Footpath		0.9	591782	823598	Poor	0.56	Tertiary		7.95	10.60	10.60	2.6	Inadequate	Inadequate	Yes
	605	Batch 10	Owala	Culvert	1 BC (1.2 x 2)	2.5	592324	822167	Good	0.82	Secondary		9.90	13.20	13.20	4.0	Inadequate	Adequate	Yes
	462	Batch 4	Agunbiade	Natural Stream		0.6	593828	825747	Fair	0.86	Tertiary		10.20	13.60	13.60	1.7	Inadequate	Inadequate	Yes
On12 Middle Ona West	1105	Batch 15	Ogbagba Area	Culvert	1 BC (1.66 x 1.46)	1.7	591055	816791	Fair		Tertiary					4.1	Adequate	Inadequate	Yes
	582	Batch 9	Ologuneru	Natural Stream		1.0	591104	821372	Poor	0.17	Tertiary		2.55	3.40	3.40		Inadequate	Inadequate	Yes
	1113	Batch 15	Owode Apata Aba Ege	Culvert	1 CC (Dia 0.75)	1.1	588670	818139	Fair	0.19	Tertiary		2.85	3.80	3.80	0.5	Inadequate	Inadequate	Yes
	739	Batch 16	Oladele Face 2	Culvert	2 BC (1.05 x 0.81)	1.1	591531	817968	Good	0.21	Tertiary		3.15	4.20	4.20	2.0	Inadequate	Adequate	Yes
	615	Batch 10	Abanla Zone B2	Culvert	2 BC (1.17 x 0.72)	0.9	591846	821459	Fair	0.23	Tertiary		3.45	4.60	4.60	2.0	Inadequate	Inadequate	Yes
	736	Batch 16	Oladele face 2	Culvert	1 CC (Dia 0.78)	1.0	591557	817840	Poor	0.26	Tertiary		3.90	5.20	5.20	0.5	Inadequate	Inadequate	Yes
	779	Batch 16	Gbekuba	Culvert	1 BC (2.65 x 1.03)	1.3	592174	817290	Good	0.28	Tertiary	Flooded the area during heavy rain	4.20	5.60	5.60	4.5	Inadequate	Adequate	Yes
	737	Batch 16	Gbekuba	Culvert	1 BC (2.6 x 1.14)	1.4	592236	817305	Fair	0.29	Tertiary		4.35	5.80	5.80	5.1	Inadequate	Inadequate	Yes
	588	Batch 9	Olohungbebe Ido	Culvert	1 BC (2 x 0.85)	1.0	590786	822346	Fair	0.32	Tertiary		4.80	6.40	6.40	2.4	Inadequate	Inadequate	Yes
	590	Batch 9	Elenusonso	Culvert			588806	822259	Poor	0.32	Secondary	Blocked by sediment	4.80	6.40	6.40		Inadequate	Inadequate	Yes
	589	Batch 9	Olohungbebe Ido	Culvert	1 CC (Dia 0.78)	1.1	590773	822296	Fair	0.36	Tertiary		5.40	7.20	7.20	0.5	Inadequate	Inadequate	Yes
	1106	Batch 15	Ogbagba Area	Culvert	1 BC (1.8 x 1)	1.4	591092	817140	Fair	0.38	Tertiary		5.70	7.60	7.60	2.7	Inadequate	Inadequate	Yes
	1109	Batch 15	Apata	Culvert	4 CC (Dia 0.75) + 1 BC (4.04 x 1.03)	1.5	590566	817397	Fair	0.38	Tertiary		5.70	7.60	7.60	9.2	Adequate	Inadequate	Yes
	1112	Batch 15	Ifeleye Apata	Culvert	1 BC (1.01 x 1.05)	1.3	589069	818084	Fair	0.39	Tertiary		5.85	7.80	7.80	1.4	Inadequate	Inadequate	Yes
	585	Batch 9	Powerline Ido	Culvert	2 CC (Dia 0.9)	1.9	591269	822308	Fair	0.39	Main		5.85	7.80	7.80	1.5	Inadequate	Inadequate	Yes
	587	Batch 9	Powerline Ologuneru	Culvert	2 BC (1.15 x 1.28)	1.5	590863	822155	Fair	0.43	Tertiary		6.45	8.60	8.60	4.3	Inadequate	Inadequate	Yes
	1107	Batch 15	Ogbagba Area	Culvert	2 CC (Dia 0.75) + 1 BC (1.82 x 1.35)	1.7	591095	817248	Fair	0.44	Tertiary		6.60	8.80	8.80	5.1	Inadequate	Inadequate	Yes
	586	Batch 9	Powerline Ologuneru	Culvert	1 CC (Dia 0.9)	0.9	591120	822165	Fair	0.46	Tertiary		6.90	9.20	9.20	0.8	Inadequate	Inadequate	Yes
	1108	Batch 15	Adebisi Area	Natural Stream		1.9	591056	817427	Poor	0.49	Tertiary		7.35	9.80	9.80	21.3	Adequate	Inadequate	Yes
	1114	Batch 15	Egbodi Apata	Culvert	1 BC (0.9 x 0.85)	1.3	589190	818865	Fair	0.55	Tertiary		7.88	10.50	10.50	0.9	Inadequate	Inadequate	Yes
	1111	Batch 15	Owode Apata	Culvert	1 CC (Dia 0.8) + 1 BC (1.2 x 1.1)	1.3	589341	818060	Fair	0.63	Tertiary		8.47	11.30	11.30	2.4	Inadequate	Inadequate	Yes
	1110	Batch 15	Apata	Culvert	2 BC (1.05 x 1.08)	1.3	589411	818010	Poor	0.67	Tertiary	Usually flooded the area	8.78	11.70	11.70	3.0	Inadequate	Inadequate	Yes
	1115	Batch 15	Apata	Culvert	2 BC (1.07 x 1.6)	2.1	589407	818830	Fair	0.75	Tertiary		9.38	12.50	12.50	5.1	Inadequate	Inadequate	Yes
	1542	Batch 31	Iletuntun Area	Culvert	1 BC (2.2 x 2.1)	2.4	591406	820510	Good	0.92	Secondary		10.65	14.20	14.20	9.8	Inadequate	Adequate	Yes
	1116	Batch 15	Teacher Estate	Culvert	2 BC (1.2 x 1.2)	1.5	589810	818765	Good	0.95	Tertiary		10.87	14.50	14.50	4.1	Inadequate	Adequate	Yes
On13 Middle Ona South	145B	Batch 0	NIHORT , GBEKUBA	Culvert	2 BC (11.27 x 9.44)	10.3	593203	818749	Erosion		Secondary					1289.8	Adequate	Inadequate	Yes
	48D	PIU 1st List	IFELAGBA LANDLORDS AND RESIDENT ASSOCIATION,UPPER ADETOKUN, NEW ERUWA ROAD	Box Culvert	1 BC (0.5 x 0.75)		593058	821194		0.10	Tertiary	Scour and Gullies, water bypasses the culvert	1.50	2.00	2.00	0.3	Inadequate	Inadequate	Yes
	748	Batch 16	Jericho	Culvert	1 BC (1.2 x 0.9)	1.3	595245	818622	Fair	0.28	Tertiary		4.20	5.60	5.60	1.4	Inadequate	Inadequate	Yes
	614	Batch 10	Aba Pan	Culvert	2 CC (Dia 0.75)	1.1	592885	821420	Fair	0.32	Tertiary	Flooded during heavy rain	4.80	6.40	6.40	0.9	Inadequate	Inadequate	Yes
	620	Batch 10	Ologuneru	Natural Stream		0.6	593636	821577	Poor	0.35	Tertiary		5.25	7.00	7.00	2.2	Inadequate	Inadequate	Yes
	597	Batch 10	Adetokun Ologuneru	Culvert	1 BC (2.5 x 1.02)	1.5	592235	820155	Good	0.38	Tertiary		5.70	7.60	7.60	4.2	Inadequate	Adequate	Yes
	747	Batch 16	Sijuade	Culvert	2 CC (Dia 0.6)	2.0	595543	818518	Poor	0.40	Tertiary		6.00	8.00	8.00	0.5	Inadequate	Inadequate	Yes
	746	Batch 16	Eleyele	Culvert	2 CC (Dia 0.6)	2.1	595972	819243	Fair	0.61	Tertiary		8.33	11.10	11.10	0.5	Inadequate	Inadequate	Yes
	607	Batch 10	Idi Osan -Ologuneru	Culvert	2 CC (Dia 0.7)	1.2	593242	821311	Fair	0.62	Tertiary	Blocked with sediment and its height cannot be measured	8.40	11.20	11.20	0.8	Inadequate	Inadequate	Yes
	596	Batch 10	Adetokun Eleyele	Culvert	1 BC (2 x 1.51)	1.9	592434	820356	Good	0.82	Tertiary		9.90	13.20	13.20	5.5	Inadequate	Adequate	Yes
	606	Batch 10	Ologuneru	Footpath		1.3	593620	821472	Poor	0.84	Tertiary		10.05	13.40	13.40	15.7	Adequate	Inadequate	Yes
On14 Lower Ona North	761	Batch 16	Odo Ona	Culvert	1 BC (1.3 x 0.48)	0.7	594198	815818	Fair		Tertiary					0.6	Adequate	Inadequate	Yes
	815 Prime	Batch 22	Oluyole Extension	Culvert	1 CC (Dia 0.6)	1.3	593578	814364	Good		Tertiary					0.3	Adequate	Adequate	No
	763	Batch 16	Iyaganku GRA	Culvert	1 BC (1.4 x 1.2)	2.5	596108	815511	Good	0.11	Tertiary		1.65	2.20	2.20	2.5	Adequate	Adequate	No
	750	Batch 16	Odo Ona	Culvert	1 BC (1.1 x 0.53)	0.7	594152	815871	Fair	0.12	Tertiary		1.80	2.40	2.40	0.6	Inadequate	Inadequate	Yes
	1501	Lower Ona	Ring Rod	Culvert	1 BC (1.5 x 1.3)	3.0	594903	814873	Good	0.12	Main	The channell does not get flooded whenever it rain heavily.	1.80	2.40	2.40	3.1	Adequate	Adequate	No
	760	Batch 16	Odo Ona	Culvert	1 BC (1.3 x 0.65)	0.9	593996	815959	Poor	0.13	Tertiary	Flooded the area during heavy rainfall	1.95	2.60	2.60	1.0	Inadequate	Inadequate	Yes
	762	Batch 16	Iyaganku GRA	Culvert	2 BC (3.03 x 2.95)	3.6	596312	815437	Good	0.13	Tertiary		1.95	2.60	2.60	47.4	Adequate	Adequate	No
	759	Batch 16	Odo Ona	Culvert	1 BC (1.2 x 0.8)	1.2	593965	815986	Poor	0.15	Tertiary	Flooded the area during heavy rainfall	2.25	3.00	3.00	1.2	Inadequate	Inadequate	Yes
	253	Core 1	Aleshinloye	Culvert	1 BC (4.7 x 3.07)		596116	817072	Good	0.17	Tertiary		2.55	3.40	3.40	44.2	Adequate	Adequate	No
	773	Batch 16	Ago Taylor	Culvert	2 CC (Dia 0.6)	6.0	594739	815432	Fair	0.20	Main		3.00	4.00	4.00	0.5	Inadequate	Inadequate	Yes
	754	Batch 16	Aleshinloye Market	Culvert	1 BC (3 x 1.1)	1.6	595831	816982	Fair	0.24	Tertiary		3.60	4.80	4.80	5.8	Adequate	Inadequate	Yes
	820	Batch 22	Ring Road	Culvert	3 CC (Dia 0.9)	2.2	595255	813557	Fair	0.24	Tertiary		3.60	4.80	4.80	2.3	Inadequate	Inadequate	Yes
	233	Core 1	Iyaganku	Culvert	1 BC (0.9 x 0.92)		596108	816022	Poor	0.26	Tertiary		3.90	5.20	5.20	1.0	Inadequate	Inadequate	Yes
	740	Batch 16	Kuole North	Culvert	1 BC (0.9 x 0.94)	6.0	593798	816764	Good	0.34	Tertiary		5.10	6.80	6.80	1.0	Inadequate	Adequate	Yes
	229	Core 1	Joyce B	Culvert	2 CC (Dia 0.9)		595735	814779	Fair	0.37	Tertiary		5.55	7.40	7.40	1.5	Inadequate	Inadequate	Yes

Structure Data												Structure Assessment						
Subbasin	Structure No.	Batch_ID	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Design Flow (m3/s)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
	228	Core 1	Road B	Culvert	1 BC (2.7 x 1.47)		595806	814679	Poor	0.41	Tertiary		6.15	8.20	8.20	7.8	Adequate	Inadequate	Yes
	232	Core 1	Ogunleye	Culvert	1 BC (1.9 x 0.81)		596408	814718	Good	0.41	Tertiary		6.15	8.20	8.20	2.1	Inadequate	Adequate	Yes
	359	Core 3	Subulade Streeet	Culvert	1 CC (Dia 1.2)	1.5	595891	814334	Fair	0.41	Tertiary		6.15	8.20	8.20	1.6	Inadequate	Inadequate	Yes
	231	Core 1	Liberty	Culvert	1 BC (4.3 x 1.8)		596285	814714	Poor	0.46	Tertiary		6.90	9.20	9.20	18.4	Adequate	Inadequate	Yes
	753	Batch 16	Apata	Culvert	1 BC (1.8 x 1.75)	2.0	592289	816564	Good	0.47	Tertiary		7.05	9.40	9.40	5.9	Inadequate	Adequate	Yes
	772	Batch 16	Apata	Culvert	2 CC (Dia 0.8)	1.0	592267	815772	Good	0.52	Tertiary		7.65	10.20	10.20	1.1	Inadequate	Adequate	Yes
	767	Batch 16	Oluyole estate	Culvert	1 BC (1.5 x 1.24)	1.6	593386	814617	Good	0.59	Tertiary		8.17	10.90	10.90	2.9	Inadequate	Adequate	Yes
	291	Core 1	Joyce B	Culvert	1 BC (1.1 x 1)		596110	814930	Fair	0.61	Tertiary		8.33	11.10	11.10	1.4	Inadequate	Inadequate	Yes
	764	Batch 16	Oluyole	Culvert	1 BC (4.5 x 2.21)	2.8	594156	814588	Good	0.63	Tertiary		8.47	11.30	11.30	26.2	Adequate	Adequate	No
	766	Batch 16	Oluyole Estate	Culvert	1 BC (2.05 x 1.55)	1.8	593502	814588	Good	0.66	Tertiary		8.70	11.60	11.60	5.9	Inadequate	Adequate	Yes
	769	Batch 16	Federal college of Animal health & Production Technology	Culvert	1 CC (Dia 0.8)	1.3	593276	815276	Good	0.67	Tertiary		8.78	11.70	11.70	0.6	Inadequate	Adequate	Yes
	230	Core 1	Oyeshina Layout	Culvert	1 BC (2.7 x 1.14)		596137	814783	Poor	0.67	Tertiary		8.78	11.70	11.70	5.4	Inadequate	Inadequate	Yes
	765	Batch 16	Oluyole	Culvert	3 CC (Dia 0.6)	1.0	593596	814593	Fair	0.76	Tertiary		9.45	12.60	12.60	0.8	Inadequate	Inadequate	Yes
	752	Batch 16	Moore Plantation	Natural Stream		1.8	592911	816747	Poor	0.83	Tertiary		9.97	13.30	13.30	10.1	Inadequate	Inadequate	Yes
	755	Batch 16	Aleshinloye	Culvert	2 BC (1.75 x 1.25)	1.5	595718	816869	Good	0.98	Secondary		11.10	14.80	14.80	7.2	Inadequate	Adequate	Yes
	768	Batch 16	Oluyole Estate	Natural Stream		0.6	591915	814804	Fair	0.11	Tertiary		1.65	2.20	2.20	0.3	Inadequate	Inadequate	Yes
	1066	Batch 15	Kuola Apata	Natural Stream		1.5	590868	814725	Poor	0.12	Tertiary		1.80	2.40	2.40	32.3	Adequate	Inadequate	Yes
	1103	Batch 15	Apata	Footpath		1.6	590928	816276	Poor	0.12	Tertiary		1.80	2.40	2.40	7.6	Adequate	Inadequate	Yes
	49D	PIU 1st List	IFESOWAPO COMMUNITY LANDLORDS/LANDLADIES ASSOCIATION LAYAN VILLAGE,APATA	Natural Stream			589332	814426		0.13	Main	The main road is eroded, many signs of scour, erosion and accumualtion of water over the road	1.95	2.60	2.60		Inadequate	Inadequate	Yes
	1283	Batch 21	BESIDE C.A.C REVIVAL CENTRE AKINPELU AREA	Culvert	1 CC (Dia 0.7)	1.5	590512	814256	Good	0.14	Tertiary	Swampy area.	2.10	2.80	2.80	0.4	Inadequate	Adequate	Yes
	56D4	PIU 1st List	ORITA MERIN-ELEBU (AHUN-GESTIMANY ROAD-ABESE ESTATE-ASAKKA WAY)	Natural Stream			588921	812571		0.17	Tertiary	Low point in the road, no structure, accumualtion of water over the road	2.55	3.40	3.40		Inadequate	Inadequate	Yes
	1288	Batch 21	AKOGI LAYOUT , BESIDE ELIZABETH GRP OF SCH,	Culvert	1 CC (Dia 0.75)	1.1	588513	813921	Fair - Erosion	0.18	Tertiary	Swampy area.	2.70	3.60	3.60	0.5	Inadequate	Inadequate	Yes
	1092	Batch 15	Apata	Natural Stream		0.4	587640	814691	Poor	0.19	Tertiary		2.85	3.80	3.80	1.0	Inadequate	Inadequate	Yes
	1301	Batch 21	BESIDE ELEBU HEALTH CARE	Culvert	1 BC (2.1 x 2)	2.3	590597	812895	Fair	0.19	Secondary	Swampy area.	2.85	3.80	3.80	8.6	Adequate	Inadequate	Yes
	1286	Batch 21	OPPOSITE KIDDIES PRIVATE SCH, SHARPCONER/REVIVAL AREA	Culvert	1 BC (1.5 x 1.05)	1.5	591132	814519	Fair - Erosion	0.20	Secondary	Swampy area.	3.00	4.00	4.00	2.3	Inadequate	Inadequate	Yes
	823	Batch 22	Oluyole Extension Zone 6	Culvert	2 CC (Dia 0.9)	2.1	592254	814034	Fair	0.21	Tertiary		3.15	4.20	4.20	1.5	Inadequate	Inadequate	Yes
	1104	Batch 15	Apata	Culvert	2 CC (Dia 0.75)	1.0	590665	816456	Fair	0.22	Tertiary		3.30	4.40	4.40	0.9	Inadequate	Inadequate	Yes
	1281	Batch 21	AJALA LAYOUT, ALAGO VILLAGE	Natural Stream		0.2	588545	814515	Fair	0.26	Tertiary		3.90	5.20	5.20	0.8	Inadequate	Inadequate	Yes
	826	Batch 22	Oluyole Extension	Natural Stream		1.0	593038	812977	Poor	0.26	Tertiary		3.90	5.20	5.20	6.3	Adequate	Inadequate	Yes
	1081	Batch 15	Apata	Culvert	1 BC (2.3 x 1.24)	2.3	589292	817262	Poor	0.31	Tertiary		4.65	6.20	6.20	5.0	Inadequate	Inadequate	Yes
	1091	Batch 15	Apata	Footpath		0.6	587315	814613	Poor	0.36	Tertiary		5.40	7.20	7.20	1.6	Inadequate	Inadequate	Yes
	1302	Batch 21	OLUSETAN ESTATE, AKURO	Culvert	2 CC (Dia 0.74)	1.0	590993	812519	Fair - Erosion	0.36	Tertiary	Inlet block with sands.	5.40	7.20	7.20	0.9	Inadequate	Inadequate	Yes
	1100	Batch 15	Bembo Area	Culvert	1 BC (1.8 x 1.4)	1.6	588656	815570	Fair	0.42	Tertiary		6.30	8.40	8.40	4.3	Inadequate	Inadequate	Yes
	1284	Batch 21	OFF UNITY STREET RD3, POWERLINE, ABA-PANU	Culvert	1 BC (3.3 x 1.87)	2.1	590534	814080	Good	0.48	Main		7.20	9.60	9.60	14.1	Adequate	Adequate	No
On15 Alaro	828	Batch 22	Oluyole Extension	Culvert	2 CC (Dia 0.6)	0.9	592545	811974	Poor	0.48	Tertiary		7.20	9.60	9.60	0.5	Inadequate	Inadequate	Yes
	1101	Batch 15	Alexander Apata	Culvert	1 BC (0.75 x 0.7)	0.8	590666	815379	Poor	0.49	Tertiary		7.35	9.80	9.80	0.5	Inadequate	Inadequate	Yes
	1120	Batch 15	Aba Alamu Apata	Footpath		1.3	590572	816190	Poor	0.50	Tertiary		7.50	10.00	10.00	6.9	Inadequate	Inadequate	Yes
	1102	Batch 15	Aba Alamu Apata	Culvert	2 BC (2.6 x 1.15)	1.8	590495	816146	Fair	0.54	Tertiary	Overflow during heavy rain	7.80	10.40	10.40	10.4	Adequate	Inadequate	Yes
	821	Batch 22	Oluyole	Culvert	2 BC (2.95 x 3.2)	3.6	591946	814312	Good	0.54	Secondary		7.80	10.40	10.40	50.9	Adequate	Adequate	No
	1082	Batch 15	Meridian Apata	Culvert	1 CC (Dia 0.6)	0.9	589666	817133	Poor	0.56	Tertiary		7.95	10.60	10.60	0.3	Inadequate	Inadequate	Yes
	1292	Batch 21	IDI-AHUN, ELEBU	Natural Stream		0.3	588114	812745	Fair	0.61	Tertiary	Get flooded when it rains heavily	8.33	11.10	11.10	1.5	Inadequate	Inadequate	Yes
	822	Batch 22	Oluyole Extension	Culvert	2 CC (Dia 0.9)	1.5	591956	814064	Fair	0.63	Tertiary		8.47	11.30	11.30	1.5	Inadequate	Inadequate	Yes
	1083	Batch 15	Owode Apata	Natural Stream		0.6	589729	817018	Poor	0.65	Tertiary	Some nearby houses have been desrted because of overflow	8.62	11.50	11.50	2.6	Inadequate	Inadequate	Yes
	1569	Batch 31	Akala Area	Culvert	2 BC (2.9 x 2.7)	3.3	591984	813862	Good	0.67	Tertiary		8.78	11.70	11.70	39.7	Adequate	Adequate	No
	1093	Batch 15	Apata	Culvert	2 CC (Dia 0.6)	0.9	587616	814786	Fair	0.68	Tertiary	Flooded the area during heavy rain	8.85	11.80	11.80	0.5	Inadequate	Inadequate	Yes
	27	Batch 0	IRE-AKARI ESTATE OFF AKAUA ROAD	Natural Stream		0.9	592874	812068	Dilapidated	0.75	Tertiary	2 deteriorated pipe culverts, water passing aside	9.38	12.50	12.50	5.1	Inadequate	Inadequate	Yes
	1094	Batch 15	Apata	Natural Stream		0.7	587658	814925	Poor	0.76	Tertiary	Flooded the area during heavy rain	9.45	12.60	12.60	2.9	Inadequate	Inadequate	Yes
	1282	Batch 21	BESIDE EZRA HOTEL, IDI-OBI JANKATA	Culvert	2 BC (2.85 x 1.95)	2.3	589058	814528	Good	0.82	Main		9.90	13.20	13.20	24.8	Adequate	Adequate	No
	1285	Batch 21	WALE ADEOYE LAYOUT, OLUYOLE EXTENSION	Culvert	1 CC (Dia 0.74)	1.1	590891	814315	Poor - Dilapidated	0.86	Tertiary	Culvert depilated, depride access of vehicle passage, also get flooded when it rains	10.20	13.60	13.60	0.4	Inadequate	Inadequate	Yes
	1084	Batch 15	Meridian Apata	Culvert	2 CC (Dia 0.75)	1.7	589808	816946	Fair	0.87	Tertiary		10.28	13.70	13.70	0.9	Inadequate	Inadequate	Yes
	26	Batch 22	Ire Akari Estate	Natural Stream		1.0	593016	812145	Poor	0.92	Tertiary		10.65	14.20	14.20	6.1	Inadequate	Inadequate	Yes
	1085	Batch 15	Apata	Culvert	2 CC (Dia 0.75)	1.2	589914	816867	Poor	0.96	Tertiary		10.95	14.60	14.60	0.9	Inadequate	Inadequate	Yes

Structure Data												Structure Assessment						
Subbasin	Structure No.	Batch_ID	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Design Flow (m3/s)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
	1287	Batch 21	BOLA, IDI-AHUN AREA, HUOLA RD	Culvert	1 CC (Dia 0.7)	2.1	588121	813560	Fair - Erosion	0.98	Tertiary	Swampy area.	11.10	14.80	14.80	0.4	Inadequate	Inadequate	Yes
	824	Batch 22	Oluyole extension-Akuru	Culvert	2 BC (1.6 x 1.5)	2.0	591636	812686	Good	0.99	Tertiary		11.18	14.90	14.90	8.2	Inadequate	Adequate	Yes
	1583	Batch 31	Tanimowo Area	Footpath		1.7	589963	816793		1.00	Tertiary		11.25	15.00	15.00	20.7	Adequate	Inadequate	Yes
On16 Agara Kasumu	1314	Batch 21	OFF AYODELE BLOCK INDUSTRY, ADEBOMI RD	Natural Stream		0.1	590065	809604	Fair	0.21	Tertiary	Swampy area, get flooded when it rains	3.15	4.20	4.20	0.0	Inadequate	Inadequate	Yes
	1183	Batch 28	BANKOLE/ODO ONA ELEWE	Natural Stream		0.3	593762	809506	Poor	0.25	Tertiary	EXIST ONLY DURING RAINY SEASON	3.75	5.00	5.00	0.4	Inadequate	Inadequate	Yes
	1315	Batch 21	ESTATE EXTENSION, OFF ADEBOMI RD	Culvert	1 CC (Dia 0.7)	1.0	590182	809673	Fair	0.28	Tertiary		4.20	5.60	5.60	0.4	Inadequate	Inadequate	Yes
	1307	Batch 21	ALONG TOLATOSE EST. RD				590101	811892		0.39	Secondary	No culvet	5.85	7.80	7.80		Inadequate	Inadequate	Yes
	1305	Batch 21	ABA APATA, ALONG MOGANNA'S ESTATE.	Natural Stream		0.2	589593	810827	Fair	0.40	Tertiary		6.00	8.00	8.00	0.5	Inadequate	Inadequate	Yes
	855	Batch 22	Odo Ona Elewe	Culvert	2 CC (Dia 0.8)	1.8	592552	810650	Fair	0.54	Secondary		7.80	10.40	10.40	1.1	Inadequate	Inadequate	Yes
	859	Batch 22	Oko- Odo Zone 2	Natural Stream		0.4	592047	809955	Poor	0.60	Tertiary		8.25	11.00	11.00	2.3	Inadequate	Inadequate	Yes
	1321	Batch 21	AYEGUN, OLEYO	Natural Stream		0.2	589252	809858	Fair	0.73	Tertiary	Get flooded when it rains heavily.	9.23	12.30	12.30	0.2	Inadequate	Inadequate	Yes
	853	Batch 22	Apampa Moberi Idi- Ishin	Culvert	1 BC (1.5 x 1.12)	1.1	591800	811125		0.73	Tertiary	Under Construction	9.23	12.30	12.30	2.5	Inadequate	Inadequate	Yes
	1303	Batch 21	OLOFA	Natural Stream		0.1	588485	811286	Fair	0.75	Tertiary	Get flooded when it rains heavily.	9.38	12.50	12.50	0.4	Inadequate	Inadequate	Yes
	1306	Batch 21	FEDERAL HOUSING EST. AREA,ALONG HALLELUYAH HOUSE	Natural Stream		0.1	590196	811187	Fair	0.80	Secondary	Swampy area, get flooded when it rains	9.75	13.00	13.00	0.9	Inadequate	Inadequate	Yes
	860	Batch 22	Oko- Odo Zone 1	Culvert	1 CC (Dia 0.8)	1.0	592516	810111	Fair	0.87	Tertiary		10.28	13.70	13.70	0.6	Inadequate	Inadequate	Yes
	861	Batch 22	Isale Olosan	Culvert	1 CC (Dia 0.6)	0.9	592626	810228	Fair	0.90	Tertiary	Overflow during heavy rain	10.50	14.00	14.00	0.3	Inadequate	Inadequate	Yes
	357	Core 3	Anfani	Culvert	3 CC (Dia 0.9)	1.5	597147	813552	Poor	0.13	Tertiary	For Attention	1.95	2.60	2.60	2.3	Inadequate	Inadequate	Yes
	846	Batch 22	New Garage	Culvert	1 BC (2.98 x 2.72)	3.8	595398	810486	Fair	0.14	Main		2.10	2.80	2.80	20.8	Adequate	Inadequate	Yes
	872	Batch 23	CHALLENGE/FELELE	Culvert	1 BC (1.85 x 0.66)	1.2	597070	811980	Good	0.15	Tertiary	FLOODED OCASSIONALLY	2.25	3.00	3.00	1.5	Inadequate	Adequate	Yes
	361	Core 3	Ososami	Footpath		1.7	596607	813801	Poor	0.15	Tertiary		2.25	3.00	3.00	14.6	Adequate	Inadequate	Yes
	850	Batch 22	Iyana Agara-Odo Ona elewe	Culvert	1 CC (Dia 0.6)	1.1	594167	810376	Fair	0.16	Secondary		2.40	3.20	3.20	0.3	Inadequate	Inadequate	Yes
	867	Batch 23	POLICE POST/CHALLENGE		2 CC (Dia 0.67)		597336	813045		0.16	Tertiary	FLOODED ALWAYS	2.40	3.20	3.20	0.7	Inadequate	Inadequate	Yes
	1502	Lower Ona	Toll Gate	Culvert	2 BC (3.07 x 3)	4.0	596688	810126	Good	0.20	Tertiary	The channell does not get flooded whenever it rain heavily.	3.00	4.00	4.00	49.3	Adequate	Adequate	No
	868	Batch 23	POLICE POST/CHALLENGE	Culvert	1 BC (2.54 x 1.16)	1.6	597243	812992	Good	0.21	Tertiary		3.15	4.20	4.20	5.1	Adequate	Adequate	No
	876	Batch 23	CHALLENGE	Culvert	1 BC (3 x 1.54)	4.7	596634	810776	Good	0.24	Highway		3.60	4.80	4.80	9.5	Adequate	Adequate	No
	1503	Lower Ona	Toll Gate	Culvert	1 CC (Dia 0.7)	6.0	596655	810114	Poor	0.25	Expressway	Outlet is covered with vegetation and making it difficult to Access	3.75	5.00	5.00	0.4	Inadequate	Inadequate	Yes
	835	Batch 22	Idi Orogbo New Adeoyo	Culvert	1 BC (1.6 x 0.6)	1.2	595786	812836	Poor	0.27	Tertiary		4.05	5.40	5.40	1.1	Inadequate	Inadequate	Yes
	364	Core 3	Ososami	Culvert	1 BC (1.92 x 1.12)	1.2	596446	813739	Dilapidated	0.27	Tertiary	For Attention	4.05	5.40	5.40	3.5	Inadequate	Inadequate	Yes
	845	Batch 22	Orita Challenge	Culvert	1 CC (Dia 0.8)	1.1	595930	810803	Poor	0.28	Tertiary	Flooded the area during heavy rainfall	4.20	5.60	5.60	0.6	Inadequate	Inadequate	Yes
	849	Batch 22	Odo Ona elewe-IDC	Culvert	1 CC (Dia 0.8)	1.0	594399	810555	Fair	0.28	Tertiary		4.20	5.60	5.60	0.6	Inadequate	Inadequate	Yes
	354	Core 3	Anfani	Culvert	2 CC (Dia 0.9)	1.3	597173	813451	Good	0.28	Tertiary	The outlet show 4 rings but the inlet show 2 rings	4.20	5.60	5.60	1.5	Inadequate	Adequate	Yes
	355	Core 3	Anfani	Footpath		1.0	597222	813384	Poor	0.32	Tertiary		4.80	6.40	6.40	6.1	Adequate	Inadequate	Yes
	863	Batch 22	Odo Ona Elewe	Culvert	1 CC (Dia 0.6)	0.8	593937	811019	Fair	0.37	Tertiary		5.55	7.40	7.40	0.3	Inadequate	Inadequate	Yes
	865	Batch 22	Odo Ona Elewe	Culvert	1 CC (Dia 0.7)	1.0	593894	811064	Poor	0.37	Secondary	The area is flooded during heavy rain	5.55	7.40	7.40	0.4	Inadequate	Inadequate	Yes
On17 Lower Ona East	873	Batch 23	LAGELU ESTATE	Footpath			596959	811143	Poor	0.40	Tertiary		6.00	8.00	8.00	16.3	Adequate	Inadequate	Yes
	874	Batch 23	LAGELU ESTATE	Culvert	1 BC (3.03 x 1.6)	1.8	596887	811083	Good	0.42	Tertiary		6.30	8.40	8.40	10.1	Adequate	Adequate	No
	871	Batch 23	CHALLENGE	Culvert	2 BC (2.99 x 1.48)	5.9	596851	811929	Good	0.44	Highway		6.60	8.80	8.80	17.8	Adequate	Adequate	No
	864	Batch 22	Odo Ona Elewe	Culvert	1 CC (Dia 0.6) + 1 BC (0.93 x 0.92)	1.0	594247	810996	Fair	0.46	Tertiary		6.90	9.20	9.20	1.3	Inadequate	Inadequate	Yes
	833	Batch 22	Ring Road	Culvert	2 CC (Dia 1.2)	3.7	596234	813418	Good	0.49	Main		7.35	9.80	9.80	3.3	Inadequate	Adequate	Yes
	356	Core 3	Anfani	Natural Stream		0.7	597189	813273	Poor	0.49	Tertiary		7.35	9.80	9.80	4.0	Inadequate	Inadequate	Yes
	356 Prime	Core 3	Anfani	Footpath		0.7	597168	813261	Poor	0.53	Tertiary		7.72	10.30	10.30	13.3	Adequate	Inadequate	Yes
	831	Batch 22	Oluyole New express road	Culvert	1 BC (3.32 x 1.95)	2.7	593973	811611	Good	0.55	Main		7.88	10.50	10.50	15.0	Adequate	Adequate	No
	852	Batch 22	Odo Ona Elewe	Culvert	1 BC (1.1 x 0.98)	1.1	594267	810915	Fair	0.55	Tertiary		7.88	10.50	10.50	1.4	Inadequate	Inadequate	Yes
	848	Batch 22	New Garage	Culvert	1 CC (Dia 0.9)	2.3	595948	809954	Fair	0.60	Highway		8.25	11.00	11.00	0.8	Inadequate	Inadequate	Yes
	875	Batch 23	CHALLENGE/ LAGELU ESTATE	Culvert	1 BC (2.96 x 1.8)	5.7	596781	810986	Good	0.67	Highway		8.78	11.70	11.70	11.6	Adequate	Adequate	No
	152	Batch 0	NIGER WEST OLD LAGOS ROAD	Culvert	2 BC (2.08 x 1.96)	2.3	596602	811893	Fair	0.69	Highway	The box culvert under construction	8.92	11.90	11.90	16.6	Adequate	Inadequate	Yes
	832	Batch 22	Odo Ona Elewe	Culvert	2 BC (1.3 x 1)	1.2	594216	811682	Good	0.81	Tertiary		9.83	13.10	13.10	3.6	Inadequate	Adequate	Yes
	153	Batch 0	OLUSANYA / RING ROAD	Natural Stream			596211	813238	Dilapidated	0.82	Tertiary		9.90	13.20	13.20	14.0	Adequate	Inadequate	Yes
	840	Batch 22	Orita Challenge	Culvert	1 BC (3.1 x 1.77)	2.4	596316	811947	Fair	0.86	Tertiary		10.20	13.60	13.60	12.0	Inadequate	Inadequate	Yes
	834	Batch 22	Challenge ring road	Culvert	1 BC (4.7 x 2.32)	3.4	596167	813080	Fair	0.89	Tertiary		10.42	13.90	13.90	29.7	Adequate	Inadequate	Yes
	851	Batch 22	Tipper Garage-Odo Ona Elewe	Culvert	1 CC (Dia 0.9) + 1 BC (2.05 x 1.85)	2.2	594301	810838	Fair	0.89	Tertiary	The culvet is at the point of collapse and required urgent attention	10.42	13.90	13.90	8.3	Inadequate	Inadequate	Yes
	28	Batch 0	ODO-ONAELEWE / OJU-EKUN ROAD	Culvert	2 CC (Dia 1)	1.4	594358	810760	Fair	0.91	Secondary		10.58	14.10	14.10	2.0	Inadequate	Inadequate	Yes

Structure Data												Structure Assessment						
Subbasin	Structure No.	Batch_ID	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Design Flow (m3/s)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
	841	Batch 22	Orita Challenge	Footpath		1.7	596132	811971	Good	0.94	Tertiary		10.80	14.40	14.40	52.0	Adequate	Adequate	No
	869	Batch 23	ASABARI BRIDGE, IDI ODO/CHALLENGE, OLU AYOLA STREET	Culvert	2 BC (2.64 x 1.98)	2.0	596992	812856	Good	1.00	Tertiary	FLOODED OCCASSIONALLY	11.25	15.00	15.00	23.0	Adequate	Adequate	No
On18 Lower Ona South	1187	Batch 28	OPERE PODO	Culvert	1 CC (Dia 0.96)	2.7	596070	809240	Poor		Tertiary					0.9	Adequate	Inadequate	Yes
	1195	Batch 28	ODO ONA KEKERE	Culvert	1 CC (Dia 0.9)	3.0	595380	806011	Poor		Highway					0.8	Adequate	Inadequate	Yes
	1504	Lower Ona	Podo /Idi Ayunre	Culvert	1 CC (Dia 0.95)	5.0	595666	807668	Poor		Highway	The channel get flooded whenever it rain heavily.The capacity of culvert is lower than the volume of water.				0.9	Adequate	Inadequate	Yes
	1505	Lower Ona	Toll Gate	Culvert	1 CC (Dia 0.95)	7.0	595824	807097	Fair		Expressway	Get flooded whenever it rain heavily				0.9	Adequate	Inadequate	Yes
	1190	Batch 28	AYETORO VILLAGE	Culvert	1 CC (Dia 1)	2.9	595537	807113	Fair	0.10	Highway		1.50	2.00	2.00	1.0	Inadequate	Inadequate	Yes
	1188	Batch 28	OPERE PODO	Culvert	1 CC (Dia 0.94)	2.4	595986	808781	Poor	0.11	Highway		1.65	2.20	2.20	0.8	Inadequate	Inadequate	Yes
	1207	Batch 28	ARAPAJA/OD ONA KEKERE	Culvert	1 CC (Dia 0.46)	0.7	592703	806095	Fair	0.12	Tertiary		1.80	2.40	2.40	0.1	Inadequate	Inadequate	Yes
	1193	Batch 28	ABA IBEJI	Natural Stream		2.5	594725	807369	Poor	0.18	Tertiary	FLOODED OCCASSIONALLY	2.70	3.60	3.60	10.9	Adequate	Inadequate	Yes
	1206	Batch 28	ARAPAJA SIMISOLA	Culvert	2 CC (Dia 0.73)	1.3	593991	806644	Fair	0.20	Secondary	FLOODED ALWAYS	3.00	4.00	4.00	0.9	Inadequate	Inadequate	Yes
	1197	Batch 28	FOWOWE	Culvert	1 CC (Dia 0.8)	1.0	595004	806316	Poor	0.21	Secondary	FLOODED ALWAYS	3.15	4.20	4.20	0.6	Inadequate	Inadequate	Yes
	1219	Batch 28	ONO ONA KEKERE	Culvert	1 CC (Dia 0.72)	0.9	593472	806740	Fair	0.29	Secondary	FLOODED ALWAYS	4.35	5.80	5.80	0.4	Inadequate	Inadequate	Yes
	1192	Batch 28	ABA IBEJI	Culvert	1 CC (Dia 0.76)	1.0	594980	807324	Poor	0.30	Tertiary	FLOODED OCCASSIONALLY	4.50	6.00	6.00	0.5	Inadequate	Inadequate	Yes
	1184	Batch 28	ONIPON COMMUNITY PODO	Natural Stream		0.4	594979	808685	Poor	0.33	Tertiary	FLOODED ALWAYS	4.95	6.60	6.60	0.9	Inadequate	Inadequate	Yes
	1191	Batch 28	ABA IBEJI	Culvert	1 CC (Dia 0.6)	1.1	595140	807185	Poor	0.42	Tertiary		6.30	8.40	8.40	0.3	Inadequate	Inadequate	Yes
	1189	Batch 28	OPERE PODO	Culvert	1 CC (Dia 0.8)	4.2	595797	808015	Poor	0.60	Highway	THE OUTLET IS CURVET	8.25	11.00	11.00	0.6	Inadequate	Inadequate	Yes
	1213	Batch 28	ORIIRE COMMUNITY	Natural Stream		1.7	595534	808944	Poor	0.65	Tertiary		8.62	11.50	11.50	23.2	Adequate	Inadequate	Yes
On19 Lower Ona West	1182	Batch 28	ONIPON/ABA IBEJI	Culvert	1 CC (Dia 1.4)	1.7	595051	808000	Poor		Tertiary	NEED URGENT ATTENTION, FLOODED ALWAYS				2.5	Adequate	Inadequate	Yes
	1335	Batch 27	ONIPEPEYE	Culvert	1 BC (0.85 x 0.86)	1.5	590999	808791	Good	0.14	Tertiary	it get flooded whenever it rains heavily.	2.10	2.80	2.80	0.8	Inadequate	Adequate	Yes
	1217	Batch 28	ODO ONA KEKERE	Culvert	2 CC (Dia 0.73)	1.0	592400	807283	Fair	0.14	Secondary	STATIC WATER FLOODED ALWAYS	2.10	2.80	2.80	0.9	Inadequate	Inadequate	Yes
	1323	Batch 27	ALAWOYIN	Culvert	1 BC (1.14 x 1.07)	1.5	589262	809124	Good	0.16	Tertiary	Dried up, there is no water in the culvert	2.40	3.20	3.20	1.7	Inadequate	Adequate	Yes
	1179	Batch 28	ASUNLE AREA/ OJU EKUN ROAD	Natural Stream		0.4	592419	807965	Poor	0.18	Tertiary	FLOODED ALWAYS	2.70	3.60	3.60	0.4	Inadequate	Inadequate	Yes
	1326	Batch 27	AYEGUN OLEYO, ODO ONA	Culvert	1 BC (0.9 x 0.675)	1.3	589976	808829	Poor	0.22	Tertiary	Drainage blocked with sand,Inlet covered with bushes	3.30	4.40	4.40	0.6	Inadequate	Inadequate	Yes
	1331	Batch 27	UNITY ESTATE	Natural Stream		0.2	590646	808332	Fair	0.33	Tertiary	The road is not accessible by car and gets flooded whenever it rains heavily	4.95	6.60	6.60	0.9	Inadequate	Inadequate	Yes
	1327	Batch 27	ARIGBOJA	Footpath		0.5	590099	808623	Poor	0.42	Tertiary	Inlet and outlet covered with bushes	6.30	8.40	8.40	1.6	Inadequate	Inadequate	Yes
	1175	Batch 28	BOLUWADURO ESTATE	Natural Stream		0.4	591811	808627	Poor	0.43	Tertiary	FLOODED ALWAYS	6.45	8.60	8.60	0.4	Inadequate	Inadequate	Yes
	1218	Batch 28	BOLUWADURO ESTATE	Natural Stream		2.2	592157	808659	Poor	0.46	Tertiary		6.90	9.20	9.20	9.2	Adequate	Inadequate	Yes
	1328	Batch 27	ARIGBOJA	Natural Stream		0.3	590092	808551	Poor	0.48	Tertiary	Marshy, Gets flooded when it rains heavily	7.20	9.60	9.60	0.4	Inadequate	Inadequate	Yes
	1332	Batch 27	UNITY ESTATE	Natural Stream		0.5	590800	808004	Fair	0.53	Tertiary	The road is not accessible by car and get flooded whenever it rains heavily	7.72	10.30	10.30	0.8	Inadequate	Inadequate	Yes
	1178	Batch 28	OJU EKUN AREA		1 CC (Dia 0.6)	1.2	592229	807556	Dilapidated	0.55	Secondary	DAMAGED RING FLOODED ALWAYS	7.88	10.50	10.50	0.3	Inadequate	Inadequate	Yes
	1176	Batch 28	IRE AKARI/ BOLUWADURO	Footpath		1.6	592015	808458	Poor	0.63	Tertiary	FLOODED OCASSIONALLY	8.47	11.30	11.30	16.5	Adequate	Inadequate	Yes
	1334	Batch 27	ABADA	Natural Stream		0.2	591047	807782	Poor	0.71	Tertiary	Marshy, the road is not accesssible by car and get flooded when it rains heavily.	9.07	12.10	12.10	0.6	Inadequate	Inadequate	Yes
	1177	Batch 28	AJAKANGA/ABA IFE	Culvert	1 CC (Dia 0.72) + 1 BC (0.77 x 1.36)	1.6	592996	808300	Dilapidated	0.80	Secondary	IS A COMBINATION OF BOTH RING AND CURVET FLOODED ALWAYS	9.75	13.00	13.00	1.7	Inadequate	Inadequate	Yes
	1205	Batch 28	ASAKA 2/ OJU EKUN	Culvert	1 CC (Dia 0.6)	0.8	591648	807158	Dilapidated	0.88	Secondary	DAMAGED RING FLOODED ALWAYS	10.35	13.80	13.80	0.3	Inadequate	Inadequate	Yes
	1324	Batch 27	AYEGUN	Natural Stream		0.3	589505	808607		0.99	Tertiary	Gets Flooded when it rains heavily	11.18	14.90	14.90	0.6	Inadequate	Inadequate	Yes
On20 Lowest Ona	1220	Batch 28	RATCON QUARRY				593047	804821		0.17	Tertiary	IS A RESAVIOR WATER FROM THE ROCK	2.55	3.40	3.40		Inadequate	Inadequate	Yes
	1208	Batch 28	SOKURO/APADABA	Culvert	1 CC (Dia 0.52)	1.4	593485	805268	Fair	0.35	Tertiary		5.25	7.00	7.00	0.2	Inadequate	Inadequate	Yes
	1210	Batch 28	FAWE COMMUNITY	Culvert	1 CC (Dia 0.74)	0.9	594285	805325	Dilapidated	0.41	Tertiary	FLOODED ALWAYS	6.15	8.20	8.20	0.4	Inadequate	Inadequate	Yes
	1209	Batch 28	LAGOS/IBADAN EXPRESS WAY	Culvert			593530	804757	Poor	4.14	Tertiary	NOT ACCESSIBLE AND NOT MEASURABLE BECAUSE OF THE WATER LEVEL, FLOODED OCASSIONALLY	34.80	46.40	46.40		Inadequate	Inadequate	Yes
	1211	Batch 28	LAGOS/IBADAN EXPRESS WAY	Culvert	1 BC (1 x 1)		595173	805285	Fair	6.19	Expressway	NOT ACCESSIBLE FLOODED OCASSIONALLY	47.72	63.63	63.63	1.3	Inadequate	Inadequate	Yes
	1212	Batch 28	ALOMAJA ROAD				595173	805080	Fair	7.04	Highway	NOT ACCESSIBLE	52.34	69.79	69.79		Inadequate	Inadequate	Yes

Structure Data												Structure Assessment						
Subbasin	Structure No.	Batch_ID	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Design Flow (m3/s)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
On3 Odo Oba	1477	Upper Ona	Amusan	Culvert	1 BC (2.2 x 1.1)	1.9	601145	840521	Poor	0.16	Highway	Does not overflow to the road whenever there is heavy rainfall	2.40	3.20	3.20	4.0	Adequate	Inadequate	Yes
	181	Batch 1	Moniya	Culvert			601038	833715	Dilapidated	0.24	Expressway	Not accessible	3.60	4.80	4.80		Inadequate	Inadequate	Yes
	1490	Upper Ona	Otun Agba Akin	Culvert	1 CC (Dia 0.88)	4.2	600402	834821	Fair	0.25	Highway	Overflow up to 10-15meters whenever it rain heavily, The capacity of the culvert is lover than the volume of water.Electric pole was dumped in the inlet and making it difficulf for easy flow of water.	3.75	5.00	5.00	0.7	Inadequate	Inadequate	Yes
	180	Batch 1	Otun Agbakin	Culvert	2 BC (2.93 x 1.51)	9.0	600936	834484	Good	0.28	Expressway		4.20	5.60	5.60	17.9	Adequate	Adequate	No
	1498	Upper Ona	Moniya	Culvert	2 BC (1.95 x 1.5)	8.0	601233	837615	Fair	0.33	Expressway	The Water does not overflow to the road whenever it rain heavily and the inlet is covered with vegetation.	4.95	6.60	6.60	10.6	Adequate	Inadequate	Yes
	1478	Upper Ona	Akinyele	Culvert	1 CC (Dia 0.8)	1.7	601004	839667	Poor	0.34	Highway	The volume of water is more than the capacity of the culvert,water overflow to the road whenever it rain heavily, the Outlet is surrounded with refuse(solid waste)	5.10	6.80	6.80	0.6	Inadequate	Inadequate	Yes
	1474	Upper Ona	Akinyele	Culvert	1 BC (2.6 x 1.5)	5.0	600689	840048	Fair	0.54	Expressway	It does not get flooded whenever rain fall heavily, the inlet is covered with vegetation.	7.80	10.40	10.40	7.6	Inadequate	Inadequate	Yes
	1473	Upper Ona	Akinyele	Culvert	1 BC (2.61 x 1.5)	6.0	600848	840529	Good	0.63	Expressway	The water does not overflow to the road whenever it rain heavily,	8.47	11.30	11.30	7.7	Inadequate	Adequate	Yes
	1476	Upper Ona	Kara	Culvert	1 CC (Dia 0.9)	1.5	601222	840862	Poor	0.64	Highway	Water Overflow to the road, surrounding buildings and damaging their properties whenever there is heavy rainfall,	8.55	11.40	11.40	0.8	Inadequate	Inadequate	Yes
	1480	Upper Ona	Jeje	Culvert	1 CC (Dia 0.65)	0.8	601335	838788	Good	0.65	Tertiary	The road get flooded whenever it rain heavily and making it difficult for the resident to ply the road	8.62	11.50	11.50	0.3	Inadequate	Adequate	Yes
	1485	Upper Ona	Oniyere	Culvert	2 BC (2.7 x 2.17)	6.0	600956	837685	Fair	1.36	Expressway	Does not get flooded whenever it rain heavuly,the inlet culvert is covered with vegetation	13.95	18.60	18.60	26.9	Adequate	Inadequate	Yes
	1486	Upper Ona	Lapite	Culvert	1 CC (Dia 0.9)	2.8	600480	837799	Fair	1.71	Highway	It dre of the inlet.oes not overflow to the road but flow sideways and the inlet is covered with vegation making it difficult to take the pictu	16.58	22.10	22.10	0.8	Inadequate	Inadequate	Yes
	1481	Upper Ona	Akinyele	Culvert	2 BC (2.5 x 2)	6.0	600984	838747	Fair	1.88	Highway	It does not get flooded whenever rain fall heavily,	17.85	23.80	23.80	21.7	Adequate	Inadequate	Yes
	1482	Upper Ona	Akinyele	Culvert	2 BC (3.05 x 2.5)	5.0	600915	838750	Fair	1.92	Expressway	Water does not overflow to the road whenever it rain heavily	18.15	24.20	24.20	38.2	Adequate	Inadequate	Yes
	1483	Upper Ona	Akinyele	Culvert	2 BC (2.48 x 2.44)	5.0	600679	838784	Erosion	2.05	Highway	Does not overflow to the road whenever there is heavy rainfall.	19.12	25.50	25.50	28.2	Adequate	Inadequate	Yes
	1488	Upper Ona	Akinyele	Culvert	1 BC (3.6 x 0.67)	4.0	600829	836284	Poor	2.79	Expressway	It Does not get flooded whenever it rain heavily.The inlet was not accessible	24.67	32.90	32.90	3.3	Inadequate	Inadequate	Yes
	1489	Upper Ona	Moniya	Culvert	1 BC (4 x 2.7)	3.5	600359	835446	Poor	3.76	Highway	The Culvert is surrounded with Bamboo trees, it does not overflow to the road but overflow sideways.	31.95	42.60	42.60	30.1	Inadequate	Inadequate	Yes
	1475	Upper Ona	Akinyele	Culvert	1 BC (1.6 x 1.5)	2.3	600836	840110	Dilapidated	3.84	Secondary	It get flooeded whenever it rain heavily, the culvert is surrounded with refude (solid waste)	32.55	43.40	43.40	4.1	Inadequate	Inadequate	Yes
	1479	Upper Ona	Akinyele	Culvert	2 BC (3.3 x 2.1)	5.0	600652	839471	Fair	5.06	Expressway	The water does not overflow to the road whenever it rain heavily,	41.58	55.43	55.43	33.2	Inadequate	Inadequate	Yes
	179	Batch 1	Otun Agbakin	Culvert	1 BC (1.64 x 1.6)	3.7	600440	834486	Poor	6.35	Highway	we could not access the outlet	48.59	64.79	64.79	4.6	Inadequate	Inadequate	Yes

Structure Data												Structure Assessment						
Subbasin	Structure No.	Batch_ID	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Design Flow (m3/s)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
	1484	Upper Ona	Oloje	Culvert	1 BC (2.2 x 1.5)	2.0	600482	838744	Poor	9.30	Tertiary	Overflow to about 5-10meters accross the road whenever there is heavy rainfall, during theses period, residents and unable to ply the road, No casualty has been recorded as a result of the flood.	78.53	104.70	104.70	6.2	Inadequate	Inadequate	Yes
	1487	Upper Ona	Oniyere	Culvert	2 BC (1.95 x 1.71)	1.9	600659	837832	Erosion	10.91	Tertiary	The culvert is in good condition and water does not overflow to the road whenever there is heavy rainfall.	103.50	138.00	138.00	12.7	Inadequate	Inadequate	Yes
	188	Batch 1	Dominican Centre	Culvert	1 BC (2.5 x 1.75)	2.4	599760	834445		36.23	Tertiary		213.00	284.00	284.00	9.0	Inadequate	Inadequate	Yes
	183	Batch 1	Odo Oba	Culvert	2 CC (Dia 0.94)	2.2	598899	834053	Good	37.33	Main		213.00	284.00	284.00	1.7	Inadequate	Adequate	Yes
	160	Batch 1	Oke Oba	Natural Stream		1.7	598593	833828	Poor	38.03	Tertiary		220.88	294.50	294.50	28.5	Inadequate	Inadequate	Yes
	1493	Upper Ona	Alabata	Culvert	1 CC (Dia 0.88)	2.0	595823	839148	Fair	0.21	Main	Overflow to the road whenever there is heavy downpoor, Thevolume of water is more than the capacity of the culvert. The bad road is as a result of water overflowing to the road.	3.15	4.20	4.20	0.7	Inadequate	Inadequate	Yes
	1491	Upper Ona	Molarere	Culvert	1 CC (Dia 0.9)	2.2	598123	835169	Fair	0.52	Main	It does not overflow to the road whenever it rain heavily.	7.65	10.20	10.20	0.8	Inadequate	Inadequate	Yes
	1492	Upper Ona	Agbedo	Culvert	1 CC (Dia 1.04)	1.8	596407	838402	Fair	0.57	Main	The channel does not overflow to the road but overflows sideways up to about 5-10meters across the channel	8.02	10.70	10.70	1.1	Inadequate	Inadequate	Yes
	1579	Batch 31	Olorisa Oko	Culvert	1 CC (Dia 0.8)	1.0	596682	835949	Poor	1.63	Tertiary		15.97	21.30	21.30	0.6	Inadequate	Inadequate	Yes
	1494	Upper Ona	Alaagba	Culvert	1 CC (Dia 0.75)	1.2	595363	838285	Good	1.81	Tertiary	It overflow to the road whenevr it rain heavily, the channel need to be dredged for easy flow of water.the culver is also surronded with vegetation.	17.32	23.10	23.10	0.5	Inadequate	Adequate	Yes
On4 Upper Ona North	1580	Batch 31	Olorisa Oko	Culvert	2 CC (Dia 0.45)	1.4	596515	835735	Good	1.83	Secondary		17.48	23.30	23.30	0.2	Inadequate	Adequate	Yes
	1495	Upper Ona	Idi Oke	Natural Stream		0.3	595936	835890	Poor	6.89	Tertiary	The Culvert has been damaged by flood and was placed sideways since it wasnآt in use anymore, the diameter of the damaged culvert is 0.90meter,water overflos to the road whenever there is heavy rainfall.	51.53	68.70	68.70	0.3	Inadequate	Inadequate	Yes
	1496	Upper Ona	Seriki	Culvert			596235	835454	Fair	14.10	Secondary	The channel is filled with sediment and unable to be measured,Whenevee resident to make use of the roadr there is heavy rainfall, the water flow between 10-15meters across the road making it difficulf for the resident to make ue of the road	101.25	135.00	135.00		Inadequate	Inadequate	Yes
	1497	Upper Ona	Idi Oroko	Culvert	1 CC (Dia 0.6)	1.1	597155	834420	Poor	22.52	Tertiary	water overflow to the road whenever there is heavy rainfall, during these period nobody is able to ply the road.	143.63	191.50	191.50	0.3	Inadequate	Inadequate	Yes
	161	Batch 1	Idiroko	Culvert	2 CC (Dia 0.9)	1.6	597339	834214	Poor	23.91	Tertiary	Break down culvert	151.50	202.00	202.00	1.5	Inadequate	Inadequate	Yes
On5 Alapata North	471	Batch 4	Ajibade	Culvert	1 CC (Dia 0.6)	0.9	592066	828474	Good	1.81	Secondary		17.32	23.10	23.10	0.3	Inadequate	Adequate	Yes
	454	Batch 4	Araromi	Culvert	1 BC (1.36 x 1.2)	1.8	592187	827990	Poor	7.14	Secondary		52.89	70.51	70.51	2.4	Inadequate	Inadequate	Yes
	455	Batch 4	Araromi	Culvert	2 CC (Dia 0.9)	1.7	592023	827487	Fair	7.53	Main		55.01	73.34	73.34	1.5	Inadequate	Inadequate	Yes
	456	Batch 4	Araromi	Culvert	4 CC (Dia 0.83)	1.7	592694	826747	Fair	16.19	Main		102.10	136.13	136.13	2.4	Inadequate	Inadequate	Yes
	197	Batch 1	Oja Agbe	Culvert	2 BC (2 x 1.59)	2.1	600286	832795	Fair		Tertiary					11.9	Adequate	Inadequate	Yes
	531	Batch 5	IITA	Culvert	1 CC (Dia 0.8)	1.4	599548	828050	Fair		Tertiary					0.6	Adequate	Inadequate	Yes
	78D	PIU 3rd List	AYETORO LANDLORDS ASSOCIATION	Natural Stream			600283	833417		0.02	Tertiary	There is no crossing structure./ Scour / The driange channel passing between houses.	0.34	0.46	0.46		Inadequate	Inadequate	Yes
	528	Batch 5	IITA	Culvert	1 BC (0.95 x 0.7)	1.7	599537	828777	Good	0.14	Tertiary		2.10	2.80	2.80	0.7	Inadequate	Adequate	Yes
	532	Batch 5	IITA Dam Road	Culvert	1 CC (Dia 0.6)	1.7	599178	827854	Fair	0.15	Tertiary		2.25	3.00	3.00	0.3	Inadequate	Inadequate	Yes
	185	Batch 1	Elebu	Culvert	2 CC (Dia 0.5)	0.9	599415	833238	Good	0.20	Main	the inlet is blocked by sand	3.00	4.00	4.00	0.3	Inadequate	Adequate	Yes
	529	Batch 5	IITA	Culvert	1 CC (Dia 0.77)	1.4	599087	828614	Good	0.21	Tertiary		3.15	4.20	4.20	0.5	Inadequate	Adequate	Yes
	194	Batch 1	Oluana Village	Culvert	2 CC (Dia 0.9)	1.6	599794	830041	Poor	0.28	Tertiary		4.20	5.60	5.60	1.5	Inadequate	Inadequate	Yes
	198	Batch 1	Abanise	Culvert	2 CC (Dia 0.6)	1.0	600156	833007	Fair	0.28	Tertiary		4.20	5.60	5.60	0.5	Inadequate	Inadequate	Yes

Structure Data												Structure Assessment						
Subbasin	Structure No.	Batch_ID	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Design Flow (m3/s)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
On6 Upper Ona West	174	Batch 1	Oluana	Natural Stream		0.9	599779	829943	Erosion	0.29	Tertiary		4.35	5.80	5.80	9.6	Adequate	Inadequate	Yes
	199	Batch 1	Lagbe	Natural Stream		0.3	597868	830323	Erosion	0.35	Tertiary	Stream	5.25	7.00	7.00	0.4	Inadequate	Inadequate	Yes
	196	Batch 1	Odo Igbo	Culvert	1 BC (12.5 x 1.9)	2.1	600266	831377	Fair	0.37	Tertiary		5.55	7.40	7.40	67.2	Adequate	Inadequate	Yes
	533	Batch 5	IITA	Culvert	1 CC (Dia 0.8)	1.8	598803	829074	Good	0.38	Tertiary		5.70	7.60	7.60	0.6	Inadequate	Adequate	Yes
	534	Batch 5	IITA	Culvert	1 CC (Dia 0.8)	2.0	599541	827292	Good	0.38	Tertiary		5.70	7.60	7.60	0.6	Inadequate	Adequate	Yes
	195	Batch 1	Odo Igbo	Culvert	1 CC (Dia 0.85)	1.5	600248	831265	Dilapidated	0.40	Tertiary	Break Down Culvert	6.00	8.00	8.00	0.6	Inadequate	Inadequate	Yes
	531 Prime	Batch 5	IITA	Culvert	2 CC (Dia 0.69)	0.7	599471	828169	Good	0.42	Tertiary		6.30	8.40	8.40	0.7	Inadequate	Adequate	Yes
	176	Batch 1	IITA	Culvert	1 BC (2.5 x 1.5)	2.6	600704	830052	Fair	0.44	Highway		6.60	8.80	8.80	7.3	Inadequate	Inadequate	Yes
	530 Prime	Batch 5	IITA Dam Road	Culvert	1 CC (Dia 0.85)	1.9	598876	828715	Good	0.44	Tertiary		6.60	8.80	8.80	0.6	Inadequate	Adequate	Yes
	182	Batch 1	Moniya	Culvert	1 BC (1.8 x 1.51)	9.0	601090	833199	Good	0.46	Expressway		6.90	9.20	9.20	4.8	Inadequate	Adequate	Yes
	162	Batch 1	Asanjanna	Culvert	2 CC (Dia 0.8)	1.4	599001	832922	Good	0.48	Tertiary		7.20	9.60	9.60	1.1	Inadequate	Adequate	Yes
	535	Batch 5	IITA	Culvert	1 CC (Dia 0.6) + 1 BC (0.9 x 0.98)	1.9	599203	827225	Good	0.48	Tertiary		7.20	9.60	9.60	1.3	Inadequate	Adequate	Yes
	170	Batch 1	Isaleawero Okeodo	Culvert	2 BC (1.25 x 1.1)	1.8	600781	832657	Poor	0.51	Tertiary		7.57	10.10	10.10	3.9	Inadequate	Inadequate	Yes
	177	Batch 1	Akingbile	Culvert	1 CC (Dia 0.57)	2.6	600844	830802	Fair	0.51	Highway	Break down wing walls	7.57	10.10	10.10	0.2	Inadequate	Inadequate	Yes
	532 Prime	Batch 5	IITA Dam Road	Culvert	2 CC (Dia 0.6)	1.4	599117	828012	Good	0.52	Tertiary		7.65	10.20	10.20	0.5	Inadequate	Adequate	Yes
	193	Batch 1	Oyerinde-Olukotun	Footpath		4.5	599023	831829	Erosion	0.53	Tertiary		7.72	10.30	10.30	39.8	Adequate	Inadequate	Yes
	163	Batch 1	Asanjanna	Natural Stream		2.0	598882	832840	Erosion	0.56	Tertiary		7.95	10.60	10.60	24.8	Adequate	Inadequate	Yes
	169	Batch 1	Isaleawero Okeodo	Natural Stream		1.6	600738	832827	Erosion	0.58	Tertiary		8.10	10.80	10.80	19.9	Adequate	Inadequate	Yes
	168	Batch 1	Dagbolu	Culvert	1 BC (1.8 x 0.95)	1.1	600717	833098	Good	0.72	Tertiary		9.15	12.20	12.20	2.5	Inadequate	Adequate	Yes
	480	Batch 5	Baale Agbe	Culvert	3 BC (3.74 x 0.7)	2.1	597149	828762		1.09	Tertiary		11.93	15.90	15.90	11.2	Inadequate	Inadequate	Yes
	175	Batch 5	IITA	Culvert	4 CC (Dia 0.6)	1.8	599976	829749	Poor	1.30	Tertiary		13.50	18.00	18.00	1.0	Inadequate	Inadequate	Yes
	1499	Upper Ona	Idi Ose	Culvert	4 CC (Dia 0.5)	1.6	599975	829753	Poor	1.30	Tertiary	The Inlet is used as fish fond and also for irrigation.	13.50	18.00	18.00	0.6	Inadequate	Inadequate	Yes
	174 prime	Batch 1	Oluana	Culvert	1 BC (1.05 x 0.03)	0.7	599394	829896	Dilapidated	2.02	Tertiary	Blocked With Sand	18.90	25.20	25.20	0.0	Inadequate	Inadequate	Yes
	190	Batch 1	Akinbile Oluana	Culvert			598830	829918	Poor	2.40	Tertiary		21.75	29.00	29.00		Inadequate	Inadequate	Yes
	477	Batch 5	IITA	Culvert	2 BC (2.85 x 1.95)	3.3	598414	829327	Good	87.69	Tertiary		411.00	548.00	548.00	24.8	Inadequate	Adequate	Yes
	478	Batch 18	IITA	Culvert	6 BC (3.2 x 0.97)	1.6	599095	827196	Poor	95.84	Tertiary		435.75	581.00	581.00	30.9	Inadequate	Inadequate	Yes
On7 Upper Ona East	449	Batch 3	Agbede	Culvert			607149	831612	Poor	0.11	Tertiary	The Culvert is blocked with sand	1.65	2.20	2.20		Inadequate	Inadequate	Yes
	225	Batch 2	Otiko	Natural Stream		0.2	603944	831045	Poor	0.16	Tertiary		2.40	3.20	3.20	0.3	Inadequate	Inadequate	Yes
	226	Batch 2	Eyinolu	Natural Stream		0.3	605874	832012	Fair	0.17	Tertiary		2.55	3.40	3.40	0.6	Inadequate	Inadequate	Yes
	224	Batch 2	Alaja	Footpath		1.9	601685	830796	Erosion	0.25	Tertiary		3.75	5.00	5.00	12.1	Adequate	Inadequate	Yes
	120	Batch 31	Arulogun	Culvert	1 CC (Dia 0.8)	0.2	605499	831035	Fair	0.27	Main		4.05	5.40	5.40	0.6	Inadequate	Inadequate	Yes
	223	Batch 2	Orieni	Natural Stream		1.1	602597	832520	Erosion	0.34	Main		5.10	6.80	6.80	12.0	Adequate	Inadequate	Yes
	450	Batch 3	Agbede	Culvert	2 CC (Dia 0.6)	1.6	607168	831035	Good	0.40	Tertiary	this culvet only function when it rain heavily	6.00	8.00	8.00	0.5	Inadequate	Adequate	Yes
	227	Batch 2	Balogun	Culvert	1 CC (Dia 0.35)	0.5	606510	831848	Poor	0.47	Tertiary		7.05	9.40	9.40	0.1	Inadequate	Inadequate	Yes
	207	Batch 2	Seriki	Culvert	1 CC (Dia 0.65) + 1 BC (1.7 x 1.2)	1.4	601755	830216	Good	0.55	Tertiary		7.88	10.50	10.50	3.6	Inadequate	Adequate	Yes
	213	Batch 2	Eyinolu	Natural Stream		0.3	606217	831920	Poor	0.81	Tertiary		9.83	13.10	13.10	1.5	Inadequate	Inadequate	Yes
	447	Batch 3	Oloyin-Onilu	Culvert	1 CC (Dia 0.8)	1.2	606973	833754	Good	1.50	Main		15.00	20.00	20.00	0.6	Inadequate	Adequate	Yes
	216	Batch 2	Dabiri	Natural Stream		1.0	604982	832524	Good	62.24	Secondary		294.75	393.00	393.00	5.6	Inadequate	Adequate	Yes
	215	Batch 2	Yanjuade Aroro	Natural Stream		3.1	604442	831776	Good	67.94	Secondary	the old culvert has collapsed and new one has been constructed	314.25	419.00	419.00	9.6	Inadequate	Adequate	Yes
On8 Upper Ona South	514	Batch 5	IITA	Culvert	1 BC (3.4 x 1.9)	1.9	601469	829553	Fair	0.10	Tertiary		1.50	2.00	2.00	14.9	Adequate	Inadequate	Yes
	504	Batch 5	Shasha	Culvert	1 BC (1.6 x 1.5)	3.1	600866	827375	Fair	0.14	Highway		2.10	2.80	2.80	4.1	Adequate	Inadequate	Yes
	539	Batch 6	Arulogun	Natural Stream		0.7	602644	828692	Poor	0.14	Tertiary		2.10	2.80	2.80	0.9	Inadequate	Inadequate	Yes
	562	Batch 6	Mercy Estate	Footpath		0.7	602385	827924	Poor	0.14	Tertiary		2.10	2.80	2.80	0.5	Inadequate	Inadequate	Yes
	503	Batch 5	Shasha	Culvert	1 BC (1.51 x 0.93)	1.1	600679	827286	Poor	0.19	Tertiary		2.85	3.80	3.80	2.0	Inadequate	Inadequate	Yes
	538	Batch 6	Gospel Time Estate	Culvert	1 CC (Dia 0.8)	1.0	602572	829108	Fair	0.20	Tertiary	the area is usually flooded when it rain	3.00	4.00	4.00	0.6	Inadequate	Inadequate	Yes
	564	Federal Housing	Barack	Culvert	1 CC (Dia 0.9)	2.0	602187	826351	Good	0.21	Tertiary		3.15	4.20	4.20	0.8	Inadequate	Adequate	Yes
	541	Batch 6	sagbe	Culvert	2 CC (Dia 0.75)	1.1	601531	829417	Good	0.23	Tertiary	the drainage is usually over flow during heavy rain fall	3.45	4.60	4.60	0.9	Inadequate	Adequate	Yes
	559	Batch 6	Abutu	Culvert	1 CC (Dia 0.8)	1.1	603175	828378	Fair	0.23	Main	the area is usually flooded	3.45	4.60	4.60	0.6	Inadequate	Inadequate	Yes
	577	Federal Housing	Ojoo	Culvert	1 CC (Dia 0.8)	1.1	603174	828376	Fair	0.23	Main	Always flooded when it rains heavy	3.45	4.60	4.60	0.6	Inadequate	Inadequate	Yes
	542	Batch 6	Sagbe	Footpath		0.9	601557	829317	Poor	0.25	Tertiary	For Attention (there was culvert here before, it has collape)	3.75	5.00	5.00	5.9	Adequate	Inadequate	Yes
	563	Batch 6	Goodness Estate Ojoo	Culvert	1 BC (1.9 x 1.44)	1.7	602284	827914	Good	0.27	Tertiary		4.05	5.40	5.40	4.8	Inadequate	Adequate	Yes
	558	Batch 6	Gospel Time Estate	Natural Stream		0.9	603201	828678	Poor	0.33	Tertiary		4.95	6.60	6.60	6.7	Adequate	Inadequate	Yes
	557	Batch 6	White House area	Natural Stream		1.6	603224	828827	Poor	0.36	Tertiary		5.40	7.20	7.20	19.2	Adequate	Inadequate	Yes
	543	Batch 6	sagbe	Culvert	1 BC (8.2 x 3.24)	3.2	601561	829020	Poor	0.41	Tertiary	For Attention (there was culvert here before, it has collape)	6.15	8.20	8.20	94.6	Adequate	Inadequate	Yes
	505	Batch 5	Shasha	Culvert	1 BC (3.2 x 2.82)	3.1	600612	827528	Fair	0.45	Tertiary		6.75	9.00	9.00	24.0	Adequate	Inadequate	Yes

Structure Data												Structure Assessment						
Subbasin	Structure No.	Batch_ID	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Design Flow (m3/s)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
	506	Batch 5	Abatakan	Natural Stream		1.6	600509	827621	Erosion	0.51	Tertiary		7.57	10.10	10.10	27.9	Adequate	Inadequate	Yes
	513	Batch 5	Sagbe	Footpath		1.2	601459	828779	Poor	0.54	Tertiary		7.80	10.40	10.40	9.2	Inadequate	Inadequate	Yes
	512	Batch 5	Sagbe	Culvert	1 CC (Dia 0.6) + 1 BC (0.75 x 0.6)	0.8	601419	828545	Fair	0.61	Tertiary		8.33	11.10	11.10	0.7	Inadequate	Inadequate	Yes
	548	Batch 6	Arulogun	Culvert	1 CC (Dia 1.2)	2.0	602090	827098	Poor	0.61	Main	For Attention	8.33	11.10	11.10	1.6	Inadequate	Inadequate	Yes
	510	Batch 5	IITA	Culvert	1 BC (3.3 x 1)	1.0	600499	828264	Good	0.67	Tertiary		8.78	11.70	11.70	5.6	Inadequate	Adequate	Yes
	556	Batch 6	Abutu	Culvert			603667	828713	Dilapidated	0.67	Secondary	Damaged and blocked culvert	8.78	11.70	11.70		Inadequate	Inadequate	Yes
	576	Federal Housing	Abutu	Natural Stream		0.3	603667	828714	Poor	0.67	Secondary	Always flooded when it rains heavy	8.78	11.70	11.70	2.6	Inadequate	Inadequate	Yes
	208	Batch 2	UCH Quarters	Footpath		0.4	604318	830181	Fair	0.69	Tertiary		8.92	11.90	11.90	1.4	Inadequate	Inadequate	Yes
	508	Batch 5	IITA	Culvert	1 BC (1.2 x 1.17)	1.2	600517	827840	Good	0.73	Tertiary		9.23	12.30	12.30	2.0	Inadequate	Adequate	Yes
	509	Batch 5	IITA	Natural Stream		2.2	600487	827943	Good	0.73	Tertiary		9.23	12.30	12.30	0.8	Inadequate	Adequate	Yes
	515	Batch 5		Culvert	1 BC (1.6 x 1.6)	1.6	600960	825088	Poor		Tertiary					4.5	Adequate	Inadequate	Yes
	516	Batch 5	Supper	Culvert	1 BC (2 x 1.12)	1.4	600922	825030	Poor	0.10	Tertiary		1.50	2.00	2.00	3.6	Adequate	Inadequate	Yes
	517	Batch 5		Natural Stream		1.6	600882	824964	Poor	0.10	Tertiary		1.50	2.00	2.00	3.1	Adequate	Inadequate	Yes
	518	Batch 5	Ojoo	Natural Stream		0.4	600812	824911	Poor	0.14	Tertiary		2.10	2.80	2.80	1.1	Inadequate	Inadequate	Yes
	518 Prime	Batch 5	Ojoo	Culvert	1 BC (3.1 x 1.6)	1.9	600769	824915	Fair	0.16	Tertiary		2.40	3.20	3.20	10.4	Adequate	Inadequate	Yes
	569	Federal Housing	Barack	Culvert	1 CC (Dia 0.9)	1.5	603245	823456	Good	0.16	Tertiary		2.40	3.20	3.20	0.8	Inadequate	Adequate	Yes
	568	Federal Housing	Barack	Culvert	1 CC (Dia 0.9)	1.9	603294	824346	Fair	0.17	Tertiary		2.55	3.40	3.40	0.8	Inadequate	Inadequate	Yes
	666	Batch 11	Ojokondo				600443	822959		0.18	Tertiary	No culvet	2.70	3.60	3.60		Inadequate	Inadequate	Yes
	673	Batch 11	Orogun-Ojo	Culvert	1 BC (3 x 1.82)	2.1	600846	824500	Good	0.19	Tertiary		2.85	3.80	3.80	12.0	Adequate	Adequate	No
	519 Prime	Batch 5	Ojoo	Culvert	1 BC (1.9 x 1.4)	2.1	600705	824861	Fair	0.19	Tertiary		2.85	3.80	3.80	4.7	Adequate	Inadequate	Yes
	519	Batch 5	Ojoo	Culvert	1 BC (3.38 x 0.8)	1.2	600722	824824	Fair	0.20	Tertiary		3.00	4.00	4.00	4.1	Adequate	Inadequate	Yes
	671	Batch 11	30/30 Sawmill	Culvert	3 Cells (Dia 0.78)	1.3	601454	822044	Fair	0.23	Tertiary		3.45	4.60	4.60	1.5	Inadequate	Inadequate	Yes
	1500	Upper Ona	Ojoo	Culvert	2 BC (2.5 x 2.55)	2.9	600424	825309	Fair	0.25	Tertiary	Does not overflow to the road whenever it rain heavily	3.75	5.00	5.00	30.2	Adequate	Inadequate	Yes
	672	Batch 11	Orogun-Ojo	Culvert	1 BC (1.6 x 1.13)	1.4	600726	824541	Fair	0.26	Tertiary	Overflood the area during heavy rain	3.90	5.20	5.20	2.8	Inadequate	Inadequate	Yes
	691	Batch 12	Aduloju	Culvert	1 CC (Dia 0.9)	1.2	602301	822631	Fair	0.27	Tertiary		4.05	5.40	5.40	0.8	Inadequate	Inadequate	Yes
	570	Federal Housing	Barack	Culvert	1 BC (1.92 x 1.55)	2.0	603494	823209	Good	0.29	Tertiary		4.35	5.80	5.80	5.4	Adequate	Adequate	No
	566	Federal Housing	Barack	Culvert	1 CC (Dia 0.9)	3.0	603111	822821	Fair	0.30	Tertiary		4.50	6.00	6.00	0.8	Inadequate	Inadequate	Yes
	665	Batch 11	Ojokondo	Culvert	1 BC (2.2 x 1.74)	2.0	600401	823221	Good	0.31	Tertiary	Overfood during heavy rain	4.65	6.20	6.20	7.6	Adequate	Adequate	No
	669	Batch 11	Bodija	Culvert	1 BC (3.35 x 1.38)	1.7	600675	822285	Good	0.31	Tertiary	FLOODED ALWAYS NEED URGENT ATTENTION	4.65	6.20	6.20	9.2	Adequate	Adequate	No
On9 Orogun	571	Federal Housing	Barack	Culvert	1 CC (Dia 0.9)	2.2	603889	823477	Fair	0.32	Tertiary		4.80	6.40	6.40	0.8	Inadequate	Inadequate	Yes
	664	Batch 11	Agbegba	Footpath		1.0	600402	823333	Poor	0.33	Tertiary		4.95	6.60	6.60	8.6	Adequate	Inadequate	Yes
	663	Batch 11	Agbegba	Culvert	1 BC (1.11 x 1.23)	1.5	600396	823450	Fair	0.35	Tertiary	Overflood at heavy rain	5.25	7.00	7.00	1.9	Inadequate	Inadequate	Yes
	682	Batch 12	Kajola	Culvert	1 CC (Dia 0.33)	0.9	601863	824416	Poor	0.37	Tertiary	The culvet was bloked by sediment	5.55	7.40	7.40	0.1	Inadequate	Inadequate	Yes
	662	Batch 18	Agbowo	Culvert	1 BC (2.05 x 1.35)	1.6	600364	823569	Fair	0.40	Tertiary		6.00	8.00	8.00	4.9	Inadequate	Inadequate	Yes
	690	Batch 12	Aduloju	Culvert	2 BC (1.15 x 1.97)	2.2	602049	822831	Good	0.41	Tertiary		6.15	8.20	8.20	7.4	Inadequate	Adequate	Yes
	491	Batch 5	University of Ibadan	Culvert	2 BC (2.85 x 1.95)	2.9	599980	825122	Good	0.47	Main		7.05	9.40	9.40	24.8	Adequate	Adequate	No
	670	Batch 11	30/30 Bodija	Culvert	1 CC (Dia 0.9) + 1 BC (1.8 x 0.88)	1.1	601500	822153	Fair	0.55	Tertiary	ENTERS SHOP ANDMARKET DURING HEAVY RAIN	7.88	10.50	10.50	3.0	Inadequate	Inadequate	Yes
	635	Batch 11	Agbowo	Culvert	1 BC (2.66 x 1.33)	1.6	601017	822646	Fair	0.62	Tertiary		8.40	11.20	11.20	6.6	Inadequate	Inadequate	Yes
	631	Batch 18	Orogun/adediran junction	Culvert	1 BC (2.96 x 1.67)	2.3	600269	824545	Fair	0.70	Highway		9.00	12.00	12.00	10.5	Inadequate	Inadequate	Yes
	689	Batch 12	Ajao off Ojo road	Culvert	2 CC (Dia 0.8)	1.0	601846	823061	Good	0.73	Tertiary	Flooded the area during heavy rain	9.23	12.30	12.30	1.1	Inadequate	Adequate	Yes
	688	Batch 12	Jakan Ajao	Culvert	1 BC (1.37 x 0.57)	0.8	601778	823112	Poor	0.75	Tertiary	Flooded the area during heavy rain	9.38	12.50	12.50	0.9	Inadequate	Inadequate	Yes
	687	Batch 12	Jakan Ajao	Culvert	1 BC (1.93 x 1.17)	1.4	601691	823210	Good	0.79	Tertiary		9.68	12.90	12.90	3.7	Inadequate	Adequate	Yes
	686	Batch 12	Jakan Ajao	Natural Stream		0.4	601652	823281	Poor	0.82	Tertiary	Flooded and prevent movement during heavy rain	9.90	13.20	13.20	1.6	Inadequate	Inadequate	Yes
	685	Batch 12	Jakan Ajao	Culvert	1 BC (1.3 x 1.07)	1.2	601667	823354	Fair	0.85	Tertiary	Overflow into street during heavy rain	10.13	13.50	13.50	2.0	Inadequate	Inadequate	Yes
	684	Batch 12	Jakan	Culvert	1 BC (1.15 x 1.05)	1.5	601681	823427	Fair	0.87	Tertiary	overflow into street during heavy rain	10.28	13.70	13.70	1.6	Inadequate	Inadequate	Yes
	683	Batch 12	Irepodun Ojo road	Culvert	1 BC (1.67 x 1.5)	1.8	601690	823513	Fair	0.89	Tertiary	overflow into street during heavy rain	10.42	13.90	13.90	4.3	Inadequate	Inadequate	Yes
	632	Batch 11	Ajibode	Culvert	2 CC (Dia 1.2)	1.9	600125	824528	Fair	0.90	Main	During heavy rain it prevents motorist from plying the road	10.50	14.00	14.00	3.3	Inadequate	Inadequate	Yes
	572	Federal Housing	Barack	Culvert	1 BC (2.1 x 1.85)	3.5	603924	823565	Fair	0.95	Tertiary		10.87	14.50	14.50	7.8	Inadequate	Inadequate	Yes

Structure Data												Structure Assessment						
Subbasin	Structure No.	Batch_ID	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Vertical Distance from Road L. to Exist. Culv. Inv.	Easting	Northing	Condition	Catchment Area (km2)	Cross Road Classification	Remarks based on Survey conducted in 2017	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Design Flow (m3/s)	Existing Flow Capacity	Hydraulic Adequacy	Structural Adequacy	Necissity for a New structure
Iddo Basin	1076	Batch 15	Orisunbare	Culvert	1 CC (Dia 0.75)	1.0	588089	818587	Poor	0.22	Tertiary		3.30	4.40	4.40	0.5	Inadequate	Inadequate	Yes
	1079	Batch 15	Apata Area	Culvert	1 BC (2.5 x 0.75)	1.5	588004	817689	Fair	0.33	Tertiary		4.95	6.60	6.60	2.6	Inadequate	Inadequate	Yes
	1075	Batch 15	Orisunbare	Natural Stream		0.4	587940	818484	Poor	0.41	Tertiary		6.15	8.20	8.20	1.3	Inadequate	Inadequate	Yes
	1074	Batch 15	Orisunbare	Natural Stream		0.6	587855	818440	Poor	0.50	Tertiary	Overflow during heavy rain and prevent people from passsing	7.50	10.00	10.00	2.8	Inadequate	Inadequate	Yes
	1068	Batch 15	Akintola Adelumo Village	Culvert	1 BC (1.85 x 0.85)	1.1	587582	819529	Poor	0.78	Tertiary	For attention,the culvert is damaged	9.60	12.80	12.80	2.2	Inadequate	Inadequate	Yes
	1073	Batch 15	Ire akari Estate	Culvert	2 BC (1.2 x 0.85)	1.1	587374	818185	Fair	0.83	Tertiary	Overflow during heavy rain	9.97	13.30	13.30	2.6	Inadequate	Inadequate	Yes
	1072	Batch 15	Ire akari Estate	Natural Stream		0.9	587309	818166	Poor	0.86	Tertiary		10.20	13.60	13.60	3.0	Inadequate	Inadequate	Yes
	1070	Batch 15	Amugbekun	Culvert	1 BC (1.25 x 1.37)	5.0	587078	818082	Fair	0.88	Tertiary		10.35	13.80	13.80	2.6	Inadequate	Inadequate	Yes
	1071	Batch 15	Apata Area	Culvert	1 BC (1.3 x 1.2)	1.9	587238	818134	Fair	0.88	Tertiary	Overflow during heavy rain	10.35	13.80	13.80	2.3	Inadequate	Inadequate	Yes
	1067	Batch 15	Olude	Culvert	2 CC (Dia 0.68)	0.9	587048	819382		1.17	Tertiary		12.52	16.70	16.70	0.7	Inadequate	Inadequate	Yes
	1078	Batch 15	Ibode Igbo	Culvert	1 BC (2.7 x 2.3)	2.7	587245	817574	Good	1.81	Tertiary		17.32	23.10	23.10	14.5	Inadequate	Adequate	Yes
	41D1	PIU 1st List	BETHEL ESTATE LANDLORD AND LANDLADIES ASSOCIATION ABEOKUTA EXPRESSWAY BODE IGBO, APATA, IBADAN OYO STATE	Pipe Culvert	2 CC (Dia 0.75)		586876	818001	Good	1.86	Tertiary	Patially blocked Culvert by Sediments	17.70	23.60	23.60	0.9	Inadequate	Adequate	Yes
	1069	Batch 15	Panada	Culvert	2 CC (Dia 0.75)	2.2	586868	817997	Good	1.86	Tertiary		17.70	23.60	23.60	0.9	Inadequate	Adequate	Yes
	1077	Batch 15	Ibode Igbo	Culvert	1 CC (Dia 0.9)	3.3	587154	817633	Good	1.99	Highway		18.68	24.90	24.90	0.8	Inadequate	Adequate	Yes
	41D2	PIU 1st List	BETHEL ESTATE LANDLORD AND LANDLADIES ASSOCIATION ABEOKUTA EXPRESSWAY BODE IGBO, APATA, IBADAN OYO STATE	Natural Stream			586360	817903	Poor	4.82	Tertiary	There is no structure	39.90	53.20	53.20		Inadequate	Inadequate	Yes
	1506	Batch 31	Ibadan Abeokuta Express	Culvert	1 BC (1 x 1)	1.3	585628	817914	Fair	5.81	Highway	We could not take measurement due to water level	45.65	60.87	60.87	1.3	Inadequate	Inadequate	Yes
	65D	PIU 2nd List	OKE-ADO IGISOGBA/ANISERE/ARETU/ALARABA COMMUNITY,OMI ADIO	Footpath			582566	815424	Poor	100.72	Tertiary	Primative Wooden Footpath acrros the Iddo Main River. Both pedestrian and vehicles will have to stop-over for hours during heavy rain.	375.68	500.90	500.90		Inadequate	Inadequate	Yes
Osun Basin	1396	Batch 14	AGUSI FATUMO	Culvert	1 BC (2.95 x 2.67)	3.8	615930	823937	Poor	1.94	Highway	INLET AND OUTLET SURROUNDED WITH THICK VEGETATION AND REFUSE	18.30	24.40	24.40	20.0	Inadequate	Inadequate	Yes
	1397	Batch 14	ARIJE	Culvert	1 CC (Dia 0.9)	1.4	615935	823792	Fair	2.00	Tertiary	INLET BLOCKED WHILE OUTLET IS STAGNANT	18.75	25.00	25.00	0.8	Inadequate	Inadequate	Yes
	1398	Batch 14	ARIJE	Natural Stream		0.3	615917	823723	Fair	2.15	Tertiary	SURROUNDED WITH THICK VEGETATION , Natural Stream BESIDE RAIL TRACK	19.88	26.50	26.50	0.8	Inadequate	Inadequate	Yes
	1399	Batch 14	ARIJE/ERUNMU	Natural Stream		0.4	616038	822924	Poor	3.06	Tertiary	LARGE BODY OF WATER , INLET AND OUTLET SURRROUNDED WITH VEGETATION, SURROUNDED WITH WATER.	26.70	35.60	35.60	0.1	Inadequate	Inadequate	Yes

Annex

12

Sizing of Crossing Structures lying on Natural Streams

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1 Introduction

There are around 1615 crossing locations in Ibadan comprising of 46 Bridges, 1067 Culverts and 181 boardwalks and footpaths. The rest of these crossing locations (321) have yet still no structures. It is important to ensure that the sizes of these structures are sufficient to convey the flow through them without causing any constrictions or bottle necks.

As the number of Structures are very large, the Consultant divided them to:

- Division 1: Structures located on proposed channels
- Division II: Structures located on natural streams

In this respect, this annex (Annex 12) presents the design and cost estimate of the crossing structures located on natural streams (2nd Division). While Annex 9 presents the design of identified crossing locations lying on proposed channels of the 1st Division. Other Annexes (Annex 8, 9 and 11) presents the assessment of these structures.

This annex comprises of the following:

- Design Basis
- Sample of Calculation for one of the structures.
- Compiled table including the design of all structures lying on natural streams, along with their cost estimate.

2 Crossing Structures lying on Natural Streams (2nd Division)

There are around 959 crossing locations in Ibadan that are located on natural streams. Based on the structure's assessment in Annex 11, there are around 855 crossing locations that needs to be rehabilitated. All these crossing locations are designed under the Masterplan such that they comprise of 8 Bridges and 847 Culverts.

2.1 Design Basis

Crossing structures lying on proposed channels are designed based on the following:

2.1.1. Culverts

a- Culverts are designed to convey a flow based on a 25-year return period or according to longer return periods in case of Main Road crossings or Expressway crossings.

b- Culverts are checked to convey a flow based on a 100-year return period such that the stormwater does not overtop the crossing road.

c- Culverts are sized using Culvert Master software.

2.1.2. Bridges

a- Bridges are designed to convey a flow based on a 100-year return period and with a sufficient freeboard of not less than 0.75m

b- The span of the bridge is taken as the top width of the channel

c- The Bridge's deck is assumed 1.25m above the freeboard. i.e. 2m above the water level of the 100-year return period.

2.2 Sample of Calculation for One of The Structures

This section investigates the design methodology of the 2nd division structures, which is the design of the crossing works lying on natural stream for one of the structures; Structure no. 803 (27T). Based on the assessment provided in Annex 11, this structure is necessary to be rehabilitated.

Since the 100-year design flow data (calculated in Annex 11) for this structure is 17 m^3/s. i.e. not exceeding 250 m^3/s, thus this structure in is designed as box culverts (no bridges).

The structural data of structure no. 803 (27T) is presented in Table 2.1 outlined in red. The following fields are presented:

- Subbasin name and Id,
- Crossing number (Structure no.)
- The Address (Location)
- The Existing Crossing Structure Dimensions
- The existing structural condition of the culvert
- The contributing rainfall catchment area of each structure.
- The crossing road classification.

Moreover, Table 2.2 presents the structure design of structure no. 803 (27T) outlined in red, the following fields are presented:

- The 25 & 100-year flows
- The Structure Status (To be left as existing or proposed for rehabilitation)
- The proposed crossing structure type (Box Culvert or Bridge)
- The design basis (based on a channelized stream or a natural stream)
- The Proposed Crossing Structure Dimensions
- The proposed vertical distance between the Road Level and the Proposed Culvert Invert Level
- The Consultant whom designed this Structure (Dar or Abfort or Pheman or Others)
- The objective of this design or its status (Masterplan or Pool of Works or Going for Bid or Under Construction)

Furthermore, Table 2.3 presents the cost estimate of the structure outlined in red, the following fields are presented:

- The Barrel Length of the Culvert or the Width of the Bridge
- The total concrete volume (in m^3)
- The concrete cost of the Culvert (in USD)
- The steel weight (in tons)
- The steel cost (in USD)
- The total cost of the Culvert.

For structure no. 803 (27T), the design is based on structures lying on a natural stream, the 25-year flow is 12.14 m^3/s (25-year return period), the proposed dimensions to convey this flow is 1 Box Culverts (4m x 2m). The proposed vertical distance between the Road Level and the Proposed Culvert Invert Level is 3m. This structure is designed by Dar in Lot 2 of the First Pool of Priority works. Figure 2.1 shows the output calculations for structure number 803 as designed by the Culvert Master Hydraulic Model. In the Culvert Master Model, the manning's roughness coefficient for a concrete box culvert is taken as n = 0.013, the culvert slope is 0.3%. The culvert is designed based on design flow of the 25yrs (12.14 m^3/s), and checked with the 100yrs design flow (17 m^3/s), such that storm water does not overtop the crossing road. Thus, the proposed dimensions for this structure is 1 Box Culverts (4.0m x 2m).

For the cost estimate of structure no. 803, a 1 Box Culvert with dimensions (4m x 2m). The estimate concrete volume is around 215 m^3 while the estimated steel weight is around 27 tons. Thus, the estimated cost for this Culvert is 156,800 USD (47.8 M Naira).

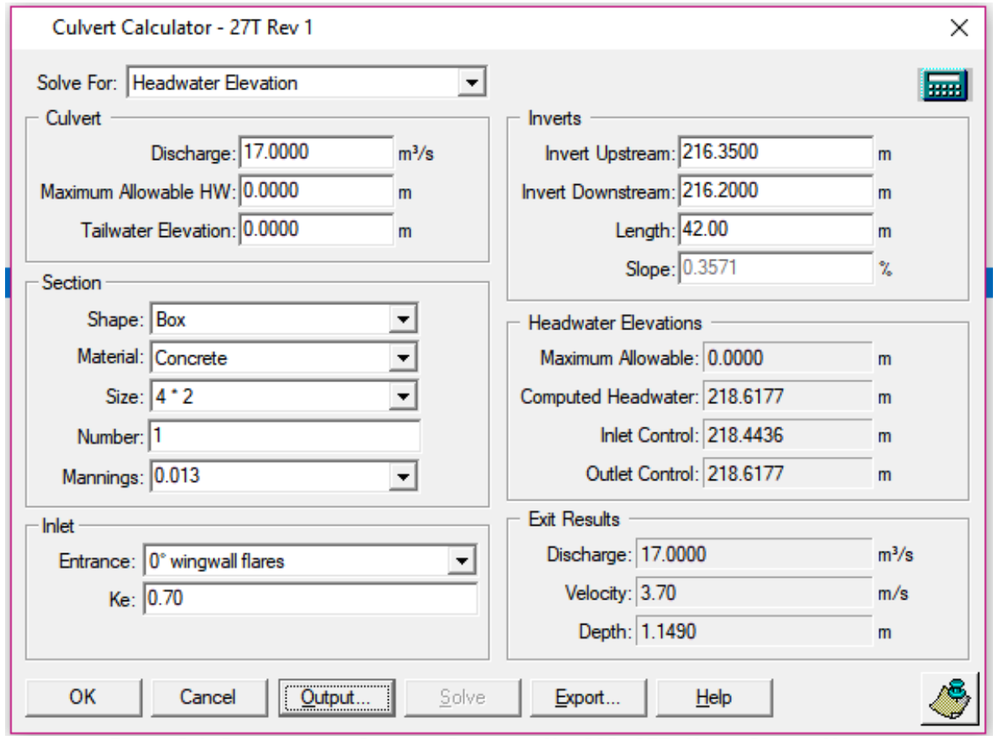

Figure 2.1: Design of the Crossing Structure No. 803 (27T) Using Culvert Master

Table 2.1: Structure Data of Crossing No. 803 (27T)

Subbasin	Structure No.	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Condition	Catchment Area (km2)	Cross Road Classification
Subbasin	Structu_No	Address	Ext_St_Typ	Ext_St_Dim	Condition	Cat_A_Km2	X_RoadClas
Ob2 Upper Ogbere	701 Prime	Bashorun	Culvert	2 CC (Dia 0.9)	Fair	0.29	Tertiary
	88	SAWMILL / ALARERE	Culvert	2 CC (Dia 0.95)	Erosion	0.61	Tertiary
	794	AKERE/IWO RAOD	Culvert	1 BC (2.38 x 1.41)	Fair	0.63	Tertiary
	803	NEW IFE ROAD	Culvert	2 CC (Dia 0.9)	Good	0.68	Expressway
	308	Akinyele	Culvert	2 CC (Dia 0.85)	Poor	0.72	Tertiary
	301	Fagbamile Area	Culvert	2 BC (1.7 x 2.27)	Good	0.73	Tertiary
	423	Olorunshogo	Culvert	3 BC (2.9 x 2.35)	Good	0.75	Tertiary
	85	MUFULANIMUN	Culvert	2 BC (2.17 x 1.57)	Erosion	0.75	Tertiary
	798	AMUDA OOJERE/IWO ROAD	Culvert	2 BC (2.86 x 1.87)	Good	0.88	Tertiary
	302	Agbala Itura Fagbamila Area	Culvert	1 BC (3.2 x 1.77)	Fair	0.88	Tertiary
	424	Ogbere	Culvert	3 BC (1.42 x 2.57)	Fair	0.89	Tertiary
	303	Agbala Itura	Footpath		Poor	0.94	Tertiary
	305	Oremeji C.A.C	Bridge	1 BC (1.8 x 1.5)	Good	0.99	Expressway

Table 2.2: Structure Design of Crossing No. 803 (27T)

Subbasin	Structure No.	Location	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Min. Vertical distance from road level to culvert invert level	Designed by	Status
Subbasin	Structu_No	Address			Str_Status	Pr_X_StrTy	Dsn_Based	Pr_X_StDim	VD_RC_Prp	Designd_by	Status
Ob2 Upper Ogbere	701 Prime	Bashorun	4.35	5.80	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan
	88	SAWMILL / ALARERE	8.33	11.10	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan
	794	AKERE/IWO RAOD	8.47	11.30	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan
	803	NEW IFE ROAD	12.14	17	Proposed	Box Culvert	Natural Stream	1 Cv (4.0 x 2.0)	3.0	Dar (Lot2)	Going For Bid
	308	Akinyele	9.15	12.20	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan
	301	Fagbamile Area	9.23	12.30	Existing						
	423	Olorunshogo	9.38	12.50	Existing						
	85	MUFULANIMUN	9.38	12.50	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan
	798	AMUDA OOJERE/IWO ROAD	10.35	13.80	Existing						
	302	Agbala Itura Fagbamila Area	10.35	13.80	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan
	424	Ogbere	10.42	13.90	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan
	303	Agbala Itura	10.80	14.40	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan
	305	Oremeji C.A.C	11.18	14.90	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan

Table 2.3: Structure Cost Estimate of Crossing No. 803 (27T)

Subbasin	Structure No.	Location	Existing Crossing Structure Dimensions	Proposed Crossing Structure Dimensions	Designed by	Status	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)
Subbasin	Structu_No	Address	Ext_St_Dim	Pr_X_StDim	Designd_by	Status	BrLength_m	Con_Vol_m3	C_Cst_USD	Stl_Wgt__T	St_Cst_USD	Cv_TCostUS
Ob2 Upper Ogbere	701 Prime	Bashorun	2 CC (Dia 0.9)	1 Cv (3 x 1)	Dar	Masterplan	10	48	12480	6	9336	35,200
	88	SAWMILL / ALARERE	2 CC (Dia 0.95)	1 Cv (3 x 1.5)	Dar	Masterplan	10	59	15340	7	11476	43,200
	794	AKERE/IWO RAOD	1 BC (2.38 x 1.41)	1 Cv (3 x 1.5)	Dar	Masterplan	10	59	15340	7	11476	43,200
	803	NEW IFE ROAD	2 CC (Dia 0.9)	1 Cv (4.0 x 2.0)	Dar (Lot2)	Going For Bid	42	215	55900	27	41818	156,800
	308	Akinyele	2 CC (Dia 0.85)	1 Cv (3.5 x 1.5)	Dar	Masterplan	10	65	16900	8	12643	48,000
	301	Fagbamile Area	2 BC (1.7 x 2.27)									
	423	Olorunshogo	3 BC (2.9 x 2.35)									
	85	MUFULANIMUN	2 BC (2.17 x 1.57)	1 Cv (3.5 x 1.5)	Dar	Masterplan	10	65	16900	8	12643	48,000
	798	AMUDA OOJERE/IWO ROAD	2 BC (2.86 x 1.87)									
	302	Agbala Itura Fagbamila Area	1 BC (3.2 x 1.77)	1 Cv (4 x 1.5)	Dar	Masterplan	10	72	18720	9	14004	52,800
	424	Ogbere	3 BC (1.42 x 2.57)	1 Cv (4 x 1.5)	Dar	Masterplan	10	72	18720	9	14004	52,800
	303	Agbala Itura		1 Cv (4 x 1.5)	Dar	Masterplan	10	72	18720	9	14004	52,800
	305	Oremeji C.A.C	1 BC (1.8 x 1.5)	1 Cv (4 x 1.5)	Dar	Masterplan	40	237	61620	30	46097	172,800

Structure Data								Structure Design									Structure Cost					
Subbasin	Structure No.	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Condition	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Min. Vertical distance from road level to culvert invert level	Designed by	Status	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)
Subbasin	Structu_No	Address	Ext_St_Typ	Ext_St_Dim	Condition	Cat_A_Km2	X_RoadClas			Str_Status	Pr_X_StrTy	Dsn_Based	Pr_X_StDim	VD_RC_Prp	Designd_by	Status	BrLength_m	Con_Vol_m3	C_Cst_USD	Stl_Wgt__T	St_Cst_USD	Cv_TCostUS	BrgCst_USD
Ob1 Ogbere Headwaters	709	Alagbayun Akobo	Culvert	1 BC (2.16 x 0.93)	Good	0.25	Tertiary	3.75	5.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	714	Anifalaje	Culvert	2 CC (Dia 0.9)	Good	0.25	Tertiary	3.75	5.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	711	Kolapo Ishola GRA	Culvert	1 BC (2.2 x 1.93)	Good	0.27	Tertiary	4.05	5.40	Existing													
	717	Oluwatedo estate	Culvert	1 BC (2.5 x 1.56)	Good	0.29	Secondary	4.35	5.80	Existing													
	710	Kolapo Ishola GRA	Culvert	1 BC (2.4 x 1.5)	Good	0.41	Tertiary	6.15	8.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	716	Omolayo	Culvert	1 BC (1.9 x 2.3)	Fair	0.47	Main	7.05	9.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	20	104	27040	13	20228	76,800	
	712	Abake estate-Akobo	Culvert	1 BC (2.9 x 2.09)	Good	0.49	Secondary	7.35	9.80	Existing													
	715	Anifalaje	Culvert	2 CC (Dia 0.9)	Fair	0.69	Tertiary	8.92	11.90	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	708	Ajimututu Gas land	Culvert	1 BC (1.8 x 1.87)	Good	0.76	Main	9.45	12.60	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	20	115	29900	14	22368	84,800	
	707	Bashorun Estate Akobo	Natural Stream		Poor	0.88	Tertiary	10.35	13.80	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
Ob2 Upper Ogbere	309	Sawmill	Culvert	1 BC (1.3 x 0.89)	Poor	0.01	Tertiary	0.15	0.20	Proposed	Box Culvert	Natural Stream	1 Cv (1 x 1)	1.3	Dar	Masterplan	10	24	6240	3	4668	17,600	
	313	Ido Oro Ayekale	Culvert	1 BC (1.3 x 0.9)	Fair	0.10	Tertiary	1.50	2.00	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	314	Ayetoro Ifelodun Baba rere	Culvert	2 BC (2.38 x 1.95)	Good	0.12	Tertiary	1.80	2.40	Existing													
	804	AYEPE	Culvert	1 BC (2.04 x 0.92)	Good	0.15	Tertiary	2.25	3.00	Existing													
	702	Bashorun	Culvert	1 BC (2.53 x 1.15)	Good	0.17	Tertiary	2.55	3.40	Existing													
	311	Ogbere Idi osan Efun Kobiowu	Culvert	1 BC (1.2 x 1.07)	Poor	0.17	Tertiary	2.55	3.40	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	706	Kajola	Natural Stream		Poor	0.20	Tertiary	3.00	4.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	421	Ona-Ara	Culvert	1 BC (0.84 x 1.69)	Fair	0.21	Tertiary	3.15	4.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	315	Olopo Meta	Culvert	2 BC (1.8 x 1.6)	Fair	0.23	Tertiary	3.45	4.60	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	307	Old Ife Road	Culvert	1 BC (1.4 x 1.6)	Dilapidated	0.24	Tertiary	3.60	4.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	705	Kajola Agric	Culvert	1 BC (1.8 x 1.9)	Fair	0.25	Tertiary	3.75	5.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	701 Prime	Bashorun	Culvert	2 CC (Dia 0.9)	Fair	0.29	Tertiary	4.35	5.80	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	351	Agbakin	Culvert	1 BC (1.4 x 1.24)	Fair	0.29	Tertiary	4.35	5.80	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	422	Orisunbare	Culvert	2 BC (2.46 x 2.33)	Good	0.30	Tertiary	4.50	6.00	Existing													
	312	Maku	Culvert	1 BC (1.6 x 1.6)	Poor	0.32	Tertiary	4.80	6.40	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1.5)	2.0	Dar	Masterplan	10	46	11960	6	8947	33,600	
	701	Bashorun	Natural Stream		Poor	0.34	Tertiary	5.10	6.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1.5)	2.0	Dar	Masterplan	10	46	11960	6	8947	33,600	
	300	Agbakin	Culvert	1 CC (Dia 1.1)	Fair	0.35	Tertiary	5.25	7.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	800	MANATAN/IWO ROAD	Culvert	1 BC (1.54 x 1.02)	Good	0.37	Tertiary	5.55	7.40	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	306	Aromolaran	Culvert	2 BC (3 x 1.8)	Good	0.39	Secondary	5.85	7.80	Existing													
	799	ACADEMY/IWO ROAD	Culvert	1 BC (1.52 x 1.64)	Good	0.42	Tertiary	6.30	8.40	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	700	Bashorun	Culvert	2 CC (Dia 0.7) + 1 BC (1.55 x 1.3)	Fair	0.44	Tertiary	6.60	8.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	316	Tujuka Area	Culvert	1 BC (3 x 1.7)	Good	0.46	Secondary	6.90	9.20	Existing													
	791	BASORUN/IWO ROAD	Culvert	2 BC (2.2 x 1.75)	Good	0.53	Tertiary	7.72	10.30	Existing													
	792	IWO ROAD	Culvert	2 BC (2.31 x 1.31)	Good	0.56	Tertiary	7.95	10.60	Existing													
	793	AKERE/IWO RAOD	Culvert	1 BC (2.88 x 1.46)	Good	0.57	Tertiary	8.02	10.70	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	88	SAWMILL / ALARERE	Culvert	2 CC (Dia 0.95)	Erosion	0.61	Tertiary	8.33	11.10	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	794	AKERE/IWO RAOD	Culvert	1 BC (2.38 x 1.41)	Fair	0.63	Tertiary	8.47	11.30	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	803	NEW IFE ROAD		2 CC (Dia 0.9)	Good	0.68	Expressway	12.14	17.00	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 2)	2.6	Dar (Lot2)	Going For Bid	40	264	68640	33	51348	192,000	
	308	Akinyele	Culvert	2 CC (Dia 0.85)	Poor	0.72	Tertiary	9.15	12.20	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	301	Fagbamile Area	Culvert	2 BC (1.7 x 2.27)	Good	0.73	Tertiary	9.23	12.30	Existing													
	423	Olorunshogo	Culvert	3 BC (2.9 x 2.35)	Good	0.75	Tertiary	9.38	12.50	Existing													
	85	MUFULANIMUN	Culvert	2 BC (2.17 x 1.57)	Erosion	0.75	Tertiary	9.38	12.50	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	798	AMUDA OOJERE/IWO ROAD	Culvert	2 BC (2.86 x 1.87)	Good	0.88	Tertiary	10.35	13.80	Existing													
	302	Agbala Itura Fagbamila Area	Culvert	1 BC (3.2 x 1.77)	Fair	0.88	Tertiary	10.35	13.80	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	424	Ogbere	Culvert	3 BC (1.42 x 2.57)	Fair	0.89	Tertiary	10.42	13.90	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	303	Agbala Itura	Footpath		Poor	0.94	Tertiary	10.80	14.40	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	305	Oremeji C.A.C	Bridge	1 BC (1.8 x 1.5)	Good	0.99	Expressway	11.18	14.90	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	40	237	61620	30	46097	172,800	
	908	OLOMI		1 CC (Dia 0.74)		0.11	Tertiary	1.65	2.20	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	86D	Ogbere housing Estate, akanran road.	Pipe Culvert	1 CC (Dia 0.6)		0.11	Main	1.71	2.27	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	20	55	14300	7	10698	40,000	
	417	Akanran	Culvert	1 CC (Dia 0.8)	Fair	0.13	Tertiary	1.95	2.60	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	347	Binukonu Zone	Footpath		Poor	0.14	Tertiary	2.10	2.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	416	Akanran	Culvert	1 CC (Dia 0.8) + 1 BC (3.6 x 1.3)	Erosion	0.15	Tertiary	2.25	3.00	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	913	AYEDAADE/AGRIC/OLOMI	Natural Stream		Poor	0.19	Tertiary	2.85	3.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	905	OLORUNKEMI	Culvert	2 BC (2.99 x 2.7)	Good	0.20	Tertiary	3.00	4.00	Existing													
	414	Akanran	Natural Stream		Erosion	0.21	Tertiary	3.15	4.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	435	Orisunbare	Natural Stream		Poor	0.24	Tertiary	3.60	4.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	411	Irepodun Street	Culvert	1 BC (2 x 1.37)	Good	0.25	Tertiary	3.75	5.00	Existing													
	912	MOBOLORUNDURO/OMIYALE	Footpath		Poor	0.26	Tertiary	3.90	5.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	86D1	Ogbere housing Estate, akanran road.	Box Culvert	1 BC (1 x 0.8)		0.27	Tertiary	3.98	5.30	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	

Subbasin	Structure No.	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Condition	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Min. Vertical distance from road level to culvert invert level	Designed by	Status	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)
Ob3 Middle Ogbere	86D2	Ogbere housing Estate, akanran road.	Box Culvert	1 BC (1.7 x 0.8)		0.27	Tertiary	3.98	5.30	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	86D3	Ogbere housing Estate, akanran road.	Footpath			0.27	Tertiary	3.98	5.30	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	418	Mushin	Footpath		Poor	0.27	Tertiary	4.05	5.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	410	Ifelodun	Footpath		Erosion	0.28	Tertiary	4.20	5.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	434	Akilapa Ogbere	Culvert	2 CC (Dia 0.8)	Poor	0.37	Secondary	5.55	7.40	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	429	Oritamerrin road	Culvert	1 BC (2.6 x 1.3)	Poor	0.43	Secondary	6.45	8.60	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	433	Akilapa Okeogbere	Natural Stream		Erosion	0.49	Tertiary	7.35	9.80	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	432	Ogbere	Natural Stream		Erosion	0.50	Tertiary	7.50	10.00	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	408		Culvert	1 BC (1 x 1.1)	Poor	0.52	Tertiary	7.65	10.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	415	Akanran	Footpath		Erosion	0.52	Tertiary	7.65	10.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	431	Ogbere	Culvert	4 CC (Dia 0.77)	Poor	0.56	Tertiary	7.95	10.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	409		Footpath		Poor	0.57	Tertiary	8.02	10.70	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	86D4	Ogbere housing Estate, akanran road.	Box Culvert	1 BC (0.75 x 1)		0.57	Tertiary	8.03	10.70	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	430	Ogbere	Culvert	2 BC (2.4 x 1.83)	Good	0.61	Tertiary	8.33	11.10	Existing													
	75	ALABEDE OGBERETIOYA	Footpath		Dilapidated	0.66	Tertiary	8.70	11.60	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	906	OLOMI/MOSFALA	Culvert	1 BC (2.7 x 1.92)	Good	0.68	Tertiary	8.85	11.80	Existing													
	914	OLOMI	Culvert	1 BC (1.88 x 1.66)	Good	0.73	Tertiary	9.23	12.30	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	413	Akanran	Footpath		Erosion	0.83	Tertiary	9.97	13.30	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	907	MOSFALA ZONE 2	Footpath		Poor	0.91	Tertiary	10.58	14.10	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	915	PAPA ELEYE	Culvert	1 BC (3 x 1.82)	Good	0.95	Tertiary	10.87	14.50	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	412	Akanran	Culvert	2 BC (1.94 x 1.82)	Fair	0.95	Tertiary	10.87	14.50	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
Ob4 Foworogbun	1053	Airport Area	Natural Stream		Poor	0.10	Main	1.50	2.00	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	20	55	14300	7	10698	40,000	
	1123	Aiport -Alakia	Culvert	2 BC (1.66 x 1.45)	Good	0.12	Tertiary	1.80	2.40	Existing													
	333	Ifeolu IGEM	Footpath		Poor	0.12	Tertiary	1.80	2.40	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	343	Akoka fast fast Area	Culvert	1 BC (1.3 x 0.8)	Fair	0.14	Tertiary	2.10	2.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	921	PALUPO/ASOLO		1 CC (Dia 0.76)		0.15	Secondary	2.25	3.00	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	346	Irapada	Culvert	1 BC (1.8 x 1.53)	Good	0.17	Tertiary	2.55	3.40	Existing													
	1125	Aiport	Culvert	1 BC (5.25 x 0)	Fair	0.19	Tertiary	2.85	3.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	400	Sogade Area	Culvert	1 BC (1.3 x 1.41)	Fair	0.19	Tertiary	2.85	3.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	407	Sogade	Culvert	1 CC (Dia 0.7)	Good	0.19	Main	2.85	3.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	20	66	17160	8	12837	48,000	
	1169	Aiport	Culvert	1 CC (Dia 0.6)	Fair	0.21	Tertiary	3.15	4.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	54D1	OREDEGBE LANDLORD/LANDLADY ASSOCIATION BIOKU ADEYELU OGBERE	Natural Stream			0.27	Tertiary	4.05	5.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	341	Ogbere Idi Osan	Culvert	1 BC (3 x 1.7)	Fair	0.27	Secondary	4.05	5.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	1126	Aiport	Culvert	1 CC (Dia 0.9)	Fair	0.28	Tertiary	4.20	5.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	1124	Aiport -Alakia	Culvert	2 CC (Dia 0.8)	Good	0.29	Main	4.35	5.80	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	20	88	22880	11	17116	64,000	
	399	Akanran	Culvert	1 BC (3.2 x 2.41)	Good	0.31	Tertiary	4.65	6.20	Existing													
	444	Melangbi -Aladi	Culvert	2 CC (Dia 0.8)	Dilapidated	0.31	Tertiary	4.65	6.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	920	AIRPORT AREA		1 CC (Dia 0.78)		0.33	Tertiary	4.95	6.60	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1.5)	2.0	Dar	Masterplan	10	46	11960	6	8947	33,600	
	336	Akinfenwa	Culvert	1 CC (Dia 0.9)	Poor	0.35	Secondary	5.25	7.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	332	Gbaremu Idi Obi	Bridge	1 BC (4.4 x 2)	Good	0.37	Main	5.55	7.40	Existing													
	929	IDI OSAN/AMULOKO	Culvert	2 BC (1.2 x 1.23)	Good	0.40	Secondary	6.00	8.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	1058	Alakia	Culvert	3 CC (Dia 0.37)	Fair	0.43	Tertiary	6.45	8.60	Proposed	Box Culvert	Natural Stream	2 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	77	20020	10	14977	56,000	
	398	Alare/Oke Jegede	Footpath		Poor	0.43	Tertiary	6.45	8.60	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	903	ABABO OLOYA	Culvert	1 BC (2.27 x 2.48)	Good	0.44	Tertiary	6.60	8.80	Existing													
	339	Ifewumi Esankigbe	Culvert	1 BC (1.42 x 1)	Good	0.44	Tertiary	6.60	8.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	807	JAGUN/ NEW GBAGI	Natural Stream		Poor	0.45	Tertiary	6.75	9.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	919	AIRPORT AREA	Culvert	1 BC (0.88 x 0.88)	Good	0.45	Tertiary	6.75	9.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	340	Olaba Kajola	Culvert	2 BC (2.2 x 1.9)	Good	0.45	Secondary	6.75	9.00	Existing													
	436	Fagbile Itamerin	Footpath		Poor	0.45	Tertiary	6.75	9.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	806	JAGUN NEW GBAGI	Culvert	1 BC (0.9 x 0.84)	Good	0.46	Tertiary	6.90	9.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	925	ALAAKA		1 CC (Dia 0.64)		0.46	Tertiary	6.90	9.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1168	Aiport -Alakia	Culvert	1 BC (2 x 1.07)	Good	0.49	Tertiary	7.35	9.80	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	338	Ifewumi Esankigbe	Culvert	1 BC (2.3 x 1.27)	Fair	0.49	Secondary	7.35	9.80	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	406	Alawaye Area	Culvert	1 BC (0.7 x 1.08)	Fair	0.49	Tertiary	7.35	9.80	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	337	Gbaremu Area	Culvert	1 BC (2.9 x 1.81)	Good	0.50	Main	7.50	10.00	Existing													
	397	Olunloyo Area	Footpath		Poor	0.50	Tertiary	7.50	10.00	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	331	Ireakari	Culvert	2 CC (Dia 0.8)	Fair	0.53	Tertiary	7.72	10.30	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	335	Akinfenwa	Footpath		Poor	0.55	Tertiary	7.88	10.50	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	405	Alawaye Area	Footpath		Poor	0.56	Tertiary	7.95	10.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	928	ONIYEFUN		2 CC (Dia 0.76)		0.64	Tertiary	8.55	11.40	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	446	Isale Olunloyo	Culvert	1 BC (2.3 x 2.13)	Good	0.64	Tertiary	8.55	11.40	Existing													
	334	Akinfenwa Aroye	Culvert	1 BC (1.7 x 1.3)	Good	0.70	Secondary	9.00	12.00	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1525	Ife Akintunde Layout Alakia	Culvert	1 BC (2.4 x 0.96)	Fair	0.75	Tertiary	9.38	12.50	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	927	ONIYEFUN	Natural Stream		Poor	0.79	Tertiary	9.68	12.90	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	330	Hope	Natural Stream		Fair	0.80	Tertiary	9.75	13.00	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	403	Mosa Olunloyo Akanran	Culvert	2 CC (Dia 0.8)	Fair	0.84	Tertiary	10.05	13.40	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	

Subbasin	Structure No.	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Condition	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Min. Vertical distance from road level to culvert invert level	Designed by	Status	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)
	922	ALAAKA/IDI OSAN/ADEYORI	Natural Stream		Poor	0.89	Tertiary	10.42	13.90	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	345	Akingbade Abaede	Culvert	1 BC (3.1 x 1.45)	Fair	0.90	Tertiary	10.50	14.00	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	923	ALAAKA/IDI OSAN		4 CC (Dia 0.78)		0.96	Tertiary	10.95	14.60	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	77	AGIGBOTOLUWA	Culvert	1 BC (2.2 x 1.08)	Fair	0.97	Tertiary	11.03	14.70	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	1264	21 DIAMOND EST. AREA, IDI-AGBADO	Culvert	1 CC (Dia 0.78)	Good		Tertiary			Existing													
	917	OLUNDE AREA	Natural Stream		Poor	0.12	Tertiary	1.80	2.40	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	1251	OLUWANISOLA,AJIMASIN ONIREKE	Natural Stream		Fair	0.15	Tertiary	2.25	3.00	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	918	OBIDERE	Natural Stream		Poor	0.16	Tertiary	2.40	3.20	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1273	OLORUNTOYIN,IFESOWAPO AREA	Culvert	1 CC (Dia 0.55)	Fair	0.19	Tertiary	2.85	3.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1252	ALAPATA AYETORO ALONG ONULA	Natural Stream		Poor	0.21	Secondary	3.15	4.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1257	FIRE FIRE AREA,AGRIC OLOMI	Culvert	1 CC (Dia 0.6)	Fair	0.24	Tertiary	3.60	4.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1271	JELE RD,OGORI OLOJUORO	Culvert	1 BC (0.6 x 1.48)	Fair	0.24	Tertiary	3.60	4.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1249	OKE-ELESHIN	Culvert	2 BC (0.9 x 1.82)	Fair	0.25	Tertiary	3.75	5.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
Ob5 Lower Ogbere North	1250	ONIREKE, AGO OLUNDE	Footpath		Fair	0.26	Tertiary	3.90	5.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	1268	BEHIND GOD MERCY APOTOLIC CHURCH, FATUNSI AREA	Culvert	1 BC (1.75 x 0.89)	Poor	0.27	Tertiary	4.05	5.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	1241	ANU-OLUWAPO ARANNI, AYEGUN	Natural Stream		Fair	0.31	Tertiary	4.65	6.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	1248	AMUERE IRE-AIKARI JOGBIN OLUNDE	Culvert	1 CC (Dia 0.7)	Fair	0.37	Tertiary	5.55	7.40	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	1262	GBAKO ISOKAN OFF OLOJUORO	Culvert	1 CC (Dia 0.6)	Fair	0.38	Tertiary	5.70	7.60	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	1269	ABA-ASA	Culvert	1 BC (0.6 x 1.48)	Fair	0.40	Tertiary	6.00	8.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	1254	OJE-SANMI , AYETORO	Culvert	2 CC (Dia 0.7)	Fair	0.42	Tertiary	6.30	8.40	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	1259	FADIPE, IFESOWAPO	Culvert	1 BC (1.2 x 0.87)	Fair	0.42	Tertiary	6.30	8.40	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	1253	ORISUNBARE ALAPATA, AYETORO	Culvert	1 CC (Dia 0.72)	Fair	0.52	Secondary	7.65	10.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1272	JELE RD,OGORI OLOJUORO	Culvert	2 CC (Dia 0.8)	Fair	0.59	Tertiary	8.17	10.90	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1279	IFEOLUWA RD,ARAROMI	Natural Stream		Fair	0.47	Tertiary	7.05	9.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
Ob6 Lower Ogbere South	1275	LANIOKA ONIKEKE, SAMOUNJU	Culvert	1 BC (0.97 x 0.89)	Fair	0.64	Tertiary	8.55	11.40	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1276	LAKODUN EST. LAKO	Culvert	1 CC (Dia 0.6)	Poor	1.54	Tertiary	15.30	20.40	Proposed	Box Culvert	Natural Stream	2 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	118	30680	15	22951	86,400	
	1277	JAGUN,ONAYE RD	Culvert	2 CC (Dia 0.69)	Fair	1.63	Tertiary	15.97	21.30	Proposed	Box Culvert	Natural Stream	2 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	118	30680	15	22951	86,400	
	1278	ABOLOKE,ARAROMI RD	Culvert	2 BC (1.5 x 1.28)	Poor	4.29	Tertiary	35.92	47.90	Proposed	Box Culvert	Natural Stream	2 Cv (5 x 2)	2.6	Dar	Masterplan	10	178	46280	22	34621	129,600	
	1280	ALAPE RD, ARAROMI	Culvert	2 CC (Dia 0.8)	Good	5.23	Main	42.50	56.67	Proposed	Box Culvert	Natural Stream	2 Cv (5.5 x 2)	2.6	Dar	Masterplan	20	332	86320	42	64574	241,600	
	785	Secretariat	Natural Stream		Poor		Secondary			Proposed	Box Culvert	Natural Stream	1 Cv (1 x 1)	1.3	Dar	Masterplan	10	24	6240	3	4668	17,600	
	26D2	LEKAN SALAMI ESTATE, BODIJA	Box Culvert	2 BC (0.5 x 0.5)		0.12	Tertiary	1.80	2.40	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	699	Oluwo Nla Estate	Culvert	2 BC (2.51 x 2.14)	Good	0.19	Tertiary	2.85	3.80	Existing													
	790	BASORUN	Culvert	1 BC (3.08 x 1.78)	Good	0.22	Tertiary	3.30	4.40	Existing													
	674	New Bodija	Culvert	3 CC (Dia 0.85)	Fair	0.24	Tertiary	3.60	4.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	694	Deeper life Ashi	Culvert	2 CC (Dia 0.9)	Good	0.26	Tertiary	3.90	5.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	25D	LALA AVENUE NEAR GLORY VIEW HOTEL KONGI BODIJA	Box Culvert	2 BC (1.8 x 1.2)		0.37	Tertiary	5.55	7.40	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	646	Old Bodija Estate	Culvert	1 CC (Dia 0.9)	Good	0.39	Tertiary	5.85	7.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	696	Ashi	Culvert	1 BC (2.4 x 2.21)	Good	0.40	Tertiary	6.00	8.00	Existing													
	731	Oluwo Kekere Estate	Culvert	2 BC (2.49 x 2.74)	Good	0.46	Tertiary	6.90	9.20	Existing													
	789	AGODI GRA	Culvert	1 BC (2.04 x 1.64)	Good	0.46	Tertiary	6.90	9.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
Og1 Upper Ogunpa	697	Ikolaba	Culvert	2 BC (2.49 x 2.74)	Good	0.50	Tertiary	7.50	10.00	Existing													
	48	DLADEJI , CLOSE	Culvert	3 CC (Dia 0.95)	Fair	0.53	Tertiary	7.72	10.30	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	698	Oluwo Kekere Estate	Culvert	1 BC (2.9 x 1.52)	Good	0.56	Tertiary	7.95	10.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	645	Old Bodija Estate	Culvert	2 BC (2.4 x 0.63)	Good	0.62	Tertiary	8.40	11.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	695	Deeper life Ashi	Footpath		Poor	0.66	Tertiary	8.70	11.60	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	49	ASHI ROAD, BODIJA (OJU ODO ASHI ASHI RIVER)	Culvert	3 CC (Dia 1.05)	Erosion	0.74	Secondary	9.30	12.40	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	644	Bodija Adeyi Junction	Culvert	2 BC (1.2 x 0.62)	Good	0.79	Main	9.68	12.90	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	20	115	29900	14	22368	84,800	
	643	Adeyi Estate	Culvert	2 CC (Dia 0.9)	Fair	0.81	Tertiary	9.83	13.10	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	50	IKOLABA , GRA	Culvert	1 BC (2 x 1.5)	Erosion	0.85	Tertiary	10.13	13.50	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	47	ADENUGA STREET , KONGI LAYOUT	Culvert	1 BC (3.26 x 2.1)	Fair	0.90	Tertiary	10.50	14.00	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	637	Adebajo, New Bodija, Adebajo Street	Culvert	1 BC (3.8 x 1.35)	Good	1.00	Secondary	11.25	15.00	Proposed	Box Culvert	Natural Stream	1 Cv (4.5 x 1.5)	2.0	Dar	Masterplan	10	78	20280	10	15171	57,600	
	782	Mokola	Culvert	2 BC (2.45 x 1.52)	Good		Tertiary			Existing													
	73D	THE COMMUNITY OF FASOLA OREDEYIN SW4/902 OKE-ADO	Natural Stream			0.02	Tertiary	0.34	0.45	Proposed	Box Culvert	Natural Stream	1 Cv (1 x 1)	1.3	Dar	Masterplan	10	24	6240	3	4668	17,600	
	73D1	THE COMMUNITY OF FASOLA OREDEYIN SW4/902 OKE-ADO	Pipe Culvert	1 CC (Dia 0.6)		0.02	Tertiary	0.34	0.45	Proposed	Box Culvert	Natural Stream	1 Cv (1 x 1)	1.3	Dar	Masterplan	10	24	6240	3	4668	17,600	

Subbasin	Structure No.	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Condition	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Min. Vertical distance from road level to culvert invert level	Designed by	Status	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)
Og2 Middle Ogunpa	256	Oke Seni	Culvert	1 BC (3.6 x 1.07)	Good	0.17	Tertiary	2.55	3.40	Existing													
	240	Amule Area	Culvert	1 BC (3.2 x 1.63)	Poor	0.18	Tertiary	2.70	3.60	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	239	Foko Area	Culvert	1 BC (3.4 x 1.47)	Fair	0.24	Tertiary	3.60	4.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	781	Mokola Housing Estate	Culvert	2 CC (Dia 0.9)	Fair	0.26	Main	3.90	5.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	20	88	22880	11	17116	64,000	
	251	Ayeye	Culvert	1 BC (14 x 4.7)	Good	0.27	Secondary	4.05	5.40	Existing													
	296	Surulere street Oke bola	Culvert	1 BC (1.3 x 1.17)	Poor	0.30	Tertiary	4.50	6.00	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	257	Abebi Area	Bridge	1 BC (5.77 x 2.94)	Fair	0.32	Secondary	4.80	6.40	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1.5)	2.0	Dar	Masterplan	10	46	11960	6	8947	33,600	
	254	Awolowo way	Culvert	1 BC (3.4 x 1.82)	Fair	0.33	Secondary	4.95	6.60	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1.5)	2.0	Dar	Masterplan	10	46	11960	6	8947	33,600	
	293	UCH	Culvert	2 BC (2.7 x 2.5)	Good	0.33	Tertiary	4.95	6.60	Existing													
	234	Oke Ado	Culvert	2 BC (1.3 x 0.95)	Good	0.35	Secondary	5.25	7.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	238	Oke Bola	Natural Stream		Poor	0.36	Secondary	5.40	7.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	252	Oke Seni	Bridge	2 BC (1.7 x 1.77)	Good	0.36	Tertiary	5.40	7.20	Existing													
	258	Alawo Area	Footpath		Fair	0.43	Tertiary	6.45	8.60	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	255	Ogunpa Market	Culvert	1 BC (3.1 x 1.42)	Fair	0.45	Tertiary	6.75	9.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	283	Onireke GRA	Culvert	2 BC (2.4 x 2.96)	Fair	0.50	Tertiary	7.50	10.00	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	783	Mokola	Culvert	1 BC (1.2 x 0.99)	Fair	0.51	Tertiary	7.57	10.10	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	784	Mokola	Culvert	2 CC (Dia 0.9) + 1 BC (2.8 x 1.9)	Good	0.54	Main	7.80	10.40	Existing													
	237	Oke Ado	Culvert	1 BC (2 x 0.95)	Good	0.55	Secondary	7.88	10.50	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	250	Agbeni Market	Culvert	1 BC (4.6 x 3.18)	Fair	0.56	Main	7.95	10.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	20	104	27040	13	20228	76,800	
	1550	Oke Ado	Culvert	2 CC (Dia 0.8)	Good	0.59	Tertiary	8.17	10.90	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	36	ONIREKE AVENUE , ONIREKE ROAD	Culvert	1 BC (2 x 1.38)	Fair	0.63	Main	8.47	11.30	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	20	104	27040	13	20228	76,800	
	1551	Gege	Culvert	2 BC (4.95 x 1.84)	Poor	0.64	Tertiary	8.55	11.40	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	259	Alaawo	Footpath		Fair	0.68	Tertiary	8.85	11.80	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	292	Jenbewon Area	Footpath		Erosion	0.72	Tertiary	9.15	12.20	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	298	Alaawo	Culvert	1 BC (3.2 x 2.7)	Good	0.73	Tertiary	9.23	12.30	Existing													
	289	Dandaru	Culvert	1 BC (2.5 x 1.01)	Good	0.75	Main	9.38	12.50	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	20	115	29900	14	22368	84,800	
	249	Gege	Culvert	1 BC (13.1 x 2.2)	Fair	0.81	Secondary	9.83	13.10	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	39	PARLLAMENT ROAD	Culvert	2 BC (1.55 x 1.2)	Good	0.95	Main	10.87	14.50	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	20	127	33020	16	24702	92,800	
	247	Secretariat	Culvert	1 BC (8.1 x 4.4)	Good	12.93	Tertiary	111.00	148.00	Existing													
	144B	DANDARU	Culvert	1 BC (6.5 x 3.83)	Fair	13.23	Highway	111.00	148.00	Proposed	Box Culvert	Natural Stream	3 Cv (7 x 2.5)	3.3	Dar	Masterplan	20	638	165880	80	124091	464,000	
Og3 Kudeti	392	Olunloyo	Culvert	2 BC (2.9 x 2.5)	Poor		Secondary			Proposed	Box Culvert	Natural Stream	1 Cv (1 x 1)	1.3	Dar	Masterplan	10	24	6240	3	4668	17,600	
	352	Koloko Area	Culvert	1 BC (1.98 x 1.51)	Good	0.10	Tertiary	1.50	2.00	Existing													
	387	Ile Tuntun	Culvert	2 BC (1 x 1.11)	Good	0.11	Tertiary	1.65	2.20	Existing													
	317	Arikewuyo	Culvert	1 BC (2.5 x 1.34)	Poor	0.14	Tertiary	2.10	2.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	388	Ile Tuntun	Culvert	1 BC (2.9 x 0.96)	Fair	0.14	Tertiary	2.10	2.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	321	Ayekale Community	Culvert	1 BC (1.26 x 0.82)	Poor	0.17	Tertiary	2.55	3.40	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	286	Dugbe	Culvert	1 BC (3.5 x 1.8)	Poor	0.20	Main	3.00	4.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	20	77	20020	10	14977	56,000	
	299	Ode Aje	Culvert	1 BC (2.6 x 1.14)	Good	0.21	Tertiary	3.15	4.20	Existing													
	264	Yemetu	Culvert	3 CC (Dia 1.2)	Good	0.24	Highway	3.60	4.80	Existing													
	350	Oluyoro	Culvert	1 BC (2 x 1.35)	Poor	0.24	Tertiary	3.60	4.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	280	Ajegede	Culvert	2 CC (Dia 1.2)	Poor	0.26	Main	3.90	5.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	20	88	22880	11	17116	64,000	
	282	Irefin(Oje Area)	Culvert	1 BC (2.1 x 1.81)	Fair	0.26	Tertiary	3.90	5.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	318	Adekile	Culvert	1 BC (3.4 x 1.4)	Fair	0.27	Tertiary	4.05	5.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	372	Elekuro	Footpath		Good	0.27	Tertiary	4.05	5.40	Existing													
	420	Aperin	Culvert	1 BC (3 x 2.23)	Good	0.27	Main	4.05	5.40	Existing													
	72	ODE-AYE , KOSODO	Culvert	1 BC (3.3 x 2.08)	Erosion	0.27	Secondary	4.05	5.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	288	Yemetu	Footpath		Fair	0.32	Tertiary	4.80	6.40	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1.5)	2.0	Dar	Masterplan	10	46	11960	6	8947	33,600	
	389	Ile Tuntun (Mopu)	Culvert	1 CC (Dia 1.2) + 1 BC (2.7 x 1.13)	Fair	0.34	Main	5.10	6.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1.5)	2.0	Dar	Masterplan	20	81	21060	10	15755	59,200	
	320	Koloko Area	Culvert	1 CC (Dia 1.2)	Poor	0.35	Tertiary	5.25	7.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	349	Oluyoro Oke Offa	Culvert	1 BC (1.8 x 1.54)	Poor	0.37	Secondary	5.55	7.40	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	326	Agugu	Footpath		Poor	0.38	Tertiary	5.70	7.60	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	260	Total Garden	Natural Stream		Poor	0.39	Tertiary	5.85	7.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	281	Oluyoro	Culvert	1 BC (2.8 x 1.51)	Fair	0.41	Tertiary	6.15	8.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	263	Yemetu	Culvert	1 CC (Dia 0.9) + 1 BC (2.4 x 1.46)	Fair	0.42	Highway	6.30	8.40	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	20	92	23920	12	17894	67,200	
	371	Elekuro	Culvert	1 BC (1.2 x 1.2)	Poor	0.45	Tertiary	6.75	9.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	390	Yerokun	Culvert	1 BC (2.5 x 1.45)	Good	0.46	Tertiary	6.90	9.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	325	Agugu	Culvert	2 BC (2.15 x 1.59)	Fair	0.47	Tertiary	7.05	9.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	285	Oke -Offa Atipe	Culvert	2 BC (3 x 2.76)	Good	0.50	Main	7.50	10.00	Existing													
	319	Koloko	Culvert	1 BC (2.6 x 1.7)	Fair	0.52	Tertiary	7.65	10.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	348	Gate(Prison)	Culvert	1 BC (1.6 x 1.7)	Poor	0.54	Main	7.80	10.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	20	104	27040	13	20228	76,800	
	287	Isale Alfa Oje	Culvert	1 BC (2.6 x 1.8)	Poor	0.57	Highway	8.02	10.70	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	20	104	27040	13	20228	76,800	
	284	Onikokoro area	Footpath		Poor	0.59	Tertiary	8.17	10.90	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1563	Goodwill	Footpath		Good	0.61	Tertiary	8.33	11.10	Existing													
	1556	Isale Alfa	Footpath		Poor	0.63	Tertiary	8.47	11.30	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	268	Aderogba	Culvert	1 BC (2.7 x 1.45)	Fair	0.65	Secondary	8.62	11.50	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1558	Oke Alfa Atipe	Footpath		Fair	0.65	Tertiary	8.62	11.50	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	295	Ajegede	Culvert	2 BC (2.9 x 1.71)	Fair	0.67	Tertiary	8.78	11.70	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	294	Adekile	Culvert	2 BC (1.9 x 1.12)	Fair	0.71	Tertiary	9.07	12.10	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	370	Odinjo	Culvert	1 BC (2.7 x 2.04)	Fair	0.72	Tertiary	9.15	12.20	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1557	Oke Alfa Atipe	Footpath		Poor	0.74	Tertiary	9.30	12.40	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	

Subbasin	Structure No.	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Condition	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Min. Vertical distance from road level to culvert invert level	Designed by	Status	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)
	362	Akatapa	Footpath		Good	0.78	Tertiary	9.60	12.80	Existing													
	95	ALAFARA	Culvert	2 BC (3 x 1.93)	Erosion	0.78	Secondary	9.60	12.80	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	391	Odo Oba	Culvert	1 BC (1.4 x 0.93)	Good	0.83	Secondary	9.97	13.30	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	261	Gbenla Area	Culvert	1 BC (3.4 x 2.18)	Good	0.84	Tertiary	10.05	13.40	Existing													
	322	Adekile	Culvert	2 BC (2.6 x 1.65)	Good	0.91	Tertiary	10.58	14.10	Existing													
	262	Oje Igosu	Culvert	1 BC (3.1 x 1.17)	Good	0.93	Main	10.73	14.30	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	20	127	33020	16	24702	92,800	
	890	SOKA/SANYO	Footpath		Poor		Tertiary			Proposed	Box Culvert	Natural Stream	1 Cv (1 x 1)	1.3	Dar	Masterplan	10	24	6240	3	4668	17,600	
	881	SOKA/SANYO		1 CC (Dia 0.72)	Fair	0.10	Tertiary	1.50	2.00	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	1229	ALABA-KAN, AGBAMU SANYO AREA	Culvert	1 BC (0.9 x 1.25)	Good	0.13	Tertiary	1.95	2.60	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	377	Owode Academy	Culvert	1 BC (2.2 x 1.82)	Good	0.13	Tertiary	1.95	2.60	Existing													
	380	Owode Academy	Natural Stream		Poor	0.13	Tertiary	1.95	2.60	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	900	OLOMI	Culvert	2 BC (1.22 x 0.92)	Poor	0.14	Tertiary	2.10	2.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1235	OKE OLUWATEDO,KOSEUNTI JUCTION	Natural Stream		Fair	0.14	Tertiary	2.10	2.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1222	RED ROOF AREA, TOLL GATE	Culvert	1 BC (2.7 x 2.44)	Fair	0.15	Tertiary	2.25	3.00	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1228	SURULERE,FARIA OFF SANYO	Natural Stream		Fair	0.15	Tertiary	2.25	3.00	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1247	HERBERT MARCARULARY WAY, SURULERE	Natural Stream		Fair	0.15	Tertiary	2.25	3.00	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1236	ANU-OLUWAPO ZONE 28,SOKA	Natural Stream		Fair	0.16	Tertiary	2.40	3.20	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	395	Molete	Natural Stream		Poor	0.18	Tertiary	2.70	3.60	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	902	IDI MANGORO	Natural Stream		Poor	0.19	Tertiary	2.85	3.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	887	SANYO	Culvert	1 BC (2.1 x 1.98)	Good	0.20	Tertiary	3.00	4.00	Existing													
	1194	ANTONIO VILLAGE	Culvert	4 CC (Dia 0.64)	Fair	0.20	Tertiary	3.00	4.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	877	FELELE	Culvert	1 BC (2.98 x 1.7)	Good	0.24	Tertiary	3.60	4.80	Existing													
	374	Odinjo Area	Culvert	2 CC (Dia 0.8)	Good	0.24	Tertiary	3.60	4.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	879	SOKA		2 CC (Dia 0.84)	Fair	0.25	Secondary	3.75	5.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	899	OLOMI/ABA AFAA	Culvert	1 BC (1.6 x 1.2)	Good	0.27	Tertiary	4.05	5.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	901	BOLUWAJI		1 CC (Dia 1.2)	Fair	0.27	Tertiary	4.05	5.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	1244	AJAWALE RD,AGBON ESTATE	Culvert	1 BC (1.55 x 1.6)	Good	0.27	Tertiary	4.05	5.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	1223	AJOFEEBO, AGBAMU SANYO	Culvert	1 CC (Dia 0.76)	Poor	0.28	Tertiary	4.20	5.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	379	Owode Academy	Culvert	1 BC (2.1 x 1.1)	Good	0.31	Tertiary	4.65	6.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	396	Ibadan Grammar School	Culvert	1 BC (3 x 1.61)	Fair	0.31	Secondary	4.65	6.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	1225	IREWOLE, AJIYO -OLUNDE	Natural Stream		Fair	0.32	Tertiary	4.80	6.40	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1.5)	2.0	Dar	Masterplan	10	46	11960	6	8947	33,600	
	381	Owode Academy	Culvert	2 BC (2.5 x 1.53)	Fair	0.32	Tertiary	4.80	6.40	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1.5)	2.0	Dar	Masterplan	10	46	11960	6	8947	33,600	
	892	ELERE	Footpath		Fair	0.34	Tertiary	5.10	6.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1.5)	2.0	Dar	Masterplan	10	46	11960	6	8947	33,600	
	394	Ibadan Grammar School	Culvert	3 CC (Dia 0.9)	Fair	0.35	Tertiary	5.25	7.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	878	FELELE ONIGARI	Culvert	1 BC (2.34 x 2.44)	Good	0.36	Tertiary	5.40	7.20	Existing													
	886	NEW FELELE	Culvert	1 BC (1.84 x 1.6)	Good	0.37	Tertiary	5.55	7.40	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	893	ELERE	Culvert	1 BC (2.07 x 1.72)	Good	0.37	Tertiary	5.55	7.40	Existing													
	373	Molete	Culvert	1 BC (2 x 2.2)	Good	0.37	Tertiary	5.55	7.40	Existing													
	895	BOLUWAJI	Culvert	1 BC (1.34 x 1.54)	Good	0.40	Tertiary	6.00	8.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	896	BOLUWAJI	Culvert	1 BC (3.34 x 1.28)	Good	0.40	Tertiary	6.00	8.00	Existing													
	1242	IDI-ORO IFESOWAPO, ASIWAJU	Natural Stream		Fair	0.43	Tertiary	6.45	8.60	Proposed	Box Culvert	Natural Stream	2 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	77	20020	10	14977	56,000	
	894	BOLUWAJI ELERE	Culvert	1 BC (3.12 x 1.8)	Good	0.44	Secondary	6.60	8.80	Existing													
	897	BOLUWAJI	Culvert	1 BC (3.32 x 1.48)	Good	0.45	Tertiary	6.75	9.00	Existing													
	378	Molete	Culvert	1 BC (3.1 x 1.7)	Good	0.45	Secondary	6.75	9.00	Existing													
	386	Molete	Culvert		Poor	0.46	Tertiary	6.90	9.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	885	NEW FELELE	Culvert	1 BC (4.25 x 0)	Poor	0.48	Tertiary	7.20	9.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1238	ITESIWAJU RD, MAJE	Culvert	1 BC (2.64 x 1.35)	Good	0.48	Tertiary	7.20	9.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	375	Owode Academy	Footpath		Dilapidated	0.52	Tertiary	7.65	10.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	898	BOLUWAJI	Culvert	1 BC (2.6 x 2.78)	Good	0.60	Tertiary	8.25	11.00	Existing													
	1243	IDI-AGBON FELELE	Culvert	1 BC (1.5 x 1.7)	Good	0.63	Tertiary	8.47	11.30	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1245	IDI-AGBON FELELE	Culvert	1 BC (0.65 x 0.7)	Good	0.63	Tertiary	8.47	11.30	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	62	Owode	Bridge	2 BC (1.9 x 1.23)	Fair	0.64	Tertiary	8.55	11.40	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1227	ALABA-KAN, AGO -OLUNDE	Culvert	2 CC (Dia 0.75)	Fair	0.70	Tertiary	9.00	12.00	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1508	boluwaji	Culvert	1 BC (3.5 x 2.98)	Good	0.70	Tertiary	9.00	12.00	Existing													
	1564	soka	Footpath		Poor	0.85	Tertiary	10.13	13.50	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	884	IDI MANGORO/SOKA	Culvert	1 BC (3 x 1.1)	Good	0.90	Tertiary	10.50	14.00	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
Og4 Lower Ogunpa																							

Subbasin	Structure No.	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Condition	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Min. Vertical distance from road level to culvert invert level	Designed by	Status	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)
Om1 Omi Headwaters North	452	Eniosa	Culvert	1 CC (Dia 0.75)	Good	0.14	Secondary	2.10	2.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	453	Arulogun	Culvert	1 CC (Dia 0.9)	Good	0.17	Main	2.55	3.40	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	20	66	17160	8	12837	48,000	
	1336	Ariyibi	Natural Stream		Poor	0.37	Tertiary	5.55	7.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	448		Culvert	2 CC (Dia 0.9)	Fair	0.70	Main	9.00	12.00	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	20	115	29900	14	22368	84,800	
	451	Olorunda	Culvert	1 BC (1.74 x 1.5)	Fair	1.53	Main	15.22	20.30	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 2)	2.6	Dar	Masterplan	20	132	34320	17	25674	96,000	
	1337	Irepodun Estate	Culvert	1 CC (Dia 0.9)	Fair	1.69	Secondary	16.43	21.90	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	10	84	21840	11	16338	62,400	
	1339	Ladojo Vilaage	Culvert	2 CC (Dia 0.75)	Poor	3.44	Secondary	29.55	39.40	Proposed	Box Culvert	Natural Stream	2 Cv (4 x 2)	2.6	Dar	Masterplan	10	150	39000	19	29175	110,400	
	108	OLDRUNDA / ENIOSHA	Culvert	1 BC (1.67 x 1.62)	Poor	3.67	Main	31.28	41.70	Proposed	Box Culvert	Natural Stream	1 Cv (5 x 2.5)	3.3	Dar	Masterplan	20	188	48880	24	36566	137,600	
	1338	Adedapo	Culvert	2 BC (1.79 x 1.23)	Poor	4.77	Secondary	39.52	52.70	Proposed	Box Culvert	Natural Stream	2 Cv (5 x 2)	2.6	Dar	Masterplan	10	178	46280	22	34621	129,600	
	1340	Akingbohun	Culvert	1 BC (2 x 1.4)	Poor	19.15	Tertiary	118.19	157.59	Proposed	Box Culvert	Natural Stream	3 Cv (7 x 2.5)	3.3	Dar	Masterplan	10	378	98280	47	73521	275,200	
Om2 Omi Headwaters South	983	Keke	Culvert	1 CC (Dia 0.7)	Fair	0.11	Secondary	1.65	2.20	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	1347	Orita-odan	Natural Stream		Poor	0.13	Secondary	1.95	2.60	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	985	Olodo	Natural Stream		Poor	0.16	Tertiary	2.40	3.20	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1367	Pagun	Culvert	1 BC (0.92 x 0.42)	Poor	0.18	Tertiary	2.70	3.60	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1368	Begidinan-fogun Village	Culvert	2 CC (Dia 0.26)	Poor	0.27	Tertiary	4.05	5.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	982	Bank Olodo Area	Culvert	1 CC (Dia 0.9)	Fair	0.29	Secondary	4.35	5.80	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	1371	IDI-ORO VILLAGE	Natural Stream		Poor	0.36	Tertiary	5.40	7.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	1366	Aloba Village	Culvert	1 CC (Dia 0.85)	Poor	0.47	Tertiary	7.05	9.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1349	Niniola Estate	Natural Stream		Poor	0.49	Tertiary	7.35	9.80	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	984	Iyana Agandi-Olodo Area	Culvert	1 BC (1.8 x 1.53)	Good	0.61	Secondary	8.33	11.10	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1364	Arounfayo	Culvert	1 CC (Dia 0.6)	Fair	0.68	Tertiary	8.85	11.80	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1365	Onigbinde	Natural Stream		Poor	0.72	Tertiary	9.15	12.20	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1341	Olorunda Abaa	Culvert	2 CC (Dia 0.77)	Good	0.99	Tertiary	11.18	14.90	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
Om3 Upper Omi West	944	Olodo	Culvert	1 CC (Dia 0.6)	Fair		Secondary			Proposed	Box Culvert	Natural Stream	1 Cv (1 x 1)	1.3	Dar	Masterplan	10	24	6240	3	4668	17,600	
	1354	Abada	Natural Stream		Poor	0.10	Tertiary	1.50	2.00	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	1051	Amero	Culvert	1 CC (Dia 0.75)	Fair	0.15	Tertiary	2.25	3.00	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	954	kumapayi-Olodo	Culvert	1 BC (1.4 x 0.97)	Poor	0.18	Tertiary	2.70	3.60	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	978	Jenriyin	Culvert	1 CC (Dia 0.9)	Fair	0.20	Tertiary	3.00	4.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	988	Fidelity Estate	Natural Stream		Poor	0.20	Tertiary	3.00	4.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	724	Akobo-Ojurin	Culvert	1 BC (1 x 0.5)	Poor	0.23	Tertiary	3.45	4.60	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	723	Akobo-Ojurin	Culvert	2 BC (1 x 0.4)	Poor	0.25	Tertiary	3.75	5.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	977	Jenriyin	Natural Stream		Poor	0.26	Tertiary	3.90	5.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	968	Agbaja	Culvert	1 CC (Dia 0.8)	Poor	0.28	Tertiary	4.20	5.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	976	Jenriyin	Natural Stream		Poor	0.29	Tertiary	4.35	5.80	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	945	Wofun-Ayerenti	Culvert	1 CC (Dia 0.75)	Fair	0.30	Tertiary	4.50	6.00	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	963	Iyana Church Cele	Culvert	1 BC (2.45 x 1.21)	Fair	0.30	Tertiary	4.50	6.00	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	946	Wofun-Ayerenti	Culvert	1 CC (Dia 0.75)	Fair	0.31	Tertiary	4.65	6.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	942	Jenriyin	Culvert	1 CC (Dia 0.85)	Fair	0.32	Secondary	4.80	6.40	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1.5)	2.0	Dar	Masterplan	10	46	11960	6	8947	33,600	
	953	Oki	Natural Stream	1 BC (7.75 x 3.4)	Poor	0.32	Secondary	4.80	6.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 3.5)	4.6	Pheman	Going For Bid							
	967	Arulogun Alaja				0.33	Tertiary	4.95	6.60	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1.5)	2.0	Dar	Masterplan	10	46	11960	6	8947	33,600	
	1355	Ajara Estate	Natural Stream		Poor	0.33	Tertiary	4.95	6.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	722	Akobo-Ojurin	Culvert	2 CC (Dia 0.9)	Poor	0.38	Main	5.70	7.60	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	20	92	23920	12	17894	67,200	
	718	Ilupeju Estate	Culvert	2 CC (Dia 0.6)	Fair	0.39	Secondary	5.85	7.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	940	Iletuntun -Akobo Ojurin	Culvert	1 CC (Dia 0.65)	Poor	0.40	Tertiary	6.00	8.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	964	Iyana Church Cele	Footpath		Fair	0.40	Tertiary	6.00	8.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	725	Akobo-Ojurin	Culvert	1 BC (0.6 x 0.94)	Good	0.42	Tertiary	6.30	8.40	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	1052	Aseyori - Sese	Footpath		Fair	0.43	Tertiary	6.45	8.60	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	965	Iyana Church Cele	Culvert	2 CC (Dia 0.9)	Good	0.45	Main	6.75	9.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	20	92	23920	12	17894	67,200	
	969	Agbaja	Culvert	1 CC (Dia 0.7)	Fair	0.45	Tertiary	6.75	9.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	726	God city estate Akobo	Culvert	1 BC (0.88 x 0.91)	Good	0.46	Tertiary	6.90	9.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	970	Agbaja Olodo	Culvert	2 CC (Dia 0.76)	Fair	0.49	Tertiary	7.35	9.80	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	941	Harmony Estate	Culvert	1 CC (Dia 0.65)	Poor	0.51	Tertiary	7.57	10.10	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1350	Ajara	Natural Stream		Poor	0.52	Tertiary	7.65	10.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	971	Agbaja Olodo	Footpath		Poor	0.54	Tertiary	7.80	10.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	720	Idi Ishin- Akobo	Culvert	1 BC (2 x 2.02)	Good	0.56	Tertiary	7.95	10.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	947	Wakajaye	Footpath		Poor	0.56	Tertiary	7.95	10.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	975	Akoka	Natural Stream		Poor	0.59	Tertiary	8.17	10.90	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	574	After Elewuro junction	Culvert	2 CC (Dia 0.9)	Poor	0.60	Main	8.25	11.00	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	20	104	27040	13	20228	76,800	
	721	Apata	Natural Stream		Poor	0.63	Tertiary	8.47	11.30	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	959	Sawo	Culvert	2 BC (1.51 x 2.1)	Good	0.63	Tertiary	8.47	11.30	Existing													
	948	Wakajaye	Culvert	1 BC (1.8 x 1.24)	Fair	0.68	Tertiary	8.85	11.80	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	554	Elewuro	Footpath		Poor	0.69	Tertiary	8.92	11.90	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	949	Estate Oki-Agodi estate	Culvert	1 CC (Dia 0.9)	Fair	0.74	Tertiary	9.30	12.40	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	958	Okebadan Estate	Natural Stream		Poor	0.81	Tertiary	9.83	13.10	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	

Subbasin	Structure No.	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Condition	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Min. Vertical distance from road level to culvert invert level	Designed by	Status	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)
	966	Iyana Church Cele	Culvert	1 BC (1.5 x 1.57)	Good	0.82	Tertiary	9.90	13.20	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	950	Wakajaye	Culvert	1 BC (1.45 x 1.53)	Fair	0.85	Tertiary	10.13	13.50	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1050	Orogbangba	Culvert	4 CC (Dia 0.75)	Fair	0.86	Secondary	10.20	13.60	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	573	Barack	Culvert	1 BC (1.5 x 1.5)	Fair	0.87	Main	10.28	13.70	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	20	115	29900	14	22368	84,800	
	1353	Alapata Estate	Culvert	2 CC (Dia 0.62)	Poor	0.90	Tertiary	10.50	14.00	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	951	J.K Ayinde Ori-Owo, Oki, J.K Ayinde Ori-Owo	Culvert	2 CC (Dia 0.9)	Fair	1.00	Tertiary	11.25	15.00	Proposed	Box Culvert	Natural Stream	1 Cv (4.5 x 1.5)	2.0	Dar	Masterplan	10	78	20280	10	15171	57,600	
	1374	SULE-OGANLA 2	Culvert	1 CC (Dia 0.61)	Poor		Tertiary			Proposed	Box Culvert	Natural Stream	1 Cv (1 x 1)	1.3	Dar	Masterplan	10	24	6240	3	4668	17,600	
	1357	Fatumo Area	Culvert	1 CC (Dia 0.6)	Poor	0.12	Tertiary	1.80	2.40	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	1406	Kulodi/ife-ibadan express way	Culvert	1 CC (Dia 0.9)	Poor	0.12	Tertiary	1.80	2.40	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	1382	IKUMAPAYI	Culvert	1 BC (1.18 x 1.13)	Fair	0.16	Tertiary	2.40	3.20	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1387	ADEWUNMI				0.19	Highway	2.85	3.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	20	66	17160	8	12837	48,000	
	1433	Ifelodun Estate/Ikumapayi	Culvert	1 CC (Dia 0.78)	Fair	0.19	Tertiary	2.85	3.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1391	ADELEYE	Culvert	1 CC (Dia 0.9)	Poor	0.21	Highway	3.15	4.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	20	77	20020	10	14977	56,000	
	1402	Ikumapayi	Natural Stream		Poor	0.21	Tertiary	3.15	4.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1379	AHOYAYA-OLODO	Natural Stream		Poor	0.23	Tertiary	3.45	4.60	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1405	Ogungbade	Culvert	1 CC (Dia 1.2)	Good	0.23	Secondary	3.45	4.60	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1404	Ajoda	Culvert	1 CC (Dia 0.48)	Poor	0.30	Tertiary	4.50	6.00	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	1392	IDI-OSAN	Culvert	1 CC (Dia 0.88)	Poor	0.32	Tertiary	4.80	6.40	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1.5)	2.0	Dar	Masterplan	10	46	11960	6	8947	33,600	
	989	Arubiewe Olodo	Culvert	2 CC (Dia 0.9)	Fair	0.34	Secondary	5.10	6.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1.5)	2.0	Dar	Masterplan	10	46	11960	6	8947	33,600	
	1388	ADEWUNMI	Culvert	1 CC (Dia 0.94)	Fair	0.34	Tertiary	5.10	6.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1.5)	2.0	Dar	Masterplan	10	46	11960	6	8947	33,600	
Om4 Upper Omi East	1431	Ogundipe	Natural Stream		Poor	0.36	Tertiary	5.40	7.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	1380	OLODO	Culvert	2 CC (Dia 0.73)	Fair	0.38	Tertiary	5.70	7.60	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	986	Olodo	Culvert	2 CC (Dia 0.9)	Good	0.42	Highway	6.30	8.40	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	20	92	23920	12	17894	67,200	
	1375	OJOYEYE,OLODO	Culvert	2 CC (Dia 0.85)	Fair	0.44	Tertiary	6.60	8.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	1389	OLODO	Natural Stream		Poor	0.45	Tertiary	6.75	9.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	1390	OKE-OMI	Culvert	2 CC (Dia 0.85)	Good	0.51	Tertiary	7.57	10.10	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	987	Olufon-Olodo	Culvert	1 CC (Dia 0.9)	Fair	0.55	Tertiary	7.88	10.50	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1358	Agugu village	Culvert	1 CC (Dia 0.7)	Fair	0.57	Tertiary	8.02	10.70	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1432	Idi-osan	Culvert	1 CC (Dia 0.45)	Poor	0.63	Tertiary	8.47	11.30	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1376	ARUBIEWE	Natural Stream		Poor	0.66	Tertiary	8.70	11.60	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1531	Olodo	Footpath		Poor	0.74	Tertiary	9.30	12.40	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1377	ALAGBEDE	Natural Stream		Poor	0.76	Tertiary	9.45	12.60	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1533	Olodo	Natural Stream		Poor	0.78	Tertiary	9.60	12.80	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1381	IKUMAPAYI	Footpath		Fair	0.87	Tertiary	10.28	13.70	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1532	Olodo / Arubiewe	Natural Stream		Poor	0.92	Tertiary	10.65	14.20	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	1407	Ajoda Estate				0.10	Tertiary	1.50	2.00	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	1412	Ifeoluwatedo Estate	Natural Stream		Poor	0.11	Tertiary	1.65	2.20	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	1408	Ajoda Estate	Culvert	2 CC (Dia 0.74)	Poor	0.17	Tertiary	2.55	3.40	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
Om5 Middle Omi East	1409	Oluwo	Culvert	2 BC (0.69 x 1.34)	Fair	0.20	Tertiary	3.00	4.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1411	Ifeoluwatedo Estate	Culvert	2 BC (1.5 x 1.02)	Fair	0.21	Tertiary	3.15	4.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1410	Olorunsogo	Culvert	1 BC (1.12 x 0.86)	Fair	0.29	Tertiary	4.35	5.80	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	1057	Adegbayi	Culvert	1 CC (Dia 0.75)	Fair		Tertiary			Proposed	Box Culvert	Natural Stream	1 Cv (1 x 1)	1.3	Dar	Masterplan	10	24	6240	3	4668	17,600	
	1011	Oluwakeyin				0.10	Tertiary	1.50	2.00	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	1019	Olode	Culvert	1 BC (3.6 x 0.4)	Poor	0.10	Expressway	1.50	2.00	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	40	105	27300	13	20423	76,800	
	1022	Olode	Culvert	1 BC (0.9 x 0.87)	Fair	0.10	Tertiary	1.50	2.00	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	84D2	Jenrola road, oke odo alapata, femitoluwa quarters	Rectangular Section Channel			0.11	Tertiary	1.58	2.10	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	1003	Adegbayi	Culvert	1 CC (Dia 0.6)	Fair	0.11	Tertiary	1.65	2.20	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	83D1	IREPODUN LANDLORDS ASSOCIATION	Pipe Culvert	1 CC (Dia 0.85)		0.11	Tertiary	1.65	2.20	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	84D1	Jenrola road, oke odo alapata, femitoluwa quarters	Footpath			0.13	Tertiary	1.92	2.56	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	84D	Jenrola road, oke odo alapata, femitoluwa quarters	Rectangular Section Channel			0.13	Tertiary	1.97	2.62	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	1046	Isebo Alakia	Culvert	1 CC (Dia 0.8)	Fair	0.17	Tertiary	2.55	3.40	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1013	Olalere Zone D	Culvert	1 BC (1 x 0.3)	Poor	0.19	Tertiary	2.85	3.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1026	Alakia Area	Culvert	1 BC (1.2 x 1.56)	Fair	0.19	Tertiary	2.85	3.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	809	MANATAN	Natural Stream		Poor	0.20	Tertiary	3.00	4.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	

Subbasin	Structure No.	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Condition	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Min. Vertical distance from road level to culvert invert level	Designed by	Status	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)
Om6 Middle Omi West	1047	Amosun	Culvert	1 CC (Dia 0.6)	Fair	0.22	Tertiary	3.30	4.40	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	83D3	IREPODUN LANDLORDS ASSOCIATION	Pipe Culvert	1 CC (Dia 1)		0.22	Tertiary	3.30	4.40	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1002	Adegbayi	Culvert	1 CC (Dia 0.75)	Fair	0.24	Tertiary	3.60	4.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1018	Ifesowapo	Culvert	1 CC (Dia 0.75)	Fair	0.24	Tertiary	3.60	4.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	84D3	Jenrola road, oke odo alapata, femitoluwa quarters	Pipe Culvert	1 CC (Dia 0.8)		0.25	Tertiary	3.81	5.08	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	808	ADELUBI	Footpath		Good	0.27	Tertiary	4.05	5.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	1015	Kuelu Area	Culvert	1 CC (Dia 0.9)	Poor	0.27	Secondary	4.05	5.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	1030	Asipa Community	Culvert	1 BC (2.85 x 2)	Poor	0.29	Tertiary	4.35	5.80	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	27D	KOLAPO ISHOLA ESTATE	Box Culvert	1 BC (2 x 1.5)		0.29	Tertiary	4.35	5.80	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	1054	Isebo Alakia	Culvert	1 CC (Dia 0.8)	Fair	0.30	Tertiary	4.50	6.00	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	1024	Olode	Culvert	1 BC (1.5 x 1.02)	Fair	0.31	Tertiary	4.65	6.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	727	Kolapo Ishola GRA	Culvert	2 CC (Dia 0.9)	Fair	0.37	Tertiary	5.55	7.40	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	730	Kolapo Ishola GRA	Culvert	1 BC (2.35 x 1.53)	Good	0.40	Tertiary	6.00	8.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	811	ADOGBA/ MANATAN	Culvert	1 BC (2.87 x 1.04)	Good	0.45	Tertiary	6.75	9.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	1020	Adegbayi	Culvert	1 BC (1.4 x 0.81)	Good	0.45	Tertiary	6.75	9.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	733	Carlton estate GRA	Culvert	2 BC (2.1 x 1.12)	Good	0.50	Tertiary	7.50	10.00	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1023	Olode	Culvert	1 BC (1.6 x 1.24)	Good	0.51	Tertiary	7.57	10.10	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1044	Nigeria Brewery	Culvert	3 BC (1.22 x 1.2)	Good	0.53	Tertiary	7.72	10.30	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1044A	Nigerian Brewery	Culvert	1 BC (1.55 x 1.23)		0.53	Tertiary	7.72	10.30	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1519	Ifesowapo commuity Aba Odan	Culvert	2 BC (0.85 x 0.96)	Poor	0.62	Tertiary	8.40	11.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1048	Amosun	Culvert	1 CC (Dia 0.6)	Fair	0.63	Tertiary	8.47	11.30	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1001	Adegbayi	Culvert	1 CC (Dia 0.7)	Poor	0.65	Tertiary	8.62	11.50	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1518	Aba Odan	Culvert	2 BC (0.98 x 1.14)	Poor	0.65	Tertiary	8.62	11.50	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1014	Kuelu Area	Footpath		Poor	0.66	Tertiary	8.70	11.60	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1000	adegbayi	Culvert	1 BC (1.8 x 1.5)	Fair	0.73	Tertiary	9.23	12.30	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	112	AROLU AREA	Culvert	1 BC (1.5 x 1.36)	Erosion	0.75	Tertiary	9.38	12.50	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	999	Adegbayi	Culvert	1 CC (Dia 0.65)	Fair	0.85	Secondary	10.13	13.50	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1029	Asipa-Laamo	Culvert	1 BC (2.2 x 1.56)	Fair	0.85	Tertiary	10.13	13.50	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1042	Oke- Odo -Alalubosa Zone A	Culvert	2 CC (Dia 0.85)	Fair	0.86	Tertiary	10.20	13.60	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1044B	Nigeria Brewery	Culvert	3 BC (1.37 x 1.32)		0.87	Tertiary	10.28	13.70	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1012	Osun seni	Culvert	1 BC (2.1 x 1.2)	Fair	0.88	Tertiary	10.35	13.80	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	1009	Osun Seni Zone B	Culvert	1 BC (2.1 x 1.52)	Good	0.94	Tertiary	10.80	14.40	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	1041	Aroko- Agoro	Culvert	2 CC (Dia 0.7)	Fair	0.95	Tertiary	10.87	14.50	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	1171	Aiport	Natural Stream		Poor		Tertiary			Proposed	Box Culvert	Natural Stream	1 Cv (1 x 1)	1.3	Dar	Masterplan	10	24	6240	3	4668	17,600	
	1171 Prime	Aiport	Culvert	2 BC (1.46 x 0.9)	Fair	0.10	Tertiary	1.50	2.00	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	1127	Kupo Zone 3	Footpath		Poor	0.11	Tertiary	1.65	2.20	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	1126 Prime	Airport				0.11	Tertiary	1.65	2.20	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	1134	Akintunde	Natural Stream		Poor	0.12	Tertiary	1.80	2.40	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	1151	Faosin	Culvert	1 CC (Dia 0.75)	Poor	0.12	Tertiary	1.80	2.40	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	1128	Ona Ara	Footpath		Poor	0.13	Tertiary	1.95	2.60	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	1140	Irepodun	Culvert	1 CC (Dia 0.8)	Poor	0.13	Secondary	1.95	2.60	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	1438	Ejikeye-Ajia	Culvert	1 BC (0.87 x 0.97)	Fair	0.13	Secondary	1.95	2.60	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	1172 Prime	Aiport	Culvert	1 BC (1.1 x 0.8)	Fair	0.14	Tertiary	2.10	2.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1165	Akindele Atea	Culvert	1 BC (1.14 x 0.8)	Poor	0.15	Tertiary	2.25	3.00	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1436	Akamo/masopa	Culvert	1 BC (0.9 x 0.94)	Fair	0.19	Tertiary	2.85	3.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1157	Kuledi Area	Culvert	1 BC (3.7 x 0.8)	Fair	0.20	Tertiary	3.00	4.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1172	Aiport	Natural Stream		Poor	0.20	Tertiary	3.00	4.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1017	Poat	Culvert	2 CC (Dia 0.9)	Fair	0.21	Secondary	3.15	4.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1439	Ejikeye-Ajia	Culvert	1 CC (Dia 0.77)	Fair	0.21	Tertiary	3.15	4.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	53D1	ROCK VIEW ESTATE RESIDENTS ASSOCIATION OFF IYANA AGBALA, NEW IFE EXPRESS WAY, BIOKU IBADAN	Gullies			0.21	Tertiary	3.15	4.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	53D2	ROCK VIEW ESTATE RESIDENTS ASSOCIATION OFF IYANA AGBALA, NEW IFE EXPRESS WAY, BIOKU IBADAN	Natural Stream			0.21	Secondary	3.15	4.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
Om7 Middle Omi South	1163	Iderade	Culvert	2 CC (Dia 0.75)	Fair	0.22	Tertiary	3.30	4.40	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1152	Faosin	Culvert	1 BC (2.1 x 0.94)	Fair	0.24	Tertiary	3.60	4.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1162	Iderade	Natural Stream		Poor	0.24	Tertiary	3.60	4.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1440	Ejikeye-Ajia	Natural Stream		Poor	0.24	Tertiary	3.60	4.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1137	Araromi-Kure	Culvert	1 BC (1.47 x 0.9)	Poor	0.26	Tertiary	3.90	5.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	1156	Ifeoluwa Community	Footpath		Poor	0.31	Tertiary	4.65	6.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	1125 Prime	Aiport	Culvert	2 CC (Dia 1.5)	Fair	0.35	Tertiary	5.25	7.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	1138	Amuloko	Natural Stream		Poor	0.40	Tertiary	6.00	8.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	1420	Egbeda	Culvert	2 CC (Dia 0.96)	Poor	0.40	Secondary	6.00	8.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	

Subbasin	Structure No.	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Condition	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Min. Vertical distance from road level to culvert invert level	Designed by	Status	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)
	1129	Ifesowapo Community	Culvert	1 CC (Dia 0.85)	Fair	0.43	Secondary	6.45	8.60	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	1131	Amuloko	Footpath		Poor	0.48	Secondary	7.20	9.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1434	Oluwo	Natural Stream		Poor	0.51	Tertiary	7.57	10.10	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1148	Ifesowapo Area	Footpath		Fair	0.52	Tertiary	7.65	10.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1417	Olorunsogo	Culvert	1 CC (Dia 0.84)	Fair	0.58	Expressway	8.10	10.80	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	40	194	50440	24	37733	142,400	
	1167	Fakayode Area	Natural Stream		Poor	0.59	Tertiary	8.17	10.90	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1153	Araromi	Natural Stream		Poor	0.60	Tertiary	8.25	11.00	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1135	Airport	Culvert	2 BC (1.41 x 0.95)	Fair	0.63	Tertiary	8.47	11.30	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1418	Olorunsogo community	Culvert	1 CC (Dia 0.67)	Good	0.65	Tertiary	8.62	11.50	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1419	Olorunsogo community	Natural Stream		Poor	0.71	Tertiary	9.07	12.10	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1435	Olode/Ajamoro	Culvert	1 CC (Dia 0.75)	Poor	0.75	Tertiary	9.38	12.50	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1166	Akindele Atea	Culvert	1 BC (2.15 x 1.53)	Fair	0.77	Tertiary	9.52	12.70	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1421	Egbeda	Culvert	1 BC (2.4 x 1.82)	Fair	0.84	Tertiary	10.05	13.40	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1056	Bioku - Araba	Culvert	1 BC (2.81 x 2.47)	Good	0.87	Tertiary	10.28	13.70	Existing													
	1136	Inuege	Culvert	1 BC (1.15 x 0.77)	Fair	0.88	Tertiary	10.35	13.80	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	1016	Ogo Oluwa Zone F	Natural Stream		Poor	0.91	Tertiary	10.58	14.10	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	1149	Idi- Oro	Culvert	1 BC (2.1 x 1.95)	Fair	0.95	Tertiary	10.87	14.50	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	14P	OLORUNGUNWA	Culvert	2 CC (Dia 0.9)	Poor	0.15	Secondary	2.25	3.00	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 3.5)	4.6	Pheman	Going For Bid	10	88	22880	11	17116	64,000	
	1447	Odeyale-Ifesowapo	Culvert	1 CC (Dia 1)	Poor		Main			Proposed	Box Culvert	Natural Stream	1 Cv (1 x 1)	1.3	Dar	Masterplan	20	44	11440	6	8558	32,000	
	1457	Oke-elesin	Natural Stream		Poor	0.16	Tertiary	2.40	3.20	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1145	Ifeloju	Culvert	2 BC (0.73 x 0.88)	Poor	0.18	Tertiary	2.70	3.60	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1450	Orisunmbare	Footpath		Poor	0.19	Tertiary	2.85	3.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1147	Oke-Elesin	Culvert	1 BC (2.3 x 1.84)	Good	0.20	Tertiary	3.00	4.00	Existing													
	1459	Oke-odo/Olu-awo	Natural Stream		Poor	0.23	Tertiary	3.45	4.60	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1146	Ifeloju	Natural Stream		Poor	0.24	Tertiary	3.60	4.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1456	Amuloko/Oke-elesin	Natural Stream		Poor	0.24	Tertiary	3.60	4.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1468	Olupo Estate	Natural Stream		Poor	0.25	Tertiary	3.75	5.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1455	Araromi-Lapiti	Natural Stream		Poor	0.30	Tertiary	4.50	6.00	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	1143	Oke-Odo	Natural Stream		Poor	0.34	Tertiary	5.10	6.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1.5)	2.0	Dar	Masterplan	10	46	11960	6	8947	33,600	
	1465	Olokonla Road	Culvert	1 CC (Dia 0.8)	Poor	0.37	Secondary	5.55	7.40	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	1469	Alagbede	Natural Stream		Poor	0.49	Tertiary	7.35	9.80	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1466	Egbeda-Atuba	Culvert	1 CC (Dia 1.15)	Fair	0.62	Secondary	8.40	11.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1470	Alagbede	Natural Stream		Poor	0.67	Tertiary	8.78	11.70	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1471	Baale Village,Kobomoje Olomiyeye	Natural Stream		Poor	0.80	Tertiary	9.75	13.00	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1144	Oke-Odo	Footpath		Poor	0.95	Tertiary	10.87	14.50	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	1451	Thy-will	Culvert	1 BC (2 x 1.28)	Fair	0.97	Tertiary	11.03	14.70	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	1452	Gbenle Estate	Natural Stream			1.19	Tertiary	12.68	16.90	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 2)	2.6	Dar	Masterplan	10	70	18200	9	13615	51,200	
Om8 Lower Omi	1453	Gbenle Estate	Natural Stream		Poor	1.22	Tertiary	12.90	17.20	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 2)	2.6	Dar	Masterplan	10	77	20020	10	14977	56,000	
	1454	Thy-will	Natural Stream		Fair	1.25	Tertiary	13.13	17.50	Proposed	Box Culvert	Natural Stream	1 Cv (4.5 x 1.5)	2.0	Dar	Masterplan	10	78	20280	10	15171	57,600	
	1467	Olomiyeye	Natural Stream		Dilapidated	1.28	Tertiary	13.35	17.80	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 2)	2.6	Dar	Masterplan	10	77	20020	10	14977	56,000	
	1472	Orisunmbare/Olorire Estate	Footpath		Poor	3.04	Tertiary	26.55	35.40	Proposed	Box Culvert	Natural Stream	1 Cv (4.5 x 2.5)	3.3	Dar	Masterplan	10	105	27300	13	20423	76,800	
	1528	Gbenle Estate	Culvert	2 BC (2.35 x 1.9)	Fair	3.45	Tertiary	29.63	39.50	Proposed	Box Culvert	Natural Stream	1 Cv (5 x 2.5)	3.3	Dar	Masterplan	10	113	29380	14	21979	83,200	
	1458	Amuloko	Culvert	2 CC (Dia 0.75)	Poor	4.02	Tertiary	33.90	45.20	Proposed	Box Culvert	Natural Stream	2 Cv (4.5 x 2)	2.6	Dar	Masterplan	10	164	42640	21	31898	120,000	
	69	OKE-ODO OLUAWO	Culvert	1 BC (2.45 x 1.33)	Poor	4.60	Tertiary	38.25	51.00	Proposed	Box Culvert	Natural Stream	2 Cv (5 x 2)	2.6	Dar	Masterplan	10	178	46280	22	34621	129,600	
	1460	Olu-awo	Natural Stream		Fair	4.88	Tertiary	40.35	53.80	Proposed	Box Culvert	Natural Stream	2 Cv (5 x 2)	2.6	Dar	Masterplan	10	178	46280	22	34621	129,600	
	1461	Tokotaya Bus-stop	Natural Stream		Fair	5.27	Tertiary	42.72	56.96	Proposed	Box Culvert	Natural Stream	2 Cv (5.5 x 2)	2.6	Dar	Masterplan	10	192	49920	24	37344	140,800	
	1462	Abonde	Natural Stream			5.39	Tertiary	43.37	57.83	Proposed	Box Culvert	Natural Stream	2 Cv (5.5 x 2)	2.6	Dar	Masterplan	10	192	49920	24	37344	140,800	
	1462 Prime	Amuloko	Culvert	1 BC (2.2 x 1.7)	Good	5.51	Tertiary	44.02	58.70	Proposed	Box Culvert	Natural Stream	1 Cv (6.5 x 2.5)	3.3	Dar	Masterplan	10	135	35100	17	26258	99,200	
	1529	Aba Okubiyi	Footpath		Good	5.82	Tertiary	45.71	60.95	Proposed	Box Culvert	Natural Stream	2 Cv (6 x 2)	2.6	Dar	Masterplan	10	206	53560	26	40067	150,400	
	1463	Gboro village/Idi-ose	Culvert	2 BC (1.93 x 1.3)	Poor	6.56	Secondary	49.73	66.31	Proposed	Box Culvert	Natural Stream	2 Cv (6 x 2)	2.6	Dar	Masterplan	10	206	53560	26	40067	150,400	
	1464	Olorungbebe	Natural Stream		Fair	6.89	Tertiary	51.53	68.70	Proposed	Box Culvert	Natural Stream	2 Cv (6 x 2)	2.6	Dar	Masterplan	10	206	53560	26	40067	150,400	
	1446	Odeyale-Ifesowapo	Culvert	1 CC (Dia 2.9)	Good	9.87	Main	67.73	90.31	Proposed	Box Culvert	Natural Stream	2 Cv (6.5 x 2.5)	3.3	Dar	Masterplan	20	413	107380	52	80329	300,800	
	1448 Prime	Ifesowapo-Omolere Estate	Natural Stream		Good	10.29	Tertiary	70.01	93.35	Proposed	Box Culvert	Natural Stream	2 Cv (7 x 2.5)	3.3	Dar	Masterplan	10	260	67600	33	50570	190,400	
	21D2	IFESOWAPO LANDLORD AND LANDLADIES ODEYALE IFESOWAPO COMMUNITY AKANRAN ROAD	Natural Stream			10.29	Tertiary	70.01	93.35	Proposed	Box Culvert	Natural Stream	3 Cv (6 x 2)	2.6	Dar	Masterplan	10	300	78000	38	58350	219,200	
	1448	Ifesowapo-Omolere Estate	Natural Stream		Good	10.42	Tertiary	70.72	94.30	Proposed	Box Culvert	Natural Stream	3 Cv (6 x 2)	2.6	Dar	Masterplan	10	300	78000	38	58350	219,200	
	1449	Ifelere/Agbena	Culvert	2 BC (1.75 x 2.3)	Fair	10.50	Tertiary	71.16	94.88	Proposed	Box Culvert	Natural Stream	2 Cv (7 x 2.5)	3.3	Dar	Masterplan	10	260	67600	33	50570	190,400	
	625B	Ojoo-Ajibode	Culvert	2 BC (3.02 x 1.9)	Good		Tertiary			Existing													
	617	Aro-Meta Eleyele	Footpath		Poor	0.11	Tertiary	1.65	2.20	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	483	Abangbe Ajibode	Culvert	2 BC (1.4 x 1.75)	Good	0.12	Tertiary	1.80	2.40	Existing													
	524	Apete	Culvert	1 CC (Dia 0.8)	Poor	0.12	Tertiary	1.80	2.40	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	

Subbasin	Structure No.	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Condition	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Min. Vertical distance from road level to culvert invert level	Designed by	Status	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)
On10 Middle Ona North	23D	ODO-BAALE, LOKOAREA SANGO	Pipe Culvert	1 CC (Dia 0.8)		0.12	Tertiary	1.80	2.40	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	55D1	OKE-ODAN-POLY QUARTERS LANDLORDS ASSOCIATION, APETE, IBADAN IDO LGA	Natural Stream			0.12	Main	1.80	2.40	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	20	55	14300	7	10698	40,000	
	527	University of Ibadan	Culvert	1 BC (1.42 x 1.44)	Good	0.16	Tertiary	2.40	3.20	Existing													
	526	Ajibode	Culvert	1 CC (Dia 0.9)	Good	0.17	Tertiary	2.55	3.40	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	616	Agbaje Ijokodo	Footpath		Fair	0.21	Tertiary	3.15	4.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	495	Ojoo	Culvert	1 CC (Dia 0.7) + 1 BC (3.5 x 1.2)	Good	0.21	Tertiary	3.15	4.20	Existing													
	610	Apete	Culvert	1 BC (1.35 x 1.83)	Fair	0.23	Tertiary	3.45	4.60	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	658	Sango	Footpath		Fair	0.23	Tertiary	3.45	4.60	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	501	Abatakan	Culvert	1 BC (1 x 0.9)	Poor	0.24	Tertiary	3.60	4.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	466	Mojoda	Footpath		Erosion	0.25	Tertiary	3.75	5.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	134	Apete	Footpath		Poor	0.25	Tertiary	3.75	5.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	494	Ojoo	Culvert	1 BC (3.5 x 1.2)	Good	0.26	Tertiary	3.90	5.20	Existing													
	523		Natural Stream		Poor	0.27	Tertiary	4.05	5.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	496	Oguntula	Natural Stream		Erosion	0.29	Tertiary	4.35	5.80	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	661	Samanda	Culvert	2 BC (2.96 x 2.05)	Good	0.31	Highway	4.65	6.20	Existing													
	522		Footpath		Poor	0.32	Tertiary	4.80	6.40	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1.5)	2.0	Dar	Masterplan	10	46	11960	6	8947	33,600	
	648	Alaro	Footpath		Poor	0.33	Tertiary	4.95	6.60	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1.5)	2.0	Dar	Masterplan	10	46	11960	6	8947	33,600	
	521		Culvert	2 CC (Dia 0.6)	Poor	0.33	Tertiary	4.95	6.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	467	Anu Oluwa Quarters	Culvert	2 CC (Dia 0.8)	Poor	0.36	Tertiary	5.40	7.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	55D2	OKE-ODAN-POLY QUARTERS LANDLORDS ASSOCIATION, APETE, IBADAN IDO LGA	Natural Stream			0.38	Tertiary	5.70	7.60	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	660	Sango	Culvert	2 CC (Dia 0.78)	Fair	0.39	Tertiary	5.85	7.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	497	Ojoo	Culvert	1 BC (2.7 x 1.36)	Good	0.39	Tertiary	5.85	7.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	520		Footpath		Poor	0.40	Tertiary	6.00	8.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	650	Okoro	Natural Stream		Poor	0.41	Tertiary	6.15	8.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	525	Sode-Jamade Apete	Footpath		Poor	0.43	Tertiary	6.45	8.60	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	493	NISER	Culvert	2 BC (2.6 x 1.42)	Fair	0.46	Tertiary	6.90	9.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	498	Ojoo-Gospel/Total	Culvert	1 BC (2.5 x 1.51)	Good	0.54	Expressway	7.80	10.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	40	194	50440	24	37733	142,400	
	499	Old oyo Road	Culvert	2 BC (2.5 x 2.45)	Good	0.55	Highway	7.88	10.50	Existing													
	649	Okoro	Footpath		Poor	0.56	Tertiary	7.95	10.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	464	Isale School the way	Natural Stream		Erosion	0.56	Tertiary	7.95	10.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	600	Eleyele	Culvert	2 BC (2.2 x 1.43)	Poor	0.57	Tertiary	8.02	10.70	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	492	University of Ibadan	Culvert	1 BC (3.2 x 1.54)	Good	0.57	Main	8.02	10.70	Existing													
	469	Oke Odan	Culvert	2 BC (3 x 1.78)	Good	0.66	Tertiary	8.70	11.60	Existing													
	500	Ojoo	Culvert	1 BC (4.3 x 1.6)	Good	0.71	Tertiary	9.07	12.10	Existing													
	465	Ile Alli	Natural Stream		Poor	0.74	Tertiary	9.30	12.40	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	603	Apete	Culvert	2 BC (1.28 x 1.27)	Fair	0.76	Tertiary	9.45	12.60	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	630	UI	Culvert	1 BC (3.04 x 3.03)	Good	0.76	Tertiary	9.45	12.60	Existing													
	655	UI	Culvert	2 BC (3.2 x 2.07)	Good	0.79	Tertiary	9.68	12.90	Existing													
	629	UI	Natural Stream		Good	0.92	Tertiary	10.65	14.20	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	136	IJOKODO , APETE ROAD	Culvert	1 BC (15.3 x 2.55)	Poor	5.11	Main	41.85	55.80	Proposed	Box Culvert	Natural Stream	1 Cv (7 x 2.5)	3.3	Dar	Masterplan	20	238	61880	30	46291	174,400	
On11 Alapata South	608	Awotan Apete-Life Forte	Culvert	1 CC (Dia 0.87)	Poor	0.20	Main	3.00	4.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	20	77	20020	10	14977	56,000	
	612	Onigbaketun	Footpath		Poor	0.29	Secondary	4.35	5.80	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	457	Alapata	Culvert	1 CC (Dia 0.7)	Poor	0.30	Main	4.50	6.00	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	20	88	22880	11	17116	64,000	
	613	Alatare Zone C	Footpath		Poor	0.56	Tertiary	7.95	10.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	605	Owala	Culvert	1 BC (1.2 x 2)	Good	0.82	Secondary	9.90	13.20	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	462	Agunbiade	Natural Stream		Fair	0.86	Tertiary	10.20	13.60	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1105	Ogbagba Area	Culvert	1 BC (1.66 x 1.46)	Fair		Tertiary			Proposed	Box Culvert	Natural Stream	1 Cv (1 x 1)	1.3	Dar	Masterplan	10	24	6240	3	4668	17,600	
	582	Ologuneru	Natural Stream		Poor	0.17	Tertiary	2.55	3.40	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1113	Owode Apata Aba Ege	Culvert	1 CC (Dia 0.75)	Fair	0.19	Tertiary	2.85	3.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	739	Oladele Face 2	Culvert	2 BC (1.05 x 0.81)	Good	0.21	Tertiary	3.15	4.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	615	Abanla Zone B2	Culvert	2 BC (1.17 x 0.72)	Fair	0.23	Tertiary	3.45	4.60	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	736	Oladele face 2	Culvert	1 CC (Dia 0.78)	Poor	0.26	Tertiary	3.90	5.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	779	Gbekuba	Culvert	1 BC (2.65 x 1.03)	Good	0.28	Tertiary	4.20	5.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	737	Gbekuba	Culvert	1 BC (2.6 x 1.14)	Fair	0.29	Tertiary	4.35	5.80	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	588	Olohungbebe Ido	Culvert	1 BC (2 x 0.85)	Fair	0.32	Tertiary	4.80	6.40	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1.5)	2.0	Dar	Masterplan	10	46	11960	6	8947	33,600	
	590	Elenusonso	Culvert		Poor	0.32	Secondary	4.80	6.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	589	Olohungbebe Ido	Culvert	1 CC (Dia 0.78)	Fair	0.36	Tertiary	5.40	7.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	1106	Ogbagba Area	Culvert	1 BC (1.8 x 1)	Fair	0.38	Tertiary	5.70	7.60	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	

Subbasin	Structure No.	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Condition	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Min. Vertical distance from road level to culvert invert level	Designed by	Status	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)
On12 Middle Ona West	1109	Apata	Culvert	4 CC (Dia 0.75) + 1 BC (4.04 x 1.03)	Fair	0.38	Tertiary	5.70	7.60	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	1112	Ifeleye Apata	Culvert	1 BC (1.01 x 1.05)	Fair	0.39	Tertiary	5.85	7.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	585	Powerline Ido	Culvert	2 CC (Dia 0.9)	Fair	0.39	Main	5.85	7.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	20	92	23920	12	17894	67,200	
	587	Powerline Ologuneru	Culvert	2 BC (1.15 x 1.28)	Fair	0.43	Tertiary	6.45	8.60	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	1107	Ogbagba Area	Culvert	2 CC (Dia 0.75) + 1 BC (1.82 x 1.35)	Fair	0.44	Tertiary	6.60	8.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	586	Powerline Ologuneru	Culvert	1 CC (Dia 0.9)	Fair	0.46	Tertiary	6.90	9.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1108	Adebisi Area	Natural Stream		Poor	0.49	Tertiary	7.35	9.80	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1114	Egbodi Apata	Culvert	1 BC (0.9 x 0.85)	Fair	0.55	Tertiary	7.88	10.50	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1111	Owode Apata	Culvert	1 CC (Dia 0.8) + 1 BC (1.2 x 1.1)	Fair	0.63	Tertiary	8.47	11.30	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1110	Apata	Culvert	2 BC (1.05 x 1.08)	Poor	0.67	Tertiary	8.78	11.70	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1115	Apata	Culvert	2 BC (1.07 x 1.6)	Fair	0.75	Tertiary	9.38	12.50	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1542	Iletuntun Area	Culvert	1 BC (2.2 x 2.1)	Good	0.92	Secondary	10.65	14.20	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	1116	Teacher Estate	Culvert	2 BC (1.2 x 1.2)	Good	0.95	Tertiary	10.87	14.50	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
On13 Middle Ona South	145B	NIHORT , GBEKUBA	Culvert	2 BC (11.27 x 9.44)	Erosion		Secondary			Proposed	Box Culvert	Natural Stream	1 Cv (1 x 1)	1.3	Dar	Masterplan	10	24	6240	3	4668	17,600	
	48D	IFELAGBA LANDLORDS AND RESIDENT ASSOCIATION,UPPER ADETOKUN, NEW ERUWA ROAD	Box Culvert	1 BC (0.5 x 0.75)		0.10	Tertiary	1.50	2.00	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	748	Jericho	Culvert	1 BC (1.2 x 0.9)	Fair	0.28	Tertiary	4.20	5.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	614	Aba Pan	Culvert	2 CC (Dia 0.75)	Fair	0.32	Tertiary	4.80	6.40	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1.5)	2.0	Dar	Masterplan	10	46	11960	6	8947	33,600	
	620	Ologuneru	Natural Stream		Poor	0.35	Tertiary	5.25	7.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	597	Adetokun Ologuneru	Culvert	1 BC (2.5 x 1.02)	Good	0.38	Tertiary	5.70	7.60	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	747	Sijuade	Culvert	2 CC (Dia 0.6)	Poor	0.40	Tertiary	6.00	8.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	746	Eleyele	Culvert	2 CC (Dia 0.6)	Fair	0.61	Tertiary	8.33	11.10	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	607	Idi Osan -Ologuneru	Culvert	2 CC (Dia 0.7)	Fair	0.62	Tertiary	8.40	11.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	596	Adetokun Eleyele	Culvert	1 BC (2 x 1.51)	Good	0.82	Tertiary	9.90	13.20	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	606	Ologuneru	Footpath		Poor	0.84	Tertiary	10.05	13.40	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	761	Odo Ona	Culvert	1 BC (1.3 x 0.48)	Fair		Tertiary			Proposed	Box Culvert	Natural Stream	1 Cv (1 x 1)	1.3	Dar	Masterplan	10	24	6240	3	4668	17,600	
	815 Prime	Oluyole Extension	Culvert	1 CC (Dia 0.6)	Good		Tertiary			Existing													
	763	Iyaganku GRA	Culvert	1 BC (1.4 x 1.2)	Good	0.11	Tertiary	1.65	2.20	Existing													
	750	Odo Ona	Culvert	1 BC (1.1 x 0.53)	Fair	0.12	Tertiary	1.80	2.40	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	1501	Ring Rod	Culvert	1 BC (1.5 x 1.3)	Good	0.12	Main	1.80	2.40	Existing													
	760	Odo Ona	Culvert	1 BC (1.3 x 0.65)	Poor	0.13	Tertiary	1.95	2.60	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	762	Iyaganku GRA	Culvert	2 BC (3.03 x 2.95)	Good	0.13	Tertiary	1.95	2.60	Existing													
	759	Odo Ona	Culvert	1 BC (1.2 x 0.8)	Poor	0.15	Tertiary	2.25	3.00	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	253	Aleshinloye	Culvert	1 BC (4.7 x 3.07)	Good	0.17	Tertiary	2.55	3.40	Existing													
	773	Ago Taylor	Culvert	2 CC (Dia 0.6)	Fair	0.20	Main	3.00	4.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	20	77	20020	10	14977	56,000	
	754	Aleshinloye Market	Culvert	1 BC (3 x 1.1)	Fair	0.24	Tertiary	3.60	4.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	820	Ring Road	Culvert	3 CC (Dia 0.9)	Fair	0.24	Tertiary	3.60	4.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	233	Iyaganku	Culvert	1 BC (0.9 x 0.92)	Poor	0.26	Tertiary	3.90	5.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	740	Kuole North	Culvert	1 BC (0.9 x 0.94)	Good	0.34	Tertiary	5.10	6.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1.5)	2.0	Dar	Masterplan	10	46	11960	6	8947	33,600	
On14 Lower Ona North	229	Joyce B	Culvert	2 CC (Dia 0.9)	Fair	0.37	Tertiary	5.55	7.40	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	228	Road B	Culvert	1 BC (2.7 x 1.47)	Poor	0.41	Tertiary	6.15	8.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	232	Ogunleye	Culvert	1 BC (1.9 x 0.81)	Good	0.41	Tertiary	6.15	8.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	359	Subulade Streeet	Culvert	1 CC (Dia 1.2)	Fair	0.41	Tertiary	6.15	8.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	231	Liberty	Culvert	1 BC (4.3 x 1.8)	Poor	0.46	Tertiary	6.90	9.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	753	Apata	Culvert	1 BC (1.8 x 1.75)	Good	0.47	Tertiary	7.05	9.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	772	Apata	Culvert	2 CC (Dia 0.8)	Good	0.52	Tertiary	7.65	10.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	767	Oluyole estate	Culvert	1 BC (1.5 x 1.24)	Good	0.59	Tertiary	8.17	10.90	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	291	Joyce B	Culvert	1 BC (1.1 x 1)	Fair	0.61	Tertiary	8.33	11.10	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	764	Oluyole	Culvert	1 BC (4.5 x 2.21)	Good	0.63	Tertiary	8.47	11.30	Existing													
	766	Oluyole Estate	Culvert	1 BC (2.05 x 1.55)	Good	0.66	Tertiary	8.70	11.60	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	769	Federal college of Animal health & Production Technology	Culvert	1 CC (Dia 0.8)	Good	0.67	Tertiary	8.78	11.70	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	230	Oyeshina Layout	Culvert	1 BC (2.7 x 1.14)	Poor	0.67	Tertiary	8.78	11.70	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	765	Oluyole	Culvert	3 CC (Dia 0.6)	Fair	0.76	Tertiary	9.45	12.60	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	752	Moore Plantation	Natural Stream		Poor	0.83	Tertiary	9.97	13.30	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	755	Aleshinloye	Culvert	2 BC (1.75 x 1.25)	Good	0.98	Secondary	11.10	14.80	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	768	Oluyole Estate	Natural Stream		Fair	0.11	Tertiary	1.65	2.20	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	1066	Kuola Apata	Natural Stream		Poor	0.12	Tertiary	1.80	2.40	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	1103	Apata	Footpath		Poor	0.12	Tertiary	1.80	2.40	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	49D	IFESOWAPO COMMUNITY LANDLORDS/LANDLADIES ASSOCIATION LAYAN VILLAGE,APATA	Natural Stream			0.13	Main	1.95	2.60	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	20	55	14300	7	10698	40,000	
	1283	BESIDE C.A.C REVIVAL CENTRE AKINPELU AREA	Culvert	1 CC (Dia 0.7)	Good	0.14	Tertiary	2.10	2.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	56D4	ORITA MERIN-ELEBU (AHUN-GESTIMANY ROAD-ABESE ESTATE-ASAKKA WAY)	Natural Stream			0.17	Tertiary	2.55	3.40	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1288	AKOGI LAYOUT , BESIDE ELIZABETH GRP OF SCH,	Culvert	1 CC (Dia 0.75)	Fair - Erosion	0.18	Tertiary	2.70	3.60	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	

Subbasin	Structure No.	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Condition	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Min. Vertical distance from road level to culvert invert level	Designed by	Status	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)
On15 Alaro	1092	Apata	Natural Stream		Poor	0.19	Tertiary	2.85	3.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1301	BESIDE ELEBU HEALTH CARE	Culvert	1 BC (2.1 x 2)	Fair	0.19	Secondary	2.85	3.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1286	OPPOSITE KIDDIES PRIVATE SCH, SHARPCONER/REVIVAL AREA	Culvert	1 BC (1.5 x 1.05)	Fair - Erosion	0.20	Secondary	3.00	4.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	823	Oluyole Extension Zone 6	Culvert	2 CC (Dia 0.9)	Fair	0.21	Tertiary	3.15	4.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1104	Apata	Culvert	2 CC (Dia 0.75)	Fair	0.22	Tertiary	3.30	4.40	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1281	AJALA LAYOUT, ALAGO VILLAGE	Natural Stream		Fair	0.26	Tertiary	3.90	5.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	826	Oluyole Extension	Natural Stream		Poor	0.26	Tertiary	3.90	5.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	1081	Apata	Culvert	1 BC (2.3 x 1.24)	Poor	0.31	Tertiary	4.65	6.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	1091	Apata	Footpath		Poor	0.36	Tertiary	5.40	7.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	1302	OLUSETAN ESTATE, AKURO	Culvert	2 CC (Dia 0.74)	Fair - Erosion	0.36	Tertiary	5.40	7.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	1100	Bembo Area	Culvert	1 BC (1.8 x 1.4)	Fair	0.42	Tertiary	6.30	8.40	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	1284	OFF UNITY STREET RD3, POWERLINE, ABA-PANU	Culvert	1 BC (3.3 x 1.87)	Good	0.48	Main	7.20	9.60	Existing													
	828	Oluyole Extension	Culvert	2 CC (Dia 0.6)	Poor	0.48	Tertiary	7.20	9.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1101	Alexander Apata	Culvert	1 BC (0.75 x 0.7)	Poor	0.49	Tertiary	7.35	9.80	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1120	Aba Alamu Apata	Footpath		Poor	0.50	Tertiary	7.50	10.00	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1102	Aba Alamu Apata	Culvert	2 BC (2.6 x 1.15)	Fair	0.54	Tertiary	7.80	10.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	821	Oluyole	Culvert	2 BC (2.95 x 3.2)	Good	0.54	Secondary	7.80	10.40	Existing													
	1082	Meridian Apata	Culvert	1 CC (Dia 0.6)	Poor	0.56	Tertiary	7.95	10.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1292	IDI-AHUN, ELEBU	Natural Stream		Fair	0.61	Tertiary	8.33	11.10	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	822	Oluyole Extension	Culvert	2 CC (Dia 0.9)	Fair	0.63	Tertiary	8.47	11.30	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1083	Owode Apata	Natural Stream		Poor	0.65	Tertiary	8.62	11.50	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1569	Akala Area	Culvert	2 BC (2.9 x 2.7)	Good	0.67	Tertiary	8.78	11.70	Existing													
	1093	Apata	Culvert	2 CC (Dia 0.6)	Fair	0.68	Tertiary	8.85	11.80	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	27	IRE-AKARI ESTATE OFF AKAUA ROAD	Natural Stream		Dilapidated	0.75	Tertiary	9.38	12.50	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1094	Apata	Natural Stream		Poor	0.76	Tertiary	9.45	12.60	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1282	BESIDE EZRA HOTEL, IDI-OBI JANKATA	Culvert	2 BC (2.85 x 1.95)	Good	0.82	Main	9.90	13.20	Existing													
	1285	WALE ADEOYE LAYOUT, OLUYOLE EXTENSION	Culvert	1 CC (Dia 0.74)	Poor - Dilapidated	0.86	Tertiary	10.20	13.60	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1084	Meridian Apata	Culvert	2 CC (Dia 0.75)	Fair	0.87	Tertiary	10.28	13.70	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	26	Ire Akari Estate	Natural Stream		Poor	0.92	Tertiary	10.65	14.20	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	1085	Apata	Culvert	2 CC (Dia 0.75)	Poor	0.96	Tertiary	10.95	14.60	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	1287	BOLA, IDI-AHUN AREA, HUOLA RD	Culvert	1 CC (Dia 0.7)	Fair - Erosion	0.98	Tertiary	11.10	14.80	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	824	Oluyole extension-Akuru	Culvert	2 BC (1.6 x 1.5)	Good	0.99	Tertiary	11.18	14.90	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	1583	Tanimowo Area	Footpath			1.00	Tertiary	11.25	15.00	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 2)	2.6	Dar	Masterplan	10	70	18200	9	13615	51,200	
On16 Agara Kasumu	1314	OFF AYODELE BLOCK INDUSTRY, ADEBOMI RD	Natural Stream		Fair	0.21	Tertiary	3.15	4.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1183	BANKOLE/ODO ONA ELEWE	Natural Stream		Poor	0.25	Tertiary	3.75	5.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1315	ESTATE EXTENSION, OFF ADEBOMI RD	Culvert	1 CC (Dia 0.7)	Fair	0.28	Tertiary	4.20	5.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	1307	ALONG TOLATOSE EST. RD				0.39	Secondary	5.85	7.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	1305	ABA APATA, ALONG MOGANNA'S ESTATE.	Natural Stream		Fair	0.40	Tertiary	6.00	8.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	855	Odo Ona Elewe	Culvert	2 CC (Dia 0.8)	Fair	0.54	Secondary	7.80	10.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	859	Oko- Odo Zone 2	Natural Stream		Poor	0.60	Tertiary	8.25	11.00	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1321	AYEGUN, OLEYO	Natural Stream		Fair	0.73	Tertiary	9.23	12.30	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	853	Apampa Moberi Idi- Ishin	Culvert	1 BC (1.5 x 1.12)		0.73	Tertiary	9.23	12.30	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1303	OLOFA	Natural Stream		Fair	0.75	Tertiary	9.38	12.50	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1306	FEDERAL HOUSING EST. AREA,ALONG HALLELUYAH HOUSE	Natural Stream		Fair	0.80	Secondary	9.75	13.00	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	860	Oko- Odo Zone 1	Culvert	1 CC (Dia 0.8)	Fair	0.87	Tertiary	10.28	13.70	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	861	Isale Olosan	Culvert	1 CC (Dia 0.6)	Fair	0.90	Tertiary	10.50	14.00	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	357	Anfani	Culvert	3 CC (Dia 0.9)	Poor	0.13	Tertiary	1.95	2.60	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	846	New Garage	Culvert	1 BC (2.98 x 2.72)	Fair	0.14	Main	2.10	2.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	20	66	17160	8	12837	48,000	
	872	CHALLENGE/FELELE	Culvert	1 BC (1.85 x 0.66)	Good	0.15	Tertiary	2.25	3.00	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	361	Ososami	Footpath		Poor	0.15	Tertiary	2.25	3.00	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	850	Iyana Agara-Odo Ona elewe	Culvert	1 CC (Dia 0.6)	Fair	0.16	Secondary	2.40	3.20	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	867	POLICE POST/CHALLENGE		2 CC (Dia 0.67)		0.16	Tertiary	2.40	3.20	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1502	Toll Gate	Culvert	2 BC (3.07 x 3)	Good	0.20	Tertiary	3.00	4.00	Existing													
	868	POLICE POST/CHALLENGE	Culvert	1 BC (2.54 x 1.16)	Good	0.21	Tertiary	3.15	4.20	Existing													
	876	CHALLENGE	Culvert	1 BC (3 x 1.54)	Good	0.24	Highway	3.60	4.80	Existing													
	1503	Toll Gate	Culvert	1 CC (Dia 0.7)	Poor	0.25	Expressway	3.75	5.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	40	147	38220	18	28592	107,200	
	835	Idi Orogbo New Adeoyo	Culvert	1 BC (1.6 x 0.6)	Poor	0.27	Tertiary	4.05	5.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	364	Ososami	Culvert	1 BC (1.92 x 1.12)	Dilapidated	0.27	Tertiary	4.05	5.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	845	Orita Challenge	Culvert	1 CC (Dia 0.8)	Poor	0.28	Tertiary	4.20	5.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	849	Odo Ona elewe-IDC	Culvert	1 CC (Dia 0.8)	Fair	0.28	Tertiary	4.20	5.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	354	Anfani	Culvert	2 CC (Dia 0.9)	Good	0.28	Tertiary	4.20	5.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	355	Anfani	Footpath		Poor	0.32	Tertiary	4.80	6.40	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1.5)	2.0	Dar	Masterplan	10	46	11960	6	8947	33,600	
	863	Odo Ona Elewe	Culvert	1 CC (Dia 0.6)	Fair	0.37	Tertiary	5.55	7.40	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	

Subbasin	Structure No.	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Condition	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Min. Vertical distance from road level to culvert invert level	Designed by	Status	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)
On17 Lower Ona East	865	Odo Ona Elewe	Culvert	1 CC (Dia 0.7)	Poor	0.37	Secondary	5.55	7.40	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	873	LAGELU ESTATE	Footpath		Poor	0.40	Tertiary	6.00	8.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	874	LAGELU ESTATE	Culvert	1 BC (3.03 x 1.6)	Good	0.42	Tertiary	6.30	8.40	Existing													
	871	CHALLENGE	Culvert	2 BC (2.99 x 1.48)	Good	0.44	Highway	6.60	8.80	Existing													
	864	Odo Ona Elewe	Culvert	1 CC (Dia 0.6) + 1 BC (0.93 x 0.92)	Fair	0.46	Tertiary	6.90	9.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	833	Ring Road	Culvert	2 CC (Dia 1.2)	Good	0.49	Main	7.35	9.80	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	20	104	27040	13	20228	76,800	
	356	Anfani	Natural Stream		Poor	0.49	Tertiary	7.35	9.80	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	356 Prime	Anfani	Footpath		Poor	0.53	Tertiary	7.72	10.30	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	831	Oluyole New express road	Culvert	1 BC (3.32 x 1.95)	Good	0.55	Main	7.88	10.50	Existing													
	852	Odo Ona Elewe	Culvert	1 BC (1.1 x 0.98)	Fair	0.55	Tertiary	7.88	10.50	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	848	New Garage	Culvert	1 CC (Dia 0.9)	Fair	0.60	Highway	8.25	11.00	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	20	104	27040	13	20228	76,800	
	875	CHALLENGE/ LAGELU ESTATE	Culvert	1 BC (2.96 x 1.8)	Good	0.67	Highway	8.78	11.70	Existing													
	152	NIGER WEST OLD LAGOS ROAD	Culvert	2 BC (2.08 x 1.96)	Fair	0.69	Highway	8.92	11.90	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	20	115	29900	14	22368	84,800	
	832	Odo Ona Elewe	Culvert	2 BC (1.3 x 1)	Good	0.81	Tertiary	9.83	13.10	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	153	OLUSANYA / RING ROAD	Natural Stream		Dilapidated	0.82	Tertiary	9.90	13.20	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	840	Orita Challenge	Culvert	1 BC (3.1 x 1.77)	Fair	0.86	Tertiary	10.20	13.60	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	834	Challenge ring road	Culvert	1 BC (4.7 x 2.32)	Fair	0.89	Tertiary	10.42	13.90	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	851	Tipper Garage-Odo Ona Elewe	Culvert	1 CC (Dia 0.9) + 1 BC (2.05 x 1.85)	Fair	0.89	Tertiary	10.42	13.90	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	28	ODO-ONAELEWE / OJU-EKUN ROAD	Culvert	2 CC (Dia 1)	Fair	0.91	Secondary	10.58	14.10	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	841	Orita Challenge	Footpath		Good	0.94	Tertiary	10.80	14.40	Existing													
	869	ASABARI BRIDGE, IDI ODO/CHALLENGE, OLU AYOLA STREET	Culvert	2 BC (2.64 x 1.98)	Good	1.00	Tertiary	11.25	15.00	Existing													
On18 Lower Ona South	1187	OPERE PODO	Culvert	1 CC (Dia 0.96)	Poor		Tertiary			Proposed	Box Culvert	Natural Stream	1 Cv (1 x 1)	1.3	Dar	Masterplan	10	24	6240	3	4668	17,600	
	1195	ODO ONA KEKERE	Culvert	1 CC (Dia 0.9)	Poor		Highway			Proposed	Box Culvert	Natural Stream	1 Cv (1 x 1)	1.3	Dar	Masterplan	20	44	11440	6	8558	32,000	
	1504	Podo /Idi Ayunre	Culvert	1 CC (Dia 0.95)	Poor		Highway			Proposed	Box Culvert	Natural Stream	1 Cv (1 x 1)	1.3	Dar	Masterplan	20	44	11440	6	8558	32,000	
	1505	Toll Gate	Culvert	1 CC (Dia 0.95)	Fair		Expressway			Proposed	Box Culvert	Natural Stream	1 Cv (1 x 1)	1.3	Dar	Masterplan	40	84	21840	11	16338	62,400	
	1190	AYETORO VILLAGE	Culvert	1 CC (Dia 1)	Fair	0.10	Highway	1.50	2.00	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	20	55	14300	7	10698	40,000	
	1188	OPERE PODO	Culvert	1 CC (Dia 0.94)	Poor	0.11	Highway	1.65	2.20	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	20	55	14300	7	10698	40,000	
	1207	ARAPAJA/OD ONA KEKERE	Culvert	1 CC (Dia 0.46)	Fair	0.12	Tertiary	1.80	2.40	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	1193	ABA IBEJI	Natural Stream		Poor	0.18	Tertiary	2.70	3.60	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1206	ARAPAJA SIMISOLA	Culvert	2 CC (Dia 0.73)	Fair	0.20	Secondary	3.00	4.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1197	FOWOWE	Culvert	1 CC (Dia 0.8)	Poor	0.21	Secondary	3.15	4.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1219	ONO ONA KEKERE	Culvert	1 CC (Dia 0.72)	Fair	0.29	Secondary	4.35	5.80	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	1192	ABA IBEJI	Culvert	1 CC (Dia 0.76)	Poor	0.30	Tertiary	4.50	6.00	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	1184	ONIPON COMMUNITY PODO	Natural Stream		Poor	0.33	Tertiary	4.95	6.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	1191	ABA IBEJI	Culvert	1 CC (Dia 0.6)	Poor	0.42	Tertiary	6.30	8.40	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	1189	OPERE PODO	Culvert	1 CC (Dia 0.8)	Poor	0.60	Highway	8.25	11.00	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	20	104	27040	13	20228	76,800	
	1213	ORIIRE COMMUNITY	Natural Stream		Poor	0.65	Tertiary	8.62	11.50	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
On19 Lower Ona West	1182	ONIPON/ABA IBEJI	Culvert	1 CC (Dia 1.4)	Poor		Tertiary			Proposed	Box Culvert	Natural Stream	1 Cv (1 x 1)	1.3	Dar	Masterplan	10	24	6240	3	4668	17,600	
	1335	ONIPEPEYE	Culvert	1 BC (0.85 x 0.86)	Good	0.14	Tertiary	2.10	2.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1217	ODO ONA KEKERE	Culvert	2 CC (Dia 0.73)	Fair	0.14	Secondary	2.10	2.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1323	ALAWOYIN	Culvert	1 BC (1.14 x 1.07)	Good	0.16	Tertiary	2.40	3.20	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1179	ASUNLE AREA/ OJU EKUN ROAD	Natural Stream		Poor	0.18	Tertiary	2.70	3.60	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1326	AYEGUN OLEYO, ODO ONA	Culvert	1 BC (0.9 x 0.675)	Poor	0.22	Tertiary	3.30	4.40	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1331	UNITY ESTATE	Natural Stream		Fair	0.33	Tertiary	4.95	6.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	1327	ARIGBOJA	Footpath		Poor	0.42	Tertiary	6.30	8.40	Proposed	Box Culvert	Natural Stream	2 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	77	20020	10	14977	56,000	
	1175	BOLUWADURO ESTATE	Natural Stream		Poor	0.43	Tertiary	6.45	8.60	Proposed	Box Culvert	Natural Stream	2 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	77	20020	10	14977	56,000	
	1218	BOLUWADURO ESTATE	Natural Stream		Poor	0.46	Tertiary	6.90	9.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1328	ARIGBOJA	Natural Stream		Poor	0.48	Tertiary	7.20	9.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1332	UNITY ESTATE	Natural Stream		Fair	0.53	Tertiary	7.72	10.30	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1178	OJU EKUN AREA		1 CC (Dia 0.6)	Dilapidated	0.55	Secondary	7.88	10.50	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1176	IRE AKARI/ BOLUWADURO	Footpath		Poor	0.63	Tertiary	8.47	11.30	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1334	ABADA	Natural Stream		Poor	0.71	Tertiary	9.07	12.10	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1177	AJAKANGA/ABA IFE	Culvert	1 CC (Dia 0.72) + 1 BC (0.77 x 1.36)	Dilapidated	0.80	Secondary	9.75	13.00	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1205	ASAKA 2/ OJU EKUN	Culvert	1 CC (Dia 0.6)	Dilapidated	0.88	Secondary	10.35	13.80	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	1324	AYEGUN	Natural Stream			0.99	Tertiary	11.18	14.90	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	

Subbasin	Structure No.	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Condition	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Min. Vertical distance from road level to culvert invert level	Designed by	Status	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)
On20 Lowest Ona	1220	RATCON QUARRY				0.17	Tertiary	2.55	3.40	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	1208	SOKURO/APADABA	Culvert	1 CC (Dia 0.52)	Fair	0.35	Tertiary	5.25	7.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	1210	FAWE COMMUNITY	Culvert	1 CC (Dia 0.74)	Dilapidated	0.41	Tertiary	6.15	8.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	1209	LAGOS/IBADAN EXPRESS WAY	Culvert		Poor	4.14	Tertiary	34.80	46.40	Proposed	Box Culvert	Natural Stream	2 Cv (4.5 x 2)	2.6	Dar	Masterplan	10	164	42640	21	31898	120,000	
	1211	LAGOS/IBADAN EXPRESS WAY	Culvert	1 BC (1 x 1)	Fair	6.19	Expressway	47.72	63.63	Proposed	Box Culvert	Natural Stream	2 Cv (6 x 2)	2.6	Dar	Masterplan	40	656	170560	82	127592	478,400	
	1212	ALOMAJA ROAD			Fair	7.04	Highway	52.34	69.79	Proposed	Box Culvert	Natural Stream	1 Cv (7.5 x 2.5)	3.3	Dar	Masterplan	20	250	65000	31	48625	182,400	
On3 Odo Oba	1477	Amusan	Culvert	1 BC (2.2 x 1.1)	Poor	0.16	Highway	2.40	3.20	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	20	66	17160	8	12837	48,000	
	181	Moniya	Culvert		Dilapidated	0.24	Expressway	3.60	4.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	40	147	38220	18	28592	107,200	
	1490	Otun Agba Akin	Culvert	1 CC (Dia 0.88)	Fair	0.25	Highway	3.75	5.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	20	77	20020	10	14977	56,000	
	180	Otun Agbakin	Culvert	2 BC (2.93 x 1.51)	Good	0.28	Expressway	4.20	5.60	Existing													
	1498	Moniya	Culvert	2 BC (1.95 x 1.5)	Fair	0.33	Expressway	4.95	6.60	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1.5)	2.0	Dar	Masterplan	40	151	39260	19	29370	110,400	
	1478	Akinyele	Culvert	1 CC (Dia 0.8)	Poor	0.34	Highway	5.10	6.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1.5)	2.0	Dar	Masterplan	20	81	21060	10	15755	59,200	
	1474	Akinyele	Culvert	1 BC (2.6 x 1.5)	Fair	0.54	Expressway	7.80	10.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	40	194	50440	24	37733	142,400	
	1473	Akinyele	Culvert	1 BC (2.61 x 1.5)	Good	0.63	Expressway	8.47	11.30	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	40	194	50440	24	37733	142,400	
	1476	Kara	Culvert	1 CC (Dia 0.9)	Poor	0.64	Highway	8.55	11.40	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	20	115	29900	14	22368	84,800	
	1480	Jeje	Culvert	1 CC (Dia 0.65)	Good	0.65	Tertiary	8.62	11.50	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1485	Oniyere	Culvert	2 BC (2.7 x 2.17)	Fair	1.36	Expressway	13.95	18.60	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 2)	2.6	Dar	Masterplan	40	242	62920	30	47069	176,000	
	1486	Lapite	Culvert	1 CC (Dia 0.9)	Fair	1.71	Highway	16.58	22.10	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	20	144	37440	18	28008	105,600	
	1481	Akinyele	Culvert	2 BC (2.5 x 2)	Fair	1.88	Highway	17.85	23.80	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	20	144	37440	18	28008	105,600	
	1482	Akinyele	Culvert	2 BC (3.05 x 2.5)	Fair	1.92	Expressway	18.15	24.20	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	40	264	68640	33	51348	192,000	
	1483	Akinyele	Culvert	2 BC (2.48 x 2.44)	Erosion	2.05	Highway	19.12	25.50	Proposed	Box Culvert	Natural Stream	1 Cv (4.5 x 2)	2.6	Dar	Masterplan	20	156	40560	20	30342	113,600	
	1488	Akinyele	Culvert	1 BC (3.6 x 0.67)	Poor	2.79	Expressway	24.67	32.90	Proposed	Box Culvert	Natural Stream	2 Cv (4.5 x 1.5)	2.0	Dar	Masterplan	40	482	125320	60	93749	352,000	
	1489	Moniya	Culvert	1 BC (4 x 2.7)	Poor	3.76	Highway	31.95	42.60	Proposed	Box Culvert	Natural Stream	1 Cv (5 x 2.5)	3.3	Dar	Masterplan	20	188	48880	24	36566	137,600	
	1475	Akinyele	Culvert	1 BC (1.6 x 1.5)	Dilapidated	3.84	Secondary	32.55	43.40	Proposed	Box Culvert	Natural Stream	2 Cv (4.5 x 2)	2.6	Dar	Masterplan	10	164	42640	21	31898	120,000	
	1479	Akinyele	Culvert	2 BC (3.3 x 2.1)	Fair	5.06	Expressway	41.58	55.43	Proposed	Box Culvert	Natural Stream	1 Cv (6 x 2.5)	3.3	Dar	Masterplan	40	383	99580	48	74494	280,000	
	179	Otun Agbakin	Culvert	1 BC (1.64 x 1.6)	Poor	6.35	Highway	48.59	64.79	Proposed	Box Culvert	Natural Stream	2 Cv (6 x 2)	2.6	Dar	Masterplan	20	356	92560	45	69242	259,200	
	1484	Oloje	Culvert	1 BC (2.2 x 1.5)	Poor	9.30	Tertiary	78.53	104.70	Proposed	Box Culvert	Natural Stream	3 Cv (6 x 2)	2.6	Dar	Masterplan	10	300	78000	38	58350	219,200	
	1487	Oniyere	Culvert	2 BC (1.95 x 1.71)	Erosion	10.91	Tertiary	103.50	138.00	Proposed	Box Culvert	Natural Stream	3 Cv (7 x 2.5)	3.3	Dar	Masterplan	10	378	98280	47	73521	275,200	
	188	Dominican Centre	Culvert	1 BC (2.5 x 1.75)		36.23	Tertiary	213.00	284.00	Proposed	Bridge	Natural Stream	Br (65 x 10)		Dar	Masterplan	10						1,625,000
	183	Odo Oba	Culvert	2 CC (Dia 0.94)	Good	37.33	Main	213.00	284.00	Proposed	Bridge	Natural Stream	Br (65 x 20)		Dar	Masterplan	20						3,250,000
	160	Oke Oba	Natural Stream		Poor	38.03	Tertiary	220.88	294.50	Proposed	Bridge	Natural Stream	Br (65 x 10)		Dar	Masterplan	10						1,625,000
	1493	Alabata	Culvert	1 CC (Dia 0.88)	Fair	0.21	Main	3.15	4.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	20	77	20020	10	14977	56,000	
	1491	Molarere	Culvert	1 CC (Dia 0.9)	Fair	0.52	Main	7.65	10.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	20	104	27040	13	20228	76,800	
	1492	Agbedo	Culvert	1 CC (Dia 1.04)	Fair	0.57	Main	8.02	10.70	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	20	104	27040	13	20228	76,800	
	1579	Olorisa Oko	Culvert	1 CC (Dia 0.8)	Poor	1.63	Tertiary	15.97	21.30	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	10	84	21840	11	16338	62,400	

Subbasin	Structure No.	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Condition	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Min. Vertical distance from road level to culvert invert level	Designed by	Status	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)
On4 Upper Ona North	1494	Alaagba	Culvert	1 CC (Dia 0.75)	Good	1.81	Tertiary	17.32	23.10	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	10	84	21840	11	16338	62,400	
	1580	Olorisa Oko	Culvert	2 CC (Dia 0.45)	Good	1.83	Secondary	17.48	23.30	Proposed	Box Culvert	Natural Stream	2 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	118	30680	15	22951	86,400	
	1495	Idi Oke	Natural Stream		Poor	6.89	Tertiary	51.53	68.70	Proposed	Box Culvert	Natural Stream	4 Cv (4.5 x 1.5)	2.0	Dar	Masterplan	10	276	71760	35	53682	201,600	
	1496	Seriki	Culvert		Fair	14.10	Secondary	101.25	135.00	Proposed	Box Culvert	Natural Stream	5 Cv (6 x 2)	2.6	Dar	Masterplan	10	488	126880	61	94916	355,200	
	1497	Idi Oroko	Culvert	1 CC (Dia 0.6)	Poor	22.52	Tertiary	143.63	191.50	Proposed	Box Culvert	Natural Stream	7 Cv (6 x 2)	2.6	Dar	Masterplan	10	676	175760	85	131482	492,800	
	161	Idiroko	Culvert	2 CC (Dia 0.9)	Poor	23.91	Tertiary	151.50	202.00	Proposed	Box Culvert	Natural Stream	7 Cv (6 x 2)	2.6	Dar	Masterplan	10	676	175760	85	131482	492,800	
On5 Alapata North	471	Ajibade	Culvert	1 CC (Dia 0.6)	Good	1.81	Secondary	17.32	23.10	Proposed	Box Culvert	Natural Stream	2 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	118	30680	15	22951	86,400	
	454	Araromi	Culvert	1 BC (1.36 x 1.2)	Poor	7.14	Secondary	52.89	70.51	Proposed	Box Culvert	Natural Stream	2 Cv (6 x 2)	2.6	Dar	Masterplan	10	206	53560	26	40067	150,400	
	455	Araromi	Culvert	2 CC (Dia 0.9)	Fair	7.53	Main	55.01	73.34	Proposed	Box Culvert	Natural Stream	2 Cv (6 x 2)	2.6	Dar	Masterplan	20	356	92560	45	69242	259,200	
	456	Araromi	Culvert	4 CC (Dia 0.83)	Fair	16.19	Main	102.10	136.13	Proposed	Box Culvert	Natural Stream	5 Cv (6 x 2)	2.6	Dar	Masterplan	20	848	220480	106	164936	617,600	
On6 Upper Ona West	197	Oja Agbe	Culvert	2 BC (2 x 1.59)	Fair		Tertiary			Proposed	Box Culvert	Natural Stream	1 Cv (1 x 1)	1.3	Dar	Masterplan	10	24	6240	3	4668	17,600	
	531	IITA	Culvert	1 CC (Dia 0.8)	Fair		Tertiary			Proposed	Box Culvert	Natural Stream	1 Cv (1 x 1)	1.3	Dar	Masterplan	10	24	6240	3	4668	17,600	
	78D	AYETORO LANDLORDS ASSOCIATION	Natural Stream			0.02	Tertiary	0.34	0.46	Proposed	Box Culvert	Natural Stream	1 Cv (1 x 1)	1.3	Dar	Masterplan	10	24	6240	3	4668	17,600	
	528	IITA	Culvert	1 BC (0.95 x 0.7)	Good	0.14	Tertiary	2.10	2.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	532	IITA Dam Road	Culvert	1 CC (Dia 0.6)	Fair	0.15	Tertiary	2.25	3.00	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	185	Elebu	Culvert	2 CC (Dia 0.5)	Good	0.20	Main	3.00	4.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	20	77	20020	10	14977	56,000	
	529	IITA	Culvert	1 CC (Dia 0.77)	Good	0.21	Tertiary	3.15	4.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	194	Oluana Village	Culvert	2 CC (Dia 0.9)	Poor	0.28	Tertiary	4.20	5.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	198	Abanise	Culvert	2 CC (Dia 0.6)	Fair	0.28	Tertiary	4.20	5.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	174	Oluana	Natural Stream		Erosion	0.29	Tertiary	4.35	5.80	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	199	Lagbe	Natural Stream		Erosion	0.35	Tertiary	5.25	7.00	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	196	Odo Igbo	Culvert	1 BC (12.5 x 1.9)	Fair	0.37	Tertiary	5.55	7.40	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	533	IITA	Culvert	1 CC (Dia 0.8)	Good	0.38	Tertiary	5.70	7.60	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	534	IITA	Culvert	1 CC (Dia 0.8)	Good	0.38	Tertiary	5.70	7.60	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	195	Odo Igbo	Culvert	1 CC (Dia 0.85)	Dilapidated	0.40	Tertiary	6.00	8.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	531 Prime	IITA	Culvert	2 CC (Dia 0.69)	Good	0.42	Tertiary	6.30	8.40	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	176	IITA	Culvert	1 BC (2.5 x 1.5)	Fair	0.44	Highway	6.60	8.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	20	92	23920	12	17894	67,200	
	530 Prime	IITA Dam Road	Culvert	1 CC (Dia 0.85)	Good	0.44	Tertiary	6.60	8.80	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	182	Moniya	Culvert	1 BC (1.8 x 1.51)	Good	0.46	Expressway	6.90	9.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	40	194	50440	24	37733	142,400	
	162	Asanjanna	Culvert	2 CC (Dia 0.8)	Good	0.48	Tertiary	7.20	9.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	535	IITA	Culvert	1 CC (Dia 0.6) + 1 BC (0.9 x 0.98)	Good	0.48	Tertiary	7.20	9.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	170	Isaleawero Okeodo	Culvert	2 BC (1.25 x 1.1)	Poor	0.51	Tertiary	7.57	10.10	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	177	Akingbile	Culvert	1 CC (Dia 0.57)	Fair	0.51	Highway	7.57	10.10	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	20	104	27040	13	20228	76,800	
	532 Prime	IITA Dam Road	Culvert	2 CC (Dia 0.6)	Good	0.52	Tertiary	7.65	10.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	193	Oyerinde-Olukotun	Footpath		Erosion	0.53	Tertiary	7.72	10.30	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	163	Asanjanna	Natural Stream		Erosion	0.56	Tertiary	7.95	10.60	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	169	Isaleawero Okeodo	Natural Stream		Erosion	0.58	Tertiary	8.10	10.80	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	168	Dagbolu	Culvert	1 BC (1.8 x 0.95)	Good	0.72	Tertiary	9.15	12.20	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	480	Baale Agbe	Culvert	3 BC (3.74 x 0.7)		1.09	Tertiary	11.93	15.90	Proposed	Box Culvert	Natural Stream	1 Cv (4.5 x 1.5)	2.0	Dar	Masterplan	10	78	20280	10	15171	57,600	
	175	IITA	Culvert	4 CC (Dia 0.6)	Poor	1.30	Tertiary	13.50	18.00	Proposed	Box Culvert	Natural Stream	1 Cv (4.5 x 1.5)	2.0	Dar	Masterplan	10	78	20280	10	15171	57,600	
	1499	Idi Ose	Culvert	4 CC (Dia 0.5)	Poor	1.30	Tertiary	13.50	18.00	Proposed	Box Culvert	Natural Stream	1 Cv (4.5 x 1.5)	2.0	Dar	Masterplan	10	78	20280	10	15171	57,600	
	174 prime	Oluana	Culvert	1 BC (1.05 x 0.03)	Dilapidated	2.02	Tertiary	18.90	25.20	Proposed	Box Culvert	Natural Stream	1 Cv (4.5 x 2)	2.6	Dar	Masterplan	10	91	23660	11	17700	67,200	
	190	Akinbile Oluana	Culvert		Poor	2.40	Tertiary	21.75	29.00	Proposed	Box Culvert	Natural Stream	2 Cv (4.5 x 1.5)	2.0	Dar	Masterplan	10	144	37440	18	28008	105,600	
	477	IITA	Culvert	2 BC (2.85 x 1.95)	Good	87.69	Tertiary	411.00	548.00	Proposed	Bridge	Natural Stream	Br (90 x 10)		Dar	Masterplan	10						2,250,000
	478	IITA	Culvert	6 BC (3.2 x 0.97)	Poor	95.84	Tertiary	435.75	581.00	Proposed	Bridge	Natural Stream	Br (90 x 10)		Dar	Masterplan	10						2,250,000

Subbasin	Structure No.	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Condition	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Min. Vertical distance from road level to culvert invert level	Designed by	Status	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)
On7 Upper Ona East	449	Agbede	Culvert		Poor	0.11	Tertiary	1.65	2.20	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	225	Otiko	Natural Stream		Poor	0.16	Tertiary	2.40	3.20	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	226	Eyinolu	Natural Stream		Fair	0.17	Tertiary	2.55	3.40	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	224	Alaja	Footpath		Erosion	0.25	Tertiary	3.75	5.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	120	Arulogun	Culvert	1 CC (Dia 0.8)	Fair	0.27	Main	4.05	5.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	20	88	22880	11	17116	64,000	
	223	Orieni	Natural Stream		Erosion	0.34	Main	5.10	6.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1.5)	2.0	Dar	Masterplan	20	81	21060	10	15755	59,200	
	450	Agbede	Culvert	2 CC (Dia 0.6)	Good	0.40	Tertiary	6.00	8.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	227	Balogun	Culvert	1 CC (Dia 0.35)	Poor	0.47	Tertiary	7.05	9.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	207	Seriki	Culvert	1 CC (Dia 0.65) + 1 BC (1.7 x 1.2)	Good	0.55	Tertiary	7.88	10.50	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	213	Eyinolu	Natural Stream		Poor	0.81	Tertiary	9.83	13.10	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	447	Oloyin-Onilu	Culvert	1 CC (Dia 0.8)	Good	1.50	Main	15.00	20.00	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 2)	2.6	Dar	Masterplan	20	132	34320	17	25674	96,000	
	216	Dabiri	Natural Stream		Good	62.24	Secondary	294.75	393.00	Proposed	Bridge	Natural Stream	Br (75 x 10)		Dar	Masterplan	10						1,875,000
	215	Yanjuade Aroro	Natural Stream		Good	67.94	Secondary	314.25	419.00	Proposed	Bridge	Natural Stream	Br (80 x 10)		Dar	Masterplan	10						2,000,000
On8 Upper Ona South	514	IITA	Culvert	1 BC (3.4 x 1.9)	Fair	0.10	Tertiary	1.50	2.00	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	504	Shasha	Culvert	1 BC (1.6 x 1.5)	Fair	0.14	Highway	2.10	2.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	20	66	17160	8	12837	48,000	
	539	Arulogun	Natural Stream		Poor	0.14	Tertiary	2.10	2.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	562	Mercy Estate	Footpath		Poor	0.14	Tertiary	2.10	2.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	503	Shasha	Culvert	1 BC (1.51 x 0.93)	Poor	0.19	Tertiary	2.85	3.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	538	Gospel Time Estate	Culvert	1 CC (Dia 0.8)	Fair	0.20	Tertiary	3.00	4.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	564	Barack	Culvert	1 CC (Dia 0.9)	Good	0.21	Tertiary	3.15	4.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	541	sagbe	Culvert	2 CC (Dia 0.75)	Good	0.23	Tertiary	3.45	4.60	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	559	Abutu	Culvert	1 CC (Dia 0.8)	Fair	0.23	Main	3.45	4.60	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	20	77	20020	10	14977	56,000	
	577	Ojoo	Culvert	1 CC (Dia 0.8)	Fair	0.23	Main	3.45	4.60	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	20	77	20020	10	14977	56,000	
	542	Sagbe	Footpath		Poor	0.25	Tertiary	3.75	5.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	563	Goodness Estate Ojoo	Culvert	1 BC (1.9 x 1.44)	Good	0.27	Tertiary	4.05	5.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	558	Gospel Time Estate	Natural Stream		Poor	0.33	Tertiary	4.95	6.60	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1.5)	2.0	Dar	Masterplan	10	46	11960	6	8947	33,600	
	557	White House area	Natural Stream		Poor	0.36	Tertiary	5.40	7.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	543	sagbe	Culvert	1 BC (8.2 x 3.24)	Poor	0.41	Tertiary	6.15	8.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	505	Shasha	Culvert	1 BC (3.2 x 2.82)	Fair	0.45	Tertiary	6.75	9.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	506	Abatakan	Natural Stream		Erosion	0.51	Tertiary	7.57	10.10	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	513	Sagbe	Footpath		Poor	0.54	Tertiary	7.80	10.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	512	Sagbe	Culvert	1 CC (Dia 0.6) + 1 BC (0.75 x 0.6)	Fair	0.61	Tertiary	8.33	11.10	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	548	Arulogun	Culvert	1 CC (Dia 1.2)	Poor	0.61	Main	8.33	11.10	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Pheman	Going For Bid							
	510	IITA	Culvert	1 BC (3.3 x 1)	Good	0.67	Tertiary	8.78	11.70	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	556	Abutu	Culvert		Dilapidated	0.67	Secondary	8.78	11.70	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	576	Abutu	Natural Stream		Poor	0.67	Secondary	8.78	11.70	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	208	UCH Quarters	Footpath		Fair	0.69	Tertiary	8.92	11.90	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	508	IITA	Culvert	1 BC (1.2 x 1.17)	Good	0.73	Tertiary	9.23	12.30	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	509	IITA	Natural Stream		Good	0.73	Tertiary	9.23	12.30	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
On9 Orogun	515		Culvert	1 BC (1.6 x 1.6)	Poor		Tertiary			Proposed	Box Culvert	Natural Stream	1 Cv (1 x 1)	1.3	Dar	Masterplan	10	24	6240	3	4668	17,600	
	516	Supper	Culvert	1 BC (2 x 1.12)	Poor	0.10	Tertiary	1.50	2.00	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	517		Natural Stream		Poor	0.10	Tertiary	1.50	2.00	Proposed	Box Culvert	Natural Stream	1 Cv (1.5 x 1)	1.3	Dar	Masterplan	10	30	7800	4	5835	22,400	
	518	Ojoo	Natural Stream		Poor	0.14	Tertiary	2.10	2.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	518 Prime	Ojoo	Culvert	1 BC (3.1 x 1.6)	Fair	0.16	Tertiary	2.40	3.20	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	569	Barack	Culvert	1 CC (Dia 0.9)	Good	0.16	Tertiary	2.40	3.20	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	568	Barack	Culvert	1 CC (Dia 0.9)	Fair	0.17	Tertiary	2.55	3.40	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	666	Ojokondo				0.18	Tertiary	2.70	3.60	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	673	Orogun-Ojo	Culvert	1 BC (3 x 1.82)	Good	0.19	Tertiary	2.85	3.80	Existing													
	519 Prime	Ojoo	Culvert	1 BC (1.9 x 1.4)	Fair	0.19	Tertiary	2.85	3.80	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1)	1.3	Dar	Masterplan	10	36	9360	5	7002	27,200	
	519	Ojoo	Culvert	1 BC (3.38 x 0.8)	Fair	0.20	Tertiary	3.00	4.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	671	30/30 Sawmill	Culvert	3 Cells (Dia 0.78)	Fair	0.23	Tertiary	3.45	4.60	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1500	Ojoo	Culvert	2 BC (2.5 x 2.55)	Fair	0.25	Tertiary	3.75	5.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	672	Orogun-Ojo	Culvert	1 BC (1.6 x 1.13)	Fair	0.26	Tertiary	3.90	5.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	691	Aduloju	Culvert	1 CC (Dia 0.9)	Fair	0.27	Tertiary	4.05	5.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	570	Barack	Culvert	1 BC (1.92 x 1.55)	Good	0.29	Tertiary	4.35	5.80	Existing													
	566	Barack	Culvert	1 CC (Dia 0.9)	Fair	0.30	Tertiary	4.50	6.00	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	665	Ojokondo	Culvert	1 BC (2.2 x 1.74)	Good	0.31	Tertiary	4.65	6.20	Existing													
	669	Bodija	Culvert	1 BC (3.35 x 1.38)	Good	0.31	Tertiary	4.65	6.20	Existing													
	571	Barack	Culvert	1 CC (Dia 0.9)	Fair	0.32	Tertiary	4.80	6.40	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1.5)	2.0	Dar	Masterplan	10	46	11960	6	8947	33,600	
	664	Agbegba	Footpath		Poor	0.33	Tertiary	4.95	6.60	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1.5)	2.0	Dar	Masterplan	10	46	11960	6	8947	33,600	
	663	Agbegba	Culvert	1 BC (1.11 x 1.23)	Fair	0.35	Tertiary	5.25	7.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	682	Kajola	Culvert	1 CC (Dia 0.33)	Poor	0.37	Tertiary	5.55	7.40	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1)	1.3	Dar	Masterplan	10	48	12480	6	9336	35,200	
	662	Agbowo	Culvert	1 BC (2.05 x 1.35)	Fair	0.40	Tertiary	6.00	8.00	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	690	Aduloju	Culvert	2 BC (1.15 x 1.97)	Good	0.41	Tertiary	6.15	8.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	491	University of Ibadan	Culvert	2 BC (2.85 x 1.95)	Good	0.47	Main	7.05	9.40	Existing													
	670	30/30 Bodija	Culvert	1 CC (Dia 0.9) + 1 BC (1.8 x 0.88)	Fair	0.55	Tertiary	7.88	10.50	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	

Subbasin	Structure No.	Location	Existing Crossing Structure Type	Existing Crossing Structure Dimensions	Condition	Catchment Area (km2)	Cross Road Classification	25 Yrs Flow (m3/s)	100 Yrs Flow (m3/s)	Structure Status	Proposed Crossing Structure Type	Design Based on	Proposed Crossing Structure Dimensions	Min. Vertical distance from road level to culvert invert level	Designed by	Status	Barrel Length or Bridge Width (m)	Total Conc. Volume (m3)	Concrete Cost (USD)	Steel Weight (ton)	Steel Cost (USD)	Cost of Culvert (USD)	Cost of Bridge (USD)
	635	Agbowo	Culvert	1 BC (2.66 x 1.33)	Fair	0.62	Tertiary	8.40	11.20	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	631	Orogun/adediran junction	Culvert	1 BC (2.96 x 1.67)	Fair	0.70	Highway	9.00	12.00	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	20	115	29900	14	22368	84,800	
	689	Ajao off Ojo road	Culvert	2 CC (Dia 0.8)	Good	0.73	Tertiary	9.23	12.30	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	688	Jakan Ajao	Culvert	1 BC (1.37 x 0.57)	Poor	0.75	Tertiary	9.38	12.50	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	687	Jakan Ajao	Culvert	1 BC (1.93 x 1.17)	Good	0.79	Tertiary	9.68	12.90	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	686	Jakan Ajao	Natural Stream		Poor	0.82	Tertiary	9.90	13.20	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	685	Jakan Ajao	Culvert	1 BC (1.3 x 1.07)	Fair	0.85	Tertiary	10.13	13.50	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	684	Jakan	Culvert	1 BC (1.15 x 1.05)	Fair	0.87	Tertiary	10.28	13.70	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	683	Irepodun Ojo road	Culvert	1 BC (1.67 x 1.5)	Fair	0.89	Tertiary	10.42	13.90	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	632	Ajibode	Culvert	2 CC (Dia 1.2)	Fair	0.90	Main	10.50	14.00	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	20	127	33020	16	24702	92,800	
	572	Barack	Culvert	1 BC (2.1 x 1.85)	Fair	0.95	Tertiary	10.87	14.50	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	1076	Orisunbare	Culvert	1 CC (Dia 0.75)	Poor	0.22	Tertiary	3.30	4.40	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1)	1.3	Dar	Masterplan	10	42	10920	5	8169	32,000	
	1079	Apata Area	Culvert	1 BC (2.5 x 0.75)	Fair	0.33	Tertiary	4.95	6.60	Proposed	Box Culvert	Natural Stream	1 Cv (2 x 1.5)	2.0	Dar	Masterplan	10	46	11960	6	8947	33,600	
	1075	Orisunbare	Natural Stream		Poor	0.41	Tertiary	6.15	8.20	Proposed	Box Culvert	Natural Stream	1 Cv (2.5 x 1.5)	2.0	Dar	Masterplan	10	52	13520	7	10114	38,400	
	1074	Orisunbare	Natural Stream		Poor	0.50	Tertiary	7.50	10.00	Proposed	Box Culvert	Natural Stream	1 Cv (3 x 1.5)	2.0	Dar	Masterplan	10	59	15340	7	11476	43,200	
	1068	Akintola Adelumo Village	Culvert	1 BC (1.85 x 0.85)	Poor	0.78	Tertiary	9.60	12.80	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1073	Ire akari Estate	Culvert	2 BC (1.2 x 0.85)	Fair	0.83	Tertiary	9.97	13.30	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1072	Ire akari Estate	Natural Stream		Poor	0.86	Tertiary	10.20	13.60	Proposed	Box Culvert	Natural Stream	1 Cv (3.5 x 1.5)	2.0	Dar	Masterplan	10	65	16900	8	12643	48,000	
	1070	Amugbekun	Culvert	1 BC (1.25 x 1.37)	Fair	0.88	Tertiary	10.35	13.80	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	1071	Apata Area	Culvert	1 BC (1.3 x 1.2)	Fair	0.88	Tertiary	10.35	13.80	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	72	18720	9	14004	52,800	
	1067	Olude	Culvert	2 CC (Dia 0.68)		1.17	Tertiary	12.52	16.70	Proposed	Box Culvert	Natural Stream	1 Cv (4.5 x 1.5)	2.0	Dar	Masterplan	10	78	20280	10	15171	57,600	
	1078	Ibode Igbo	Culvert	1 BC (2.7 x 2.3)	Good	1.81	Tertiary	17.32	23.10	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	10	84	21840	11	16338	62,400	
Iddo Basin	41D1	BETHEL ESTATE LANDLORD AND LANDLADIES ASSOCIATION ABEOKUTA EXPRESSWAY BODE IGBO, APATA, IBADAN OYO STATE	Pipe Culvert	2 CC (Dia 0.75)	Good	1.86	Tertiary	17.70	23.60	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	10	84	21840	11	16338	62,400	
	1069	Panada	Culvert	2 CC (Dia 0.75)	Good	1.86	Tertiary	17.70	23.60	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	10	84	21840	11	16338	62,400	
	1077	Ibode Igbo	Culvert	1 CC (Dia 0.9)	Good	1.99	Highway	18.68	24.90	Proposed	Box Culvert	Natural Stream	1 Cv (4.5 x 2)	2.6	Dar	Masterplan	20	156	40560	20	30342	113,600	
	41D2	BETHEL ESTATE LANDLORD AND LANDLADIES ASSOCIATION ABEOKUTA EXPRESSWAY BODE IGBO, APATA, IBADAN OYO STATE	Natural Stream		Poor	4.82	Tertiary	39.90	53.20	Proposed	Box Culvert	Natural Stream	2 Cv (5 x 2)	2.6	Dar	Masterplan	10	178	46280	22	34621	129,600	
	1506	Ibadan Abeokuta Express	Culvert	1 BC (1 x 1)	Fair	5.81	Highway	45.65	60.87	Proposed	Box Culvert	Natural Stream	2 Cv (6 x 2)	2.6	Dar	Masterplan	20	356	92560	45	69242	259,200	
	65D	OKE-ADO IGISOGBA/ANISERE/ARETU/ALARABA COMMUNITY,OMI ADIO	Footpath		Poor	100.72	Tertiary	375.68	500.90	Proposed	Bridge	Natural Stream	Br (85 x 10)		Dar	Masterplan	10						2,125,000
	1396	AGUSI FATUMO	Culvert	1 BC (2.95 x 2.67)	Poor	1.94	Highway	18.30	24.40	Proposed	Box Culvert	Natural Stream	1 Cv (4 x 2)	2.6	Dar	Masterplan	20	144	37440	18	28008	105,600	
	1397	ARIJE	Culvert	1 CC (Dia 0.9)	Fair	2.00	Tertiary	18.75	25.00	Proposed	Box Culvert	Natural Stream	1 Cv (4.5 x 2)	2.6	Dar	Masterplan	10	91	23660	11	17700	67,200	
Osun Basin	1398	ARIJE	Natural Stream		Fair	2.15	Tertiary	19.88	26.50	Proposed	Box Culvert	Natural Stream	2 Cv (4 x 1.5)	2.0	Dar	Masterplan	10	131	34060	16	25480	96,000	
	1399	ARIJE/ERUNMU	Natural Stream		Poor	3.06	Tertiary	26.70	35.60	Proposed	Box Culvert	Natural Stream	2 Cv (4.5 x 1.5)	2.0	Dar	Masterplan	10	144	37440	18	28008	105,600	
																						44,043,200	**17,000,000**

Annex

13

Damage Losses Evaluation

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1 Asset Valuation and Classification

An essential part for the assessment of risks and vulnerabilities of physical and social structures is the identification and valuation of an inventory of objects and assets exposed to a certain hazard. Figure 1.1 gives a schematic overview of the interplay of hazard, exposure and vulnerability in the case of flood-risk. In this respect, the Consultant initiated the asset valuation and classification for buildings lying in the flood plains of Ibadan.

The developed hydrodynamic model is used to identify the inundated buildings. Next, buildings are classified according to a building value category such as low, medium and high building value categories. Next, all buildings information are collected in a geodatabase. Finally, buildings are assessed in terms of cash flow.

More information on the buildings survey and data collection are presented in the Development of Asset Valuation, Classification & GIS Database and Catalogue Report; "**N17036-0100D-RPT-ENV-07 REV 0**".

The procedure of asset valuation and classification is divided into the following steps:

1- Data Collection
2- Classification of Assets
3- Asset Valuation

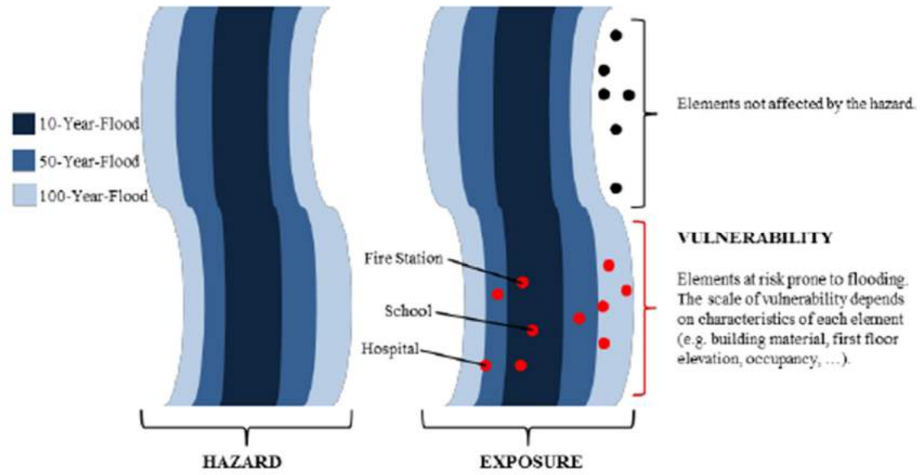

Figure 1.1: Flood Risk as the synergy of Hazard, Exposure and Vulnerability. Adapted from (Merz & Thieken 2004)

1.1 Data Collection

Using a high-resolution satellite imagery captured by Pléaides satellite (Airbus) in November and December 2015, the footprint of existing buildings falling within the river flood extent are digitized. Survey sheets were prepared accordingly, and field surveys were completed. Sample of the survey sheets are given in Figure 1.2.

Following the aerial survey conducted in January 2018 for Ibadan, all buildings lying in the floodplain were digitized once again to match the new imagery. The footprint of buildings was drawn to match correctly the shape of the buildings, refer to Figure 1.3.

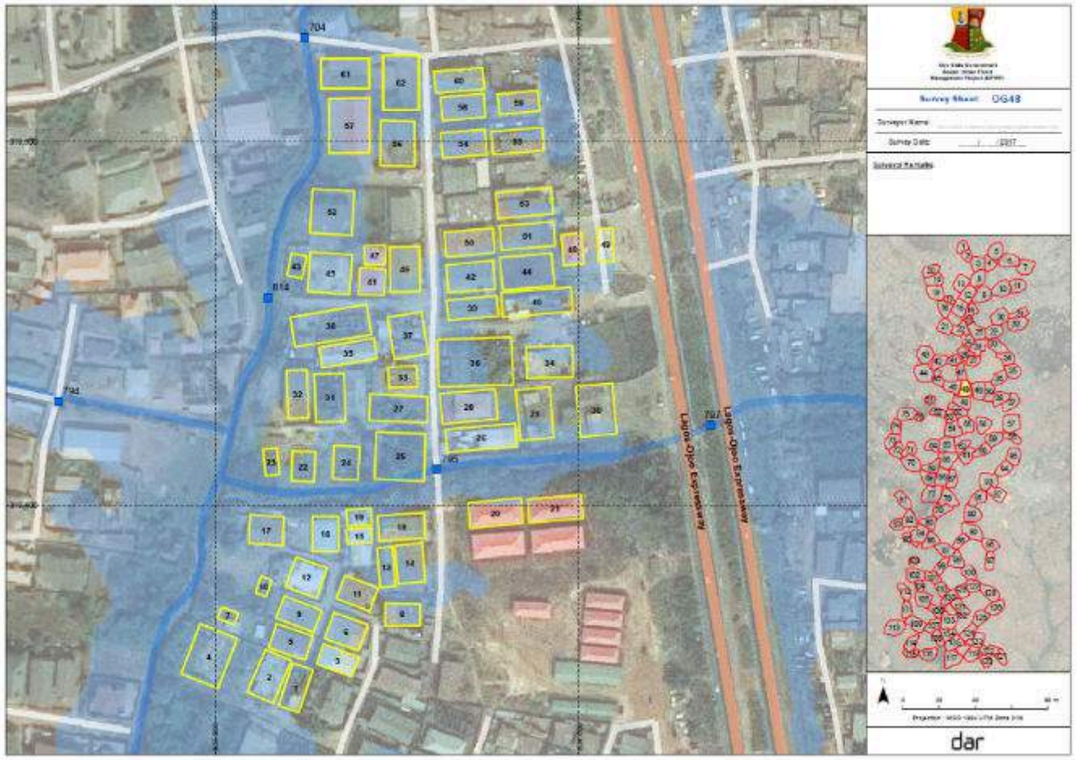

Figure 1.2: Buildings Survey Sample Sheet – Imagery 2015

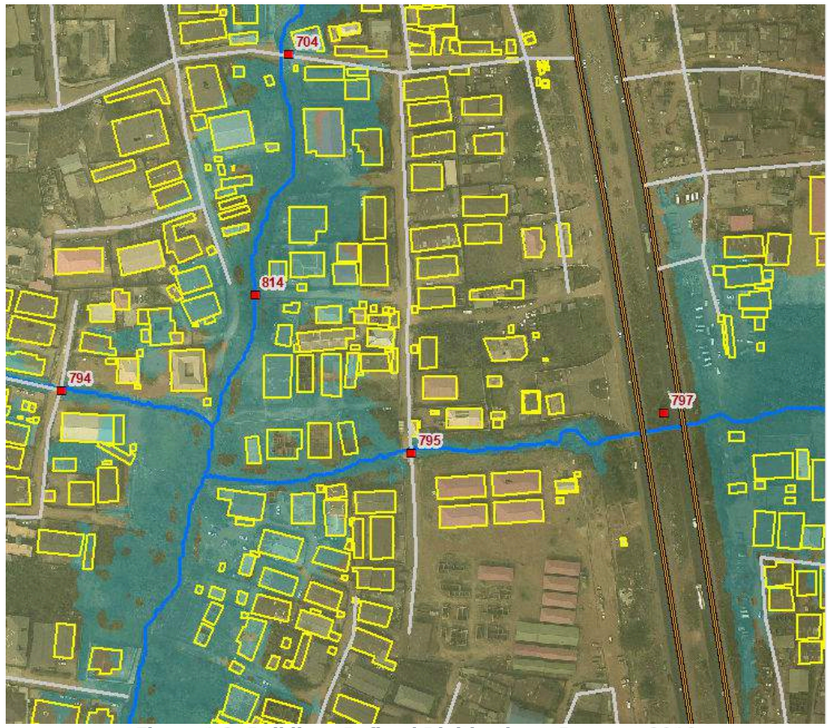

Figure 1.3: Buildings Refined Digitization – Imagery 2018

1.2 Classification of Assets

1.2.1 Buildings

The aim of the asset classification is to organize available asset information in a database and classify the assets for risk analysis purposes. The classification system is prepared to distinguish between type of buildings and their principal use such as:

- Residential,
- Commercial,
- Governmental,
- Educational,
- Religious,
- Under Construction
- Vacant, etc.

Special attention is given to lifeline infrastructure, such as critical roads, bridges, hospitals, schools...etc. Classification of buildings includes the identification of number of floors and construction materials such as:

- Brick,
- Cement Block,
- Concrete,
- Corrugated Iron,
- Mud
- Timber

Classification of buildings includes the observed building condition (good, fair, poor or dilapidated).

Finally, buildings are classified according to a building value category such as low, medium and high building value categories. To be able to distinguish between these categories, the Consultant initiated a pre-survey to several existing buildings in Ibadan. The pre-survey revealed 6 separate categories as follows:

1- High Building Value (Modern Style)
2- High Building Value (Old Style)
3- Medium Building Value (Bungalow)
4- Medium Building Value (Storeys)
5- Low Building Value (Poor)
6- Low Building Value (Dilapidated)

The Building Value Classification and their respective specifications are presented in Table 1.1. Samples of these building conditions are presented in Figure 1.4.

Table 1.1: Building Value Classification and their Specifications

Building Value Classification	Specifications
High Building Value (Modern or Old Style)	Built or refurbished within the last years or with clear signs of regular upkeep/maintenance. Very comfortable and aspirational or desirable standards with full services, possibly with own supply (electricity, water, etc.).Fully functional modern sanitary facilities.
Medium Building Value (Bungalow or Storeys)	Buildings in reasonable state of repair, habitable dwellings with comfortable conditions with access to water, electricity and refuse collection although not necessarily constant.
Poor Building Value	Fairly unsanitary although acceptable conditions for living, with access to general infrastructure (water and electricity potentially).In need of maintenance. Generally undesirable.
Dilapidated	Widespread overcrowding, poor sanitation and dilapidated housing. Presents significant health hazards and generally unacceptable living or working conditions. No infrastructure and insalubrious conditions.

High Value Category (Modern Style)

High Value Category (Old Style)

Medium Value Category (Storeys)

Medium Value Category (Bungalow)

Low Value Category (Poor)

Low Value Category (Dilapidated)

Figure 1.4: Sample of Building Values Classification

1.2.2 Roads and Railway

Within the built-up area of Ibadan, the road network is currently structured around a series of radial roads which link the outlying areas with the urban core of the city. The Lagos-Nguru railway line crosses roads at-grade crossings.

The roads are classified into principal, primary, secondary and local roads.

- Principal Roads: roads of regional or national significance that connect the major economic centres of the state and those centres to the national road network. They will often be *Expressways*, with restrictions on access and prohibitions on stopping, an example of principle roads in Ibadan is the E1 Lagos-Ojoo Expressway;
- Primary Roads: these connect the main urban areas within the State and main economic centres within the city and link these areas to the Principal Road network. They will often be *Highways* and may range in standard from two-lane single carriageway roads to multi-lane dual carriageways; an example of primary roads in Ibadan is the A5 Queen Elizabeth II road.
- Collector Roads: these collect traffic within urban and rural areas and feed that traffic onto the Primary or Principal Road networks. They will often be *Main Roads and Secondary Roads* with normally two-lane roads but may be of a higher standard where traffic demands are high; an example of collector roads in Ibadan is the Parliament road.
- Local Roads: these provide access to neighbourhoods and to individual sites, they will often be *Tertiary Roads.*

Figure 1-5 shows the existing road hierarchy in Ibadan

Each road has certain characteristics regarding its width and material used to construct this road. Road widths vary from 6m in some local roads in Ibadan and up to 32m in expressways. The thickness and types of materials used in construction such as wearing asphalt surface and aggregate base course and subbase course vary according to the type of road classification. Most of the local roads are not finished with a wearing asphalt surface and lack many road construction requirements such as concrete curbs, road divider, paving blocks, side ditches and road signs.

The geodatabase presents an inventory of all the roads in Ibadan along with their 4 types of classification.

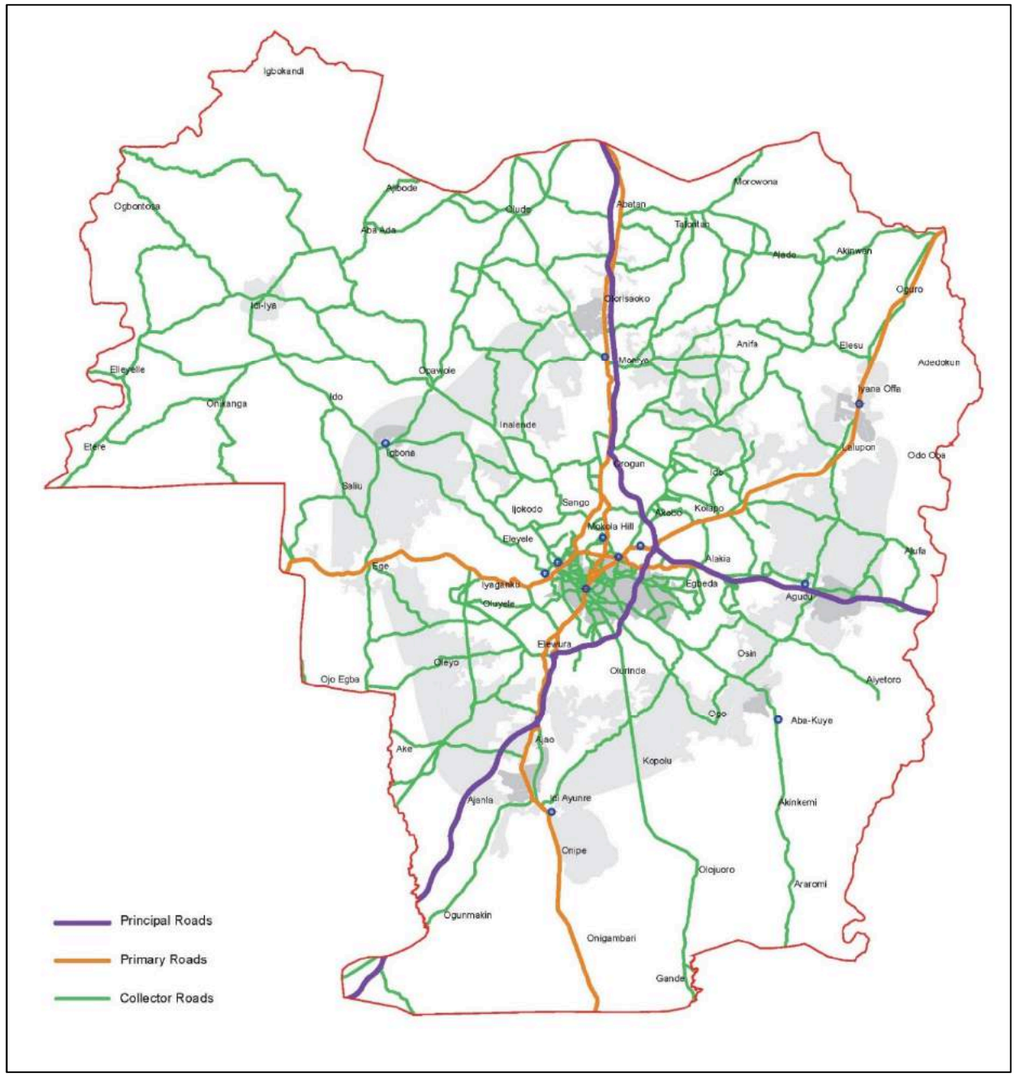

Figure 1-5: Existing Road Hierarchy

1.2.3 Infrastructure

Water Supply, Sewage and Irrigation Networks

Ibadan is supplied from two main water sources, these are Asejire Dam and Eleyele Dam as well as groundwater wells (boreholes) scattered within the project area. Not all households are connected to the existing water supply networks. Treated water is not supplied at all times due to insufficient power supply and consequently the non-operational booster stations. Distribution pipes also need rehabilitation, replacement or realignment due to their old age and due to their location with respect to existing and planned roads and developments

Currently, transmission mains and distribution networks of ductile Iron and HDPE materials, of various pipe diameters exist. Few sewage networks are laid underground ages ago, however they were never connected to domestic and non-domestic plots to collect their wastewater/sewage flows. Also, there are no fire and irrigation networks within Ibadan City, and there is definitely no need for designing an irrigation network due to the heavy rain season almost all year long.

Power Supply and Distribution

Electrical works in Ibadan include Medium Voltage (MV), Low Voltage (LV) distribution networks, in addition to street lighting installations and building service installations including indoor lighting installations.

The power supply situation in Nigeria is characterized by inadequate generation and inefficient transmission and distribution.

In Nigeria, 11 and 33 kV are used in the public system. Distribution transformers step down voltage from 11/33kV to 415V.

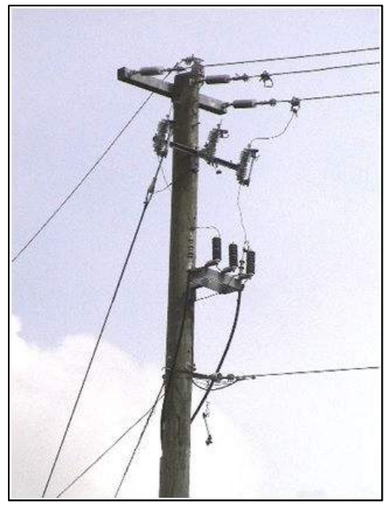

Figure 1-6: Example of the medium voltage cables in Ibadan

Medium voltage network comprises 11kV network and 11/0.415 kV pole-mounted distribution transformers

Low voltage network comprises LV overhead cables from pole mounted transformers to each house / facility building

Telecommunications Network

There is a shortage of information on the existing telecommunication network installed in Ibadan. Some general information about the existing network in Nigeria shows that Ibadan is almost covered with the GSM network.

1.3 Asset valuation

Asset valuation is the process of assessing the value of a real property or a building in terms of cash flow.

1.3.1 Buildings

Based on the pre-survey classification, the Consultant collected information on asset values in Ibadan for buildings and lands affected by flood damages in terms of Naira per square meter. Table 1.2 shows the cost estimate rates for structures.

Table 1.2: Cost Estimate Rates for Buildings

Building Type	Building Condition	Classification	Cost Estimation per m^2	
			Naira	USD
High	Good	Old	40,000	135
		Modern	45,000	150
Medium	Fair	Storey	30,000	100
		Bungalow	20,000	70
Low	Poor		15,000	50
	Dilapidated		5,000	20

The cost rates for assets and lands were used to determine the values for tenants occupying buildings in the floodplains. The following steps are followed to prepare the values of buildings:

1- Preparation of a shapefile presenting the collected buildings lying in the floodplains of the study basins with their collected landuse attributes such as basin name, type of landuse activity, building material, building condition, building value category, number of floors, building footprint area)
2- Preparation of asset rates for buildings in USD/m^2/floor according to the building value category in each LGA
3- Calculation of the building value. The asset value is estimated by

Asset Value = Building Area * No. of Floors * Building rate

1.3.2 Roads

There are three main types of roads which are; primary, secondary and local roads. To assess the value of these different type of roads, it's necessary to determine the main components of them. Hence, these components are summarized in Table 1-3 to differentiate between the costs of these three types.

Table 1-3: The main components of the local, secondary and primary roads

Road Type	Wearing Asphalt	Bitumen Base Course	Aggregate Base Course	Sub Base Course	Filling	Concrete Curbs	Reinforced Concrete Road Divider	Segmented paving blocks	Side Ditches	Road Signs
Local	-	-	✓	✓	✓	-	-	-	-	-
Secondary	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Primary	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

The value of any road could be calculated as the summation of the cost of its component, in this respect the following points will illustrate the methodology behind obtaining the value of each component.

- Asphalt layer: The area of asphalt layer is calculated by multiplying the length of the road by its total width.
- Bitumen base course: The area of this layer is considered to equal the asphalt layer area.
- Aggregate base course: The aggregate base course is calculated on a volumetric base and the thickness of this layer usually is considered to be 0.2m and its area equals to the asphalt layer.
- Sub base course: the volume of the sub base course equals to the aggregate base course.
- Filling: Volume of filling is obtained by multiplying the length of road by its width by the overburden depth by selected factor. The overburden depth is usually in the range of 0.40 m.
- Concrete curbs: The length of concrete curbs is calculated by multiplying the road length by 2.
- Reinforced concrete road divider: The length of road divider is considered to equal the road length.
- Segmented paving blocks: The area of segmented paving blocks is calculated by multiplying the road length by the difference between the road width and the total carriage way total width.
- Side ditches: The length of side ditches is obtained by multiplying the road total length by 2.
- Road signs: Number of the road signs is counted to be one sign every 50 m for one direction of the road.

Table 1-4 shows the rates of these components as provided by the client, while Table 1-5 shows the adapted costs per m^2 for the three types of roads in Ibadan city based on the above components and rates.

Table 1-4: Rates of the roads' main components

General Rates	Specifications / Quantity	Units	Cost Estimate Rates		Units
			(Naira)	(USD)	
Roadworks					
30mm Wearing Course	0.03	m	3940	12.9	USD/m2
40mm Wearing Course	0.04	m	4712	15.4	USD/m2
50mm Binder Course	0.05	m	5200	17	USD/m2
60mm Wearing Course	0.06	m		18.6	USD/m2
				310	
Base			3200	10.5	USD/m3
Stone Base			17000	55.7	USD/m3

General Rates	Specifications / Quantity	Units	Cost Estimate Rates		Units
			(Naira)	(USD)	
Sub Base			2850	9.3	USD/m3
Sub Base Filter			12500	41	USD/m2
Concrete Curbs			11500	37.7	USD/m
R. Concrete Road Divider			28000	91.8	USD/m
Segmented paving blocks			3600	11.8	USD/m2
Side Ditches					
1m x 1m Open Drain			78000	255.7	USD/m
0.6m x 0.6m Open Drain			40000	131.1	USD/m
1m x 1m Covered Drain			115000	377	USD/m
Covered R. C. Drains (1mx1m)			120000	393.4	USD/m
Traffic					USD/m2
Broken Lines			350	1.1	USD/m
Solid Lines			550	1.8	USD/m
Road Signs			100000	327.9	USD/No.

Table 1-5: Cost of roadworks per m^2

Component	Local Roads	Secondary Roads	Primary Roads
Road Length (m)	100	100	100
Both Carriageway Total widths (m)	10	20	30
Road Width (m)	15	25	35
Overburden Depth (m)	0.4	0.4	0.4
Wearing Asphalt (m^2)	-	2000	3000
Cost Asphalt (USD)	-	26,000	56,000
Bitumen Base Course (m^2)	-	2000	3000
Cost Bitumen Base Course (USD)	-	26,000	56,000
Aggregate Base Course Volume (m^3)	300	500	700
Cost Aggregate Base Course (USD)	3,000	5,000	7,000
Sub Base Course Volume (m^3)	300	500	700
Cost Sub Base (USD)	3,000	5,000	7,000
Fill Volume (m^3)	402	670	938
Fill Cost (USD)	3,000	6,000	8,000
Concrete Curbs (m)	-	200	200
Cost of Concrete Curbs (USD)	-	8,000	8,000
Reinforced Concrete Road Divider (m)	-	100	100
Cost of Reinforced Concrete Road Divider (USD)	-	9,000	9,000
Segmented paving blocks (m^2)	-	500	500
Cost of Segmented paving blocks (USD)	-	6,000	6,000
Side Ditch Lengths (m)	-	200	200
Cost of Side Ditch (USD)	-	26,000	26,000
Road Signs (No.)	-	4	4
Cost of Road Signs (USD)	-	1,000	1,000
Roadworks Cost	9,000	118,000	148,000
Roadworks (Cost/m^2)	**9**	**59**	**61**

1.3.3 Infrastructure

Due to the lack of information and as concluded from section 1.2.3 that almost there is no infrastructure base in Ibadan city to be considered while studying the risk on it since the water supply networks and sewage networks seemingly don't exist. In addition, power supply and distribution systems are provided by high transmission cables or on wooden poles which are hardly affected by flood risks.

However, the total monetary loss in the roads due to flood events will be increased by 10% to take into consideration any type of infrastructure which couldn't be surveyed by the consultant.

2 Flood Damage Functions

Flood damage functions is an important step towards the assessment of damage losses in different return periods. Determining direct flood damage is commonly done using depth-damage curves, which denote the flood damage that would occur at specific water depths per asset.

The generation and compilation of an adequate flood damage estimation involves many issues regarding the nature of damage caused by floods, such as

- Classification of damage categories.
- Obtaining detailed flood parameters such as flow velocity, depth, and duration at any given location for a given flood return period.
- Establishment of relationships between flood parameters and damage for different damage categories

More information on the flood damage functions are presented in the Technical Report of Data, Methodology and Damage Function; "N17036-0100D-RPT-ENV-10-Rev0".

2.1 Damage Function Categories

Damage factor is defined as the ratio of the total cost to replace the damaged components of a flood-affected property to the market value of the property:

$$\text{Damage Factor} = \frac{\text{Cost of Repairs}}{\text{Market Value of Building}}$$

Damage factor values vary between 0 and 1.

The estimation of the market value of every property requires extremely high effort in time and money to be implemented. In the present analysis, the methodology followed to quantify the asset values involves the classification of the structures per building type and per location in each Local Government Area (LGA).

Many countries have developed flood damage models using depth-damage curves based on analysis of past flood events and on expert judgement. Due to different methodologies being employed for various damage models in different countries, damage assessments cannot be directly compared

with each other. To address these problems, studies developed a globally consistent database of depth-damage curves. One of these studies were conducted by the Joint Research Centre (JRC), the European Commission's science and knowledge service[1].

The fundamental steps in producing Damage Function Curves are to collect damage data from actual flood events. This approach can be done by an interview survey to gain flood damage information. The survey should include information on types of structures, description of rooms, household contents, location (either in basement, first floor, or second floor), the quality and age of the structure and contents. The questionnaire survey can also include information on the height above the floor of each item and general information such as the household/commercial income, number of persons in the houses/premises, and how often they experienced flooding. The flood damage information required for the development of damage function for commercial, and industrial categories as recommended is illustrated Table 2-1.

Table 2-1: Flood damage information required for stage–damage curve

Category	Flood damage information required
Residential	Plasterwork and wall finish, Floors, Joinery, Decorations, Path and paved areas, Boundary/fence/garage/gates, Main building, Domestic appliances, Heating appliances, TV/hi-fi etc, Furniture, Personal effects, Floor covering and curtains
Commercial	Damage to stock, damage to building fabric, equipment damage, clean-up cost, depth function
Industrial	Name of company, type of business, total area of premises, total ground floor area of building only, height of floor level of buildings, plant and equipment, raw material and unfinished goods, finished goods (stocks if no processing is involved), total physical damage (estimate), average weekly turnover/output, ability to defer production/work, ability to transfer production/work

However, based on an extensive literature survey, JRC (2017) developed normalised damage curves for each continent. This dataset contains damage curves depicting fractional damage as a function of water depth as well as the relevant maximum damage values for a variety of assets and land use classes. These maximum damage values are based on construction cost surveys from multinational construction companies, which provide a coherent set of detailed building cost data across dozens of countries. This dataset can be used for consistent supra-national scale flood damage assessments, and guide assessment in countries where no damage model is currently available. The following subsections present the results of damage functions that are used in Africa, and which were adopted to be used in Ibadan.

2.2 Residential buildings

Table 2-2 shows an average damage function for residential buildings for Africa.

Table 2-2: Average continental damage function for Africa - Residential Buildings, JRC

Water depth (m)	Damage factor
0.00	0.00
0.50	0.22
1.00	0.38
1.50	0.53
2.00	0.64
3.00	0.82
4.00	0.90
5.00	0.96
6.00	1.00

2.3 Commerce

There are no commerce functions available for Africa as stated by the by the Joint Research Centre (JRC), the European Commission's science and knowledge service[2]. Table 2-3 shows an average damage function for commercial buildings on a global basis.

Table 2-3: Average continental damage function on global basis – Commerce, JRC (2017)

Water depth (m)	Damage factor
0.00	0.00
0.50	0.34
1.00	0.53
1.50	0.64
2.00	0.75
3.00	0.86
4.00	0.92
5.00	0.97
6.00	1.00

2.4 Industry

Table 2-4 shows an average damage function for industrial area for Africa.

Table 2-4: Average continental damage function for Africa - Industrial Area, JRC (2017)

Water depth (m)	Damage factor
0.00	0.00
0.50	0.06
1.00	0.25
1.50	0.40
2.00	0.49
3.00	0.68
4.00	0.92
5.00	1.00
6.00	1.00

[1] Joint Research Centre (2017), J. Huizinga, H. Moel, W. Szewczyk, "Global Flood Depth-Damage Functions", JRC Technical Reports, Methodology and the database with guidelines, European Union.

[2] Joint Research Centre (2017), J. Huizinga, H. Moel, W. Szewczyk, "Global Flood Depth-Damage Functions", JRC Technical Reports, Methodology and the database with guidelines, European Union.

2.5 Evaluation of Damage Losses

The estimation of flood losses is a crucial part when decisions about flood defense are taken on the basis of cost-benefit-analyses. The basic information includes the preparation of a hydrodynamic model of the basins under study, an inventory of assets, people exposed to flood and the appropriate damage functions to evaluate the damage in each asset. The methodology includes a mapping element that uses Geographical Information Systems (GIS) and spreadsheets (Excel) to analyze flood risk to assets and people.

This section describes the methodology to evaluate the damage losses using prepared damage functions through the following sub-sections.

2.5.1 Hydrodynamic Model

The hydrodynamic model was developed to simulate the flood flows and the corresponding flood inundation mapping including spatial extent, velocity and depth of flooding along the streams.

The following steps were followed to extract the necessary information from the hydrodynamic model:

1- Preparation of ***Extent Maps*** (shapefiles) presenting the floodwater extent for defined return periods (5, 25, 50 and 100-years) for each basin.
2- Preparation of ***Water Depth Maps*** (raster files) which present the water depth within the flood plains for the defined return periods.
3- Preparation of ***Velocity Maps*** (raster files) which presents the velocity distribution of the floodwater within the floodplain.
4- Preparation of ***Flood Hazard Maps*** (shapefiles) presenting 5 hazard classes (very low hazard, low hazard, moderate hazard, significant hazard and extreme hazard). The shapefile should include the 5 classes of flood hazards in its attribute table.

2.5.2 Buildings Exposed to Flooding

The buildings exposed to flooding are identified based on flood extents and existing buildings lying the flood plain. The procedure depends on prepared information from the hydrodynamic model and digitized buildings in the flood plain. The following additional steps are followed to prepare the buildings exposed to flooding along with the expected depth at these buildings. This is developed using the ArcMap commercial package within the GIS environment:

1- Preparation of a shapefile presenting the ***Collected Buildings*** with their landuse attributes such as the basin name, type of landuse activity, building material, building condition, building value category, number of floors, building footprint area.
2- Evaluation of ***Buildings Exposed to Flooding***, this is prepared using the prepared floodwater extent maps (from Step 1 above) and the collected buildings (from Step 5 above). This data is then gathered in a new shapefile and named as "Buildings exposed to flooding".
3- Evaluation of the ***Expected Depth of Water at each Building*** for the defined return periods, this is prepared using the water depth map (from Step 2) and the shapefile presenting the exposed buildings (from Step 6). Since the building polygon includes variable floodwater depths, an average depth value for each building is estimated. This data is then gathered in a new shapefile named as "expected depth of water for each building".

2.5.3 Infrastructure Exposed to Flooding

The transport infrastructure components exposed to flooding are identified based on flood extents and roads lying in the flood plain. The following steps were followed to prepare the roads exposed to flooding along with the expected depths at these roads. This is developed using the ArcMap commercial package within the GIS environment:

1- Preparation of a shapefile presenting all ***Roads in Ibadan***. The shapefile should include the following attribute data:
   a. Road classifications (expressways, highways, main roads, secondary roads and tertiary roads).
   b. Road widths in meters
2- Evaluation of all ***Road Segments Exposed to Flooding***, this is prepared using the prepared floodwater extent (from Step 1) and the collected roads (from Step 8).
3- Evaluation of the ***Expected Depth of Water at each Road Segment*** for the defined return periods, this is prepared using the water depth map (from Step 2) and the shapefile presenting the exposed road (from Step 8). Since the road segment includes variable floodwater depths, the water depth raster is divided into segments of 0.5m interval and the average water depth at each segment is obtained. After that the average value is assigned to the corresponding segment of the road. This data is then gathered in a new shapefile named as "expected depth of water for each road segment".

2.5.4 People within Flood plain

People exposed to flooding are identified based on flood extents and number of people standing in the flood plain. The following steps were followed to prepare the number of people exposed to flooding:

1- Preparation of a shapefile showing the boundaries of the Local Government Areas (***LGAs***) in Ibadan, this shapefile includes the following attribute data:
   a. The areas of each LGA in hectares
   b. The existing population records extracted from the 2006 Census

c. The projected population in year 2035 developed by the study done by Dar in the City Master Plan
d. Categorized Urban Areas developed by the City Master Plan for each LGA (High Dense, Medium Dense, Low Density, ..etc)
e. The existing and projected population intensities (Capita/hectare) for each categorized urban area and each LGA.

2- Calculation of the ***Number of People Exposed to Flooding*** in each hazard class. This is calculated by multiplying the projected population intensity (from Step 10) by the area of each hazard class (from Step 4).

2.5.5 Damage Losses to Buildings

Floods in riverine can cause significant damage to buildings including possible structural failure. The following steps were followed to prepare the expected damage loss to buildings according to different storm events:

1- Preparation of a ***spreadsheet for all buildings exposed to flooding*** in different return periods (from Step 5). The spreadsheet should include the following fields (attributes):
   a. Building area, number of floors and building value. The building value is estimated by:
      Building Value = Building Area * No. of Floors * Building cost rate
   b. The expected average floodwater depth for each building and for the defined return periods (from Step 6).
2- ***Classification of Buildings*** into 3 landuse activities (Residential, Commercial and Industrial).
3- Preparation of ***Damage Functions for each Landuse Activity***. The damage loss is considered as a portion of the asset value that depends on the amount of damages subjected to the building. The relation between the asset value and the damages subjected to the building is defined as Building Damage Function.
4- Evaluation of the ***Damage Losses for each Building*** according to its landuse activity. This is achieved by
   a. Preparation of the **Damage Factor** corresponding to the floodwater depth (from Step 13b) and according to its damage function for landuse activity (from Step 15)
   b. Estimation of damage loss by multiplying the damage factor (from Step 16a) by the building value (from Step 13a).
      Damage Loss $_{Building}$ = Damage Factor $_{Building}$ x Building Value
   c. Repeat the above steps for each return period.
5- Preparation of the relation between the damage loss and different return periods for each basin.

2.5.6 Damage Losses to Infrastructure

During extreme weather events transport infrastructure can be directly or indirectly damaged, posing a threat to human safety, and causing significant disruption and associated economic and social impacts. The following steps were followed to prepare the expected damage loss to transport infrastructure according to different storm events:

1- Preparation of a ***Spreadsheet for all Roads Exposed to Flooding*** in different return periods (from Step 9). The spreadsheet should include the following fields (attributes):
   a. The road classification, width and value. The road value is estimated by:
      Road Value = Road Length * Road Width * Road cost rate.
   b. The expected average floodwater depth for each road for the defined return periods (from Step 10).
2- Preparation of ***Damage Functions for each Road Classification***. The damage loss is considered as a portion of the road value that depends on the amount of damages subjected to the road. The relation between the road value and the damages subjected to the road is defined as the Road Damage Function.
3- Evaluation of the ***Damage Losses for each Road*** according to its road classification. This is achieved by
   a. Preparation of the **Damage Factor** corresponding to the floodwater depth (from Step 18b) and according to its damage function for road classification (from Step 19)
   b. Estimation of damage loss by multiplying the damage factor (from Step 20a) by the road value (from Step 18a).
      Damage Loss $_{Road}$ = Damage Factor $_{Road}$ x Road Value
   c. Repeat the above steps for each return period.
4- Preparation of the relation between the damage loss and different return periods for each basin.

2.5.7 Human Injuries and fatality

Flooding affects human health through drowning, heart attacks, injuries, infections and exposure to other flood hazards. The following steps were followed to prepare the expected number of injuries and deaths to people according to different storm events:

1- Preparation of a ***Spreadsheet for the Number of People Exposed to Flooding*** in different return periods (from Step 12). The spreadsheet should include the following fields (attributes):
   a. Hazard Class
   b. Number of people per each class per each LGA
2- Calculating ***Area Vulnerability Scores*** per each hazard class while justifying the score of each factor which contributes in the calculations of area vulnerability (Flood warning,

speed of onset and Nature of area). Table 2.5 shows an example of area vulnerability scores.

Table 2.5: Area vulnerability scores

Hazard class	Flood warning	Speed of onset	Nature of area	Sum = Area vulnerability
Extreme hazard	3	2	3	8
Significant hazard	3	2	3	8
Medium hazard	3	2	3	8
Low hazard	2	2	3	7
Very low hazard	2	2	3	7

3- Calculating ***(X) Percentage of people at risk*** per each hazard class per LGA and this is could be simply calculated by multiplying the area vulnerability score obtained (from step 24) by the average hazard rating of each hazard class.

Table 2-6: Generating X (Percentage of people at risk)

Hazard class	N(Z)	Hazard Rating (HR)	Area Vulnerability (AV)	X = HR x AV	N(ZE)
Extreme hazard	500	4.5	8	36%	180
Significant hazard	700	2.8	8	22.4%	157
Medium hazard	800	1.95	8	15.4%	123
Low hazard	1000	1.5	7	10.5%	105
Very low hazard	1500	0.13	7	0.91%	14

Note: N(Z) is the population in each hazard class in each LGA (from step 12)

N(ZE) is the number of people exposed to the risk in each hazard class in each LGA

4- Calculating ***(Y) People Vulnerability*** based on the summation of four factors which area percentage of very old residents, Percentage of inform/disabled/long term sick; Percentage of children, and percentage of roofless and homeless. All these percentages are calculated as per each LGA.

Y (%) = %elder residents + %residents suffering from long-term illness +%children +%roofless and homeless

5- According to Department of Environment Food and Rural Affairs, ***Number of Injuries*** could be calculated using the following equations:

No. of injuries = 2 x Y x N(ZE)

Where;
Y is the people vulnerability (from step 25)

N(ZE) is the number of people exposed to the risk in each hazard class in each LGA (from step 24)

6- Calculating ***Number of Deaths*** using the following equation:

Number of deaths = 2 x Number of injuries x Hazard Rating / 100

7- Preparation of a relation between the number of injuries and fatalities with different return periods for each basin.

8- Estimation of the monetary values for death and injuries based on the monetary rates provided in Table 2.7. Please refer to Report N17036-0100D-RPT-ENV-19-Rev0 where more discussions and reference regarding these values are presented.

Table 2.7: Monetary Value for Death and Injuries

Category	Monetary rates (USD/Capita)		
	Lower Value	Middle Value	Upper Value
Death	40,000	116,572	304,212
Injuries	4,000	11,657	30,421

2.5.8 Overall Damages

1- Preparation of potential injuries and fatalities in a quantitative form (capita) for all return periods (5, 25, 50 and 100-years) in all the basins.

2- Preparation of potential damages to assets and people in a quantitative form (USD) for all return periods (5, 25, 50 and 100-years) in all the basins. This is calculated by summing up all damage losses for each return period in each basin.

2.5.9 Flood Risk Analysis Methodology

In this section, the developed hydrodynamic model is used to develop different scenarios. Such scenarios include the impact of different return periods and a significant past flood event.

2.5.10 Analysis of Particular Scenarios

The selection of a storm event return period has a significant effect on flood extents and is considered as one of the important design variables. The frequency of the storm event represents the number of occurrences of an event within a specified period of time.

The developed hydrodynamic model is used to develop different scenarios. Such scenarios include different storm events or different return periods. The frequency of a storm event represents the number of occurrences of an event within a specified period of time. The selection of a return period has a significant effect on flood extents and is considered as one of the important design variables.

Referring to different guidelines and previous studies, storm event return periods commonly vary from 5 years to 100 years. The following return periods are chosen: 5-, 25-, 50- and 100-years

return periods to show the varying significance of the flood extent. The results of the Frequency Analysis of the annual maximum 24-hr Rainfall for Ibadan is used in selecting the precipitation values for each return period, refer to Annex 1.

The identities of the selected scenarios for this variable are coded as follows:

- Scenario 1: 100-year Return Period Scenario
- Scenario 2: 50-year Return Period Scenario
- Scenario 3: 25-year Return Period Scenario
- Scenario 4: 5-year Return Period Scenario

2.5.11 Significant Past Flood Event

The 26th August 2011 is considered as the most recent flood event to Ibadan. Like many previous floods but more serious, the flood hit the city of Ibadan with an unexpected magnitude of rainfall. After six hours of torrential rain, the Eleyele Dam, could hold back the flow no longer. Water poured over the top, flooding everything in its path causing the death of more than 120 people and serious damages to infrastructure estimated at about 600M USD (many bridges collapsed, roads washed away, and substantial property loss), in addition to the livestock and fish in ponds which were carried away by the flood.

Some damages caused by the flood in 2011 were stationed in the embankments of the bridges on the River Ona at Apete and Ogbere in Olomi which were swept away, causing drowning of all the surrounding communities for over four days. Many culverts were completely blocked due to the sweeping of solid wastes with the flood.

The flood caused some damage to the spillway and washed over the sidewalls of the channel downstream of the dam which caused considerable damages. Downstream the water quickly inundated the water works, which promptly were evacuated.

It was noted from several references that the water did not overtop the dam. The areas flooded include Onipepeye, Oda-Ona Elewe, Oda Ona Apata, Nihort, Ijokodo, Sango, Apete, Ajibode, Orogun, Agbowo, old Bodija, Ikolaba, Ibadan Polytechnic, Fatusi Ogbere, Olodo Kumapayi, University of Ibadan, Eleyele Waterworks and Oluyole Estate.

The precipitation values recorded in meteorological stations show that the maximum precipitation depth occurred in the IITA has a value of 165.5mm, refer to Table 2.7.

Table 2.7: Rainfall depths for the 2011 flood event in different meteorological stations

Station	IITA	NIHORT	Forestry	New Airport
Rainfall Depth (mm)	165.5	92	133.8	86.2

Comparing the maximum rainfall depth recorded in IITA (165.5mm) with the rainfall depths estimated from the rainfall frequency analysis, which is 146mm and 180mm for the 10-year and 25-year storm events respectively, the flood of 2011 is considered to be smaller than the 25-year return period storm event.

In worst cases, the inundation of 2011 resembles that of the 25-year storm event. In this report, the 2011 flood event scenario is considered as a 25-year storm scenario.

3 Risk Metrics and Economic Analysis

Risk Metrics are used to quantify flood risks, such as loss due to damage to buildings and infrastructure. The results can be used to express probable damage using a variety of forms. These include:

1. Loss Return Period Curves (LRPC)
2. Loss Exceedance Curves (LEC)
3. Average Annual Loss (AAL)

Economic analysis is important to determine the viability of a project and ensuring the project is economically justifiable. Economic analysis is performed based on project relevant data such as:

1. Capital Cost
2. Average Annual Savings (Loss Reduction) (AAS)
3. Project Useful Life
4. Social Discount Rate

The evaluation of the project is usually based on an overall indicator, such as:

1. Project Net Present Value (NPV)
2. Project Internal Rate of Return (IRR)

The following subsections give a description of each of the above terms, along with a numerical example on one of the proposed ongoing flood mitigation programs (the channelization of Orogun channel considering the losses due to damaged buildings).

3.1.1 Loss Return Period Curve (LRPC)

Loss Return Period Curves show the relation between damages or losses and the storm return period. The longer the return period, the larger the flooding extent, water depths, and flow velocities, and consequently the higher the damages or losses. Figure 3.1 shows a sample of Loss Return Period Curve

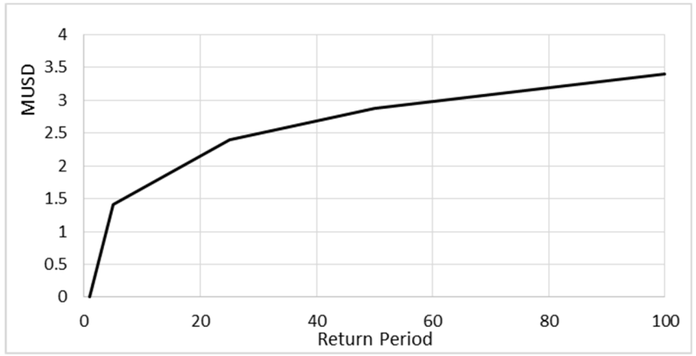

Figure 3.1: Sample of Loss Return Period Curve

3.1.2 Loss Exceedance Curves (LEC)

Loss Exceedance Curves are curves relating damage or loss to their exceedance probabilities. The probability of exceedance is equal to the reciprocal of the return period

$$P = 1/T$$

where *P* is the probability of exceedance and *T* is the return period of the flood event.

This relation is an inverse relation to the LRPC, i.e. the higher the damages, the lower their exceedance probability. Figure 3.2 shows a sample of Loss Exceedance Curve.

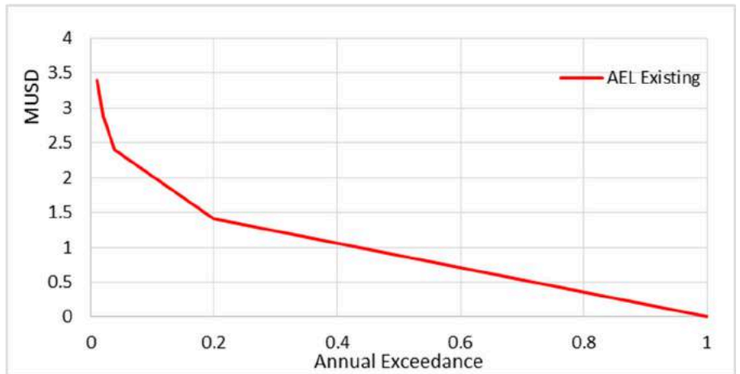

Figure 3.2: Sample of Loss Exceedance Curves – Existing Situation

3.1.3 Average Annual Loss (AAL)

Average Annual Loss (AAL, or Expected Loss EL) represents the integration of various loss values with their respective probabilities. In other words, the average annual loss is the expected value of losses based on their probability distribution. Table 3.1 shows a sample of the calculation of average annual losses due to damage to buildings in Orogun River

Table 3.1: Sample of Average Annual Losses Calculation

1	2	3	4	5
Increment	Return Period	Annual Exceedance	Losses Existing (USD)	Increment annual damage (USD)
1	1	1	0	
2	5	0.2	1,406,594	562,637
3	25	0.04	2,397,258	304,308
4	50	0.02	2,877,323	52,746
5	100	0.01	3,399,079	31,382
			AAL Existing	**951,073**

For each return period shown in column 2 of Table 3.1, the annual exceedance probability *P* is calculated in column 3 (*P* = 1 / *T*). For events of various return periods at a given location, the damage costs are shown in column 4. The incremental annual costs under the annual exceedance curve are calculated by dividing the area under the curve to a set of strips, then calculating the area of each strip as shown in column 5 and as follows:

$$\Delta L = \left[\frac{L_{(P_1)} + L_{(P_2)}}{2}\right](P_2 - P_1)$$

$$\Delta L_1 = \left[\frac{0 + 1{,}406{,}594}{2}\right](1 - 0.2) = 562{,}637\ USD/year$$

Summing these incremental costs yields an annual expected damage cost of USD 951,073/year if no structure is built. This represents the average annual cost of flood damage over many years, assuming constant economic conditions.

3.1.4 Average Annual Savings (AAS)

Figure 3.3 shows loss exceedance curves for the existing situation and after intervention. The difference between the two curves gives the savings exceedance curve due to the channelization of Orogun River. The area under the difference curve represents expected annual savings or loss reduction in buildings, refer to Figure 3.4

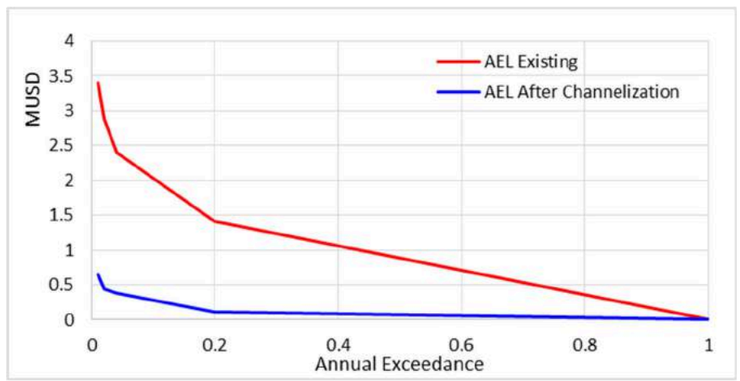

Figure 3.3: Sample of Loss Exceedance Curves – Existing and after Interventions Situations

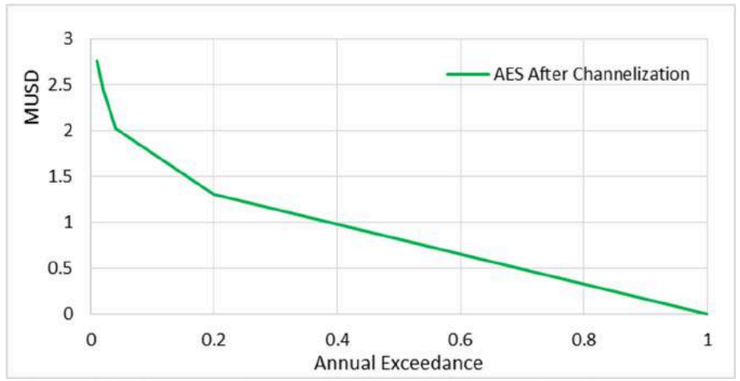

Figure 3.4: Sample of Savings Exceedance Curves – After Interventions

Average Annual Savings (or Loss Reduction) are estimated by calculating the difference between the average annual losses after interventions from the average annual losses under the existing situation. Table 3.2 shows a sample of average annual savings in buildings calculated for the proposed channelization of Orogun River.

Table 3.2: Sample of Average Annual Savings

	Ret. Per.	Annual Exceed.	Losses Existing (USD)	Increment damage (USD)	Losses after Channel. (USD)	Increment. damage (USD)	Savings in Damages (USD)	Increment. Saved Damage (USD)
1	1	1	-		-		-	
2	5	0.2	1,406,594	562,637	104,806	41,923	1,301,787	520,715
3	25	0.04	2,397,258	304,308	375,355	38,413	2,021,902	265,895
4	50	0.02	2,877,323	52,746	439,005	8,144	2,438,319	44,602
5	100	0.01	3,399,079	31,382	646,809	5,429	2,752,271	25,953
			AAL Existing	**951,073**	**AAL Channel**	**93,908**	**AES Savings**	**857,165**

Referring to the above Table, the following can be estimated:

- The average annual loss (AAL) due to damages in buildings for the existing situation is 951,073 USD.
- The average annual loss (AAL) due to damages in buildings following channelization is 93,908 USD.
- The Annual Average Savings (AAS) following channelization is the difference between the two loss amounts mentioned above, which is 857,165 USD.

3.1.5 Capital Cost

The Capital Cost is the sum of the fixed one-time expenses incurred as the construction costs of civil works to channelize the streams and construct the associated bridges and culverts. In other words, it is the total cost needed to bring the project to an operable status. Considering the above example, the capital cost of Orogun Channelization related to civil works is 6,005,833 USD

3.1.6 Project Useful Life

The Project Useful Life is the estimated amount of time (in years) that the mitigation action will be effective. The Standard Project Useful Life of Infrastructure works considering Concrete infrastructure, flood walls, roads, bridges, major drainage system is 50 years.

3.1.7 Social Discount Rate

The discount rate is the interest rate used to determine the present value of future cash flows in standard discounted cash flow analysis. For public projects, the social discount rate is usually used, which measures the rate at which a society would be willing to trade present for future consumption. As such, it is one of the most critical inputs needed for cost-benefit analysis of projects. This discount rate is usually lower than private investment rates, in the range of 3% to 7% (Blank and Tarquin, 2018). For example, the World Bank (Lopez, 2008) estimated the social discount rate for nine Latin American countries to be in the 3-4 percent range, if the recent track record in terms of growth in the region is indicative of future performance. However, if the region improves on its past performance, the social discount rate would increase to the 5-7 percent range. The paper also argues that the discount rate should be dependent on the horizon of the project, declining from 4.4 percent for a 25-year horizon to less than 4 percent for a 100-year horizon. For the purpose of this project, and due to lack of specific information, a social discount rate of 6% is considered as average rate against which projects will be evaluated.

3.1.8 Net Present Value

Present Value (PV) is the current value of a future sum of money or stream of cash flows given a specified rate of return. Future cash flows are discounted at the prescribed discount rate. The higher the discount rate, the lower the present value of the future cash flows.

The present value is always less than or equal to the future value because money has interest-earning potential, a characteristic referred to as the time value of money. A dollar today is worth more than a dollar tomorrow because the dollar can be invested and earn a day's worth of interest, making the total accumulate to a value more than a dollar by tomorrow. The PV can be calculated as

$$PV = \sum_{i=1}^{n} \frac{C_i}{(1+r)^i}$$

C_i = Cash Flow at period 1

r = rate of return

n = number of periods; this is considered as the useful lifetime of the project

In the above example, if we consider C_i = 857,165 USD (the AAS), r = 6%, n = 50 years; then the PV can be calculated fusing the following series:

$$\text{PV} = \frac{857{,}165}{(1+0.06)^1} + \frac{857{,}165}{(1+0.06)^2}\ \frac{857{,}165}{(1+0.06)^3} + \ldots\ldots\ldots \frac{857{,}165}{(1+0.06)^{50}} = 13{,}510{,}519 \text{ USD}$$

Table 3.2 shows a sample of annual present savings and the value for each term in the above series. The summation of annual present savings is the present value for savings.

The project Net Present Value is thus the difference between the PV of saving and the present project cost. Thus, in the above example, if the capital cost of Orogun Channel is 6,005,833 USD, the Net Present Value (NPV) of the project at the discount rate of 6% is 13,510,519 – 6,005,833 = 7,504,686 USD. With a positive NPV, this project is considered to be viable at 6% discount rate.

Table 3.3: Sample of Annual Present Savings

n	Present Saving	n	Present Saving	n	Present Saving	n	Present Saving	n	Present Saving
1	808,646	11	451,544	21	252,140	31	140,794	41	78,618
2	762,874	12	425,985	22	237,868	32	132,824	42	74,168
3	719,692	13	401,873	23	224,404	33	125,306	43	69,970
4	678,955	14	379,125	24	211,701	34	118,213	44	66,010
5	640,524	15	357,665	25	199,718	35	111,522	45	62,273
6	604,268	16	337,420	26	188,414	36	105,209	46	58,748
7	570,064	17	318,321	27	177,749	37	99,254	47	55,423
8	537,796	18	300,303	28	167,687	38	93,636	48	52,286
9	507,355	19	283,304	29	158,196	39	88,336	49	49,326
10	478,637	20	267,268	30	149,241	40	83,335	50	46,534
							Present Value		**13,510,519**

3.1.9 Internal Rate of Return (IRR)

The Internal Rate of Return (IRR) is considered as the break-even point (BEP) in economics and business. It is the point at which total cost and total revenue become equal, i.e. "even". There is no net loss or gain, and one has "broken even", though opportunity costs have been paid and capital has received the risk-adjusted and expected return.

In the above example, if the capital cost of Orogun Channel is 6,005,833 USD and the average annual savings in damages to buildings (AAS) is 857,165 USD, then the project's Internal Rate of Return (IRR) becomes 14.25%. That is, the expected savings from the project are equivalent to investing the capital cost with an interest rate equal to 14.25%. Since the IRR, 14.25% in this case, is larger than the social discount rate of 6%, the project is considered viable.

4 Damage Losses Evaluation (Basins)

This section evaluates the damage losses for the 4 basins in Ibadan. The rates are based on the values stated in section 1, while the methodology is based on the steps illustrated in section 2.5.

The analysis is presented in the form of Loss Return Period Curves (LRPC) and Loss Exceedance Curves (LEC) for each basin, the losses is calculated for the 4 return periods (5-, 25-, 50-, and 100-years) for each sub-basin. In addition, the Average Annual Loss (AAL) is estimated for each basin.

This section includes the losses in buildings, infrastructures, roads and people in monetary values.

4.1 Buildings Losses

4.1.1 Ona Basin

Table 4.1 shows the losses in buildings in different return periods for Ona Basin, while Figure 4.1 and Figure 4.2 show the return period curve and loss exceedance curve respectively.

Table 4.1: Average Annual Losses in Buildings - Existing Situation – Ona Basin

Increment	Return Period	Annual Exceedance	Losses Existing (USD)	Increment damage (USD)
1	1	1	-	
2	5	0.2	48,151,431	19,260,572
3	25	0.04	80,627,327	10,302,301
4	50	0.02	96,191,933	1,768,193
5	100	0.01	112,766,858	1,044,794
			AAL Existing	**32,375,860**

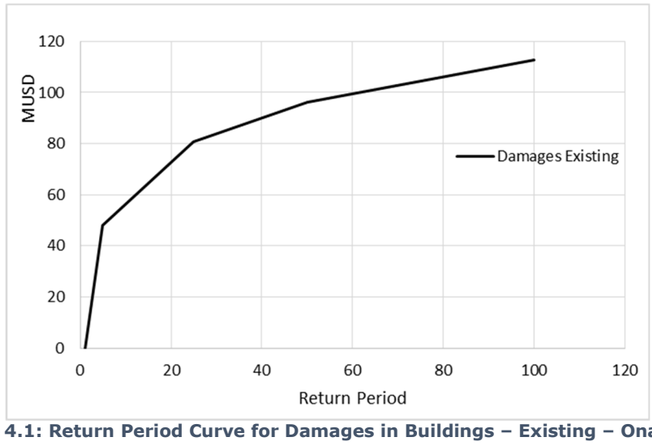

Figure 4.1: Return Period Curve for Damages in Buildings – Existing – Ona Basin

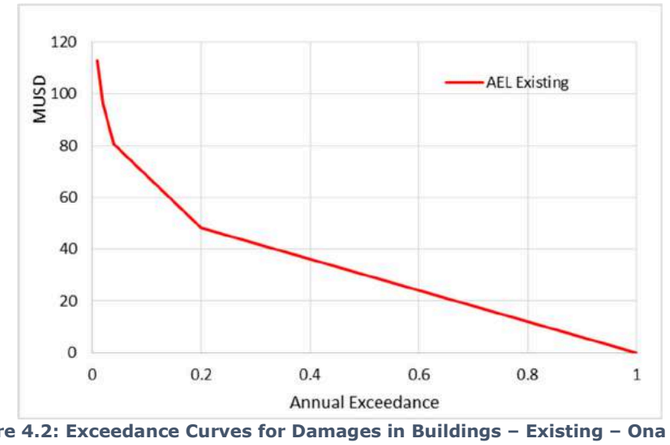

Figure 4.2: Exceedance Curves for Damages in Buildings – Existing – Ona Basin

The estimated Average Annual Losses in buildings within Ona Basin is **32.4 MUSD**

4.1.2 Ogunpa Basin

Table 4.2 shows the losses in buildings in different return periods for Ogunpa Basin, while Figure 4.3 and Figure 4.4 show the return period curve and loss exceedance curve respectively.

Table 4.2: Average Annual Losses in Buildings - Existing Situation – Ogunpa Basin

Increment	Return Period	Annual Exceedance	Losses Existing (USD)	Increment damage (USD)
1	1	1	-	
2	5	0.2	23,160,550	9,264,220
3	25	0.04	38,064,918	4,898,037
4	50	0.02	47,000,724	850,656
5	100	0.01	56,312,755	516,567
			AAL Existing	15,529,481

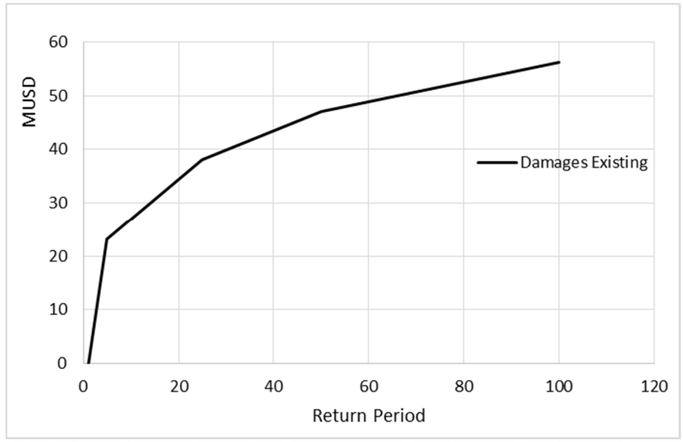

Figure 4.3: Return Period Curve for Damages in Buildings – Existing – Ogunpa Basin

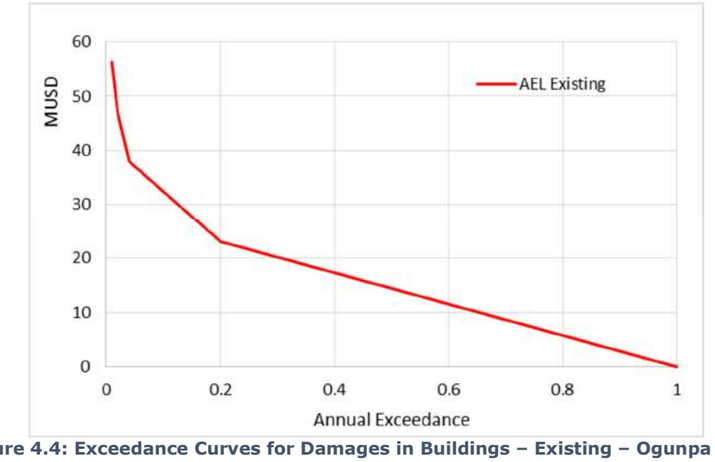

Figure 4.4: Exceedance Curves for Damages in Buildings – Existing – Ogunpa Basin

The estimated Average Annual Losses in buildings within Ogunpa Basin is **15.5 MUSD**

4.1.3 Ogbere Basin

Table 4.3 shows the losses in buildings in different return periods for Ogbere Basin, while Figure 4.5 and Figure 4.6 show the return period curve and loss exceedance curve respectively.

Table 4.3: Average Annual Losses in Buildings - Existing Situation – Ogbere Basin

Increment	Return Period	Annual Exceedance	Losses Existing (USD)	Increment damage (USD)
1	1	1	-	
2	5	0.2	12,409,849	4,963,939
3	25	0.04	19,567,801	2,558,212
4	50	0.02	23,944,879	435,127
5	100	0.01	28,066,235	260,056
			AAL Existing	8,217,334

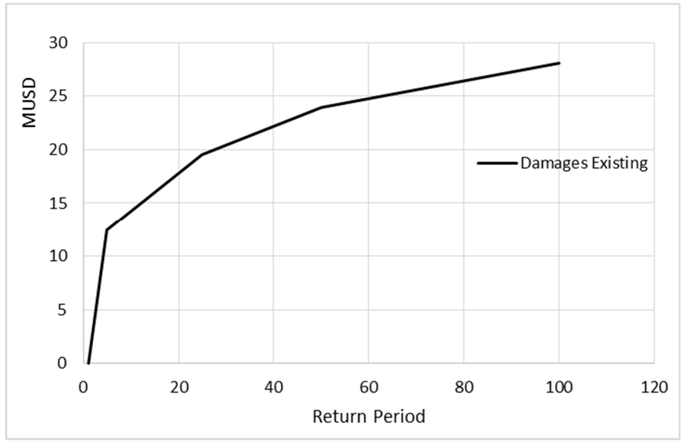

Figure 4.5: Return Period Curve for Damages in Buildings – Existing – Ogbere Basin

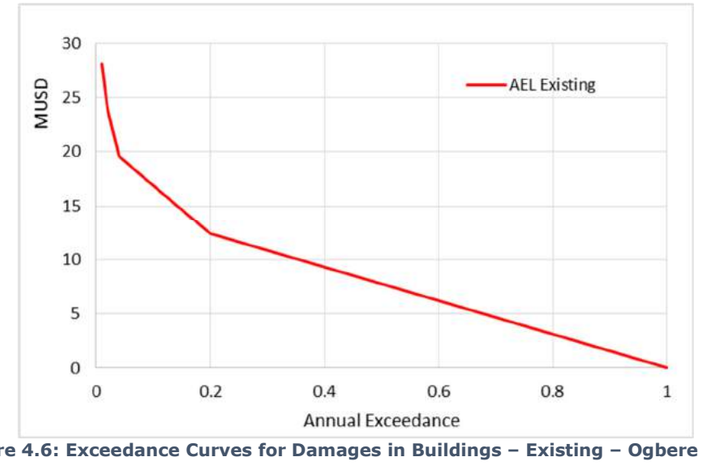

Figure 4.6: Exceedance Curves for Damages in Buildings – Existing – Ogbere Basin

The estimated Average Annual Losses in buildings within Ogbere Basin is **8.2 MUSD**

4.1.4 Omi Basin

Table 4.4 shows the losses in buildings in different return periods for Omi Basin, while Figure 4.7 and Figure 4.8 show the return period curve and loss exceedance curve respectively.

Table 4.4: Average Annual Losses in Buildings - Existing Situation – Omi Basin

Increment	Return Period	Annual Exceedance	Losses Existing (USD)	Increment damage (USD)
1	1	1	-	
2	5	0.2	14,083,404	5,633,362
3	25	0.04	25,116,030	3,135,955
4	50	0.02	30,623,053	557,391
5	100	0.01	36,714,746	336,689
			AAL Existing	9,663,396

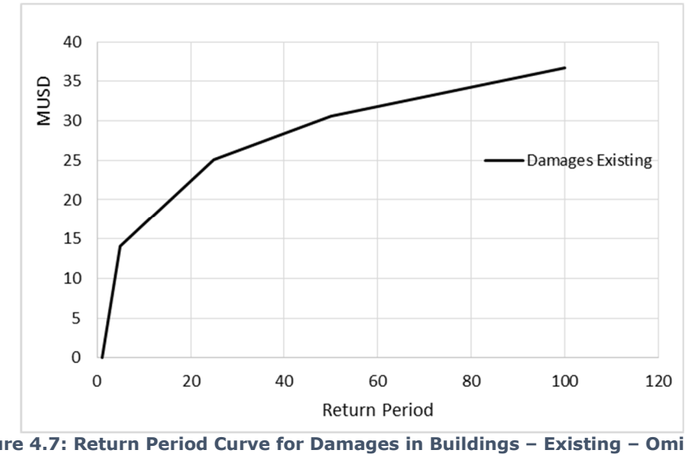

Figure 4.7: Return Period Curve for Damages in Buildings – Existing – Omi Basin

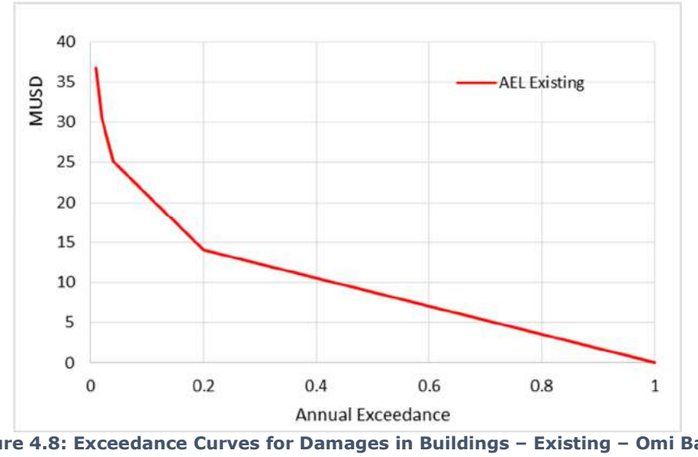

Figure 4.8: Exceedance Curves for Damages in Buildings – Existing – Omi Basin

The estimated Average Annual Losses in buildings within Omi Basin is **9.66 MUSD**

4.2 Roads and Infrastructure Losses

4.2.1 Ona Basin

Table 4.5 shows the losses in roads and infrastructure in different return periods for Ona Basin, while Figure 4.9 and Figure 4.10 show the return period curve and loss exceedance curve respectively.

Table 4.5: Average Annual Losses in Roads & Infrastructure - Existing Situation – Ona Basin

Increment	Return Period	Annual Exceedance	Losses Existing (USD)	Increment damage (USD)
1	1	1	-	
2	5	0.2	4,465,862	1,786,345
3	25	0.04	7,207,578	933,875
4	50	0.02	8,627,317	158,349
5	100	0.01	10,297,071	94,622
			AAL Existing	2,973,191

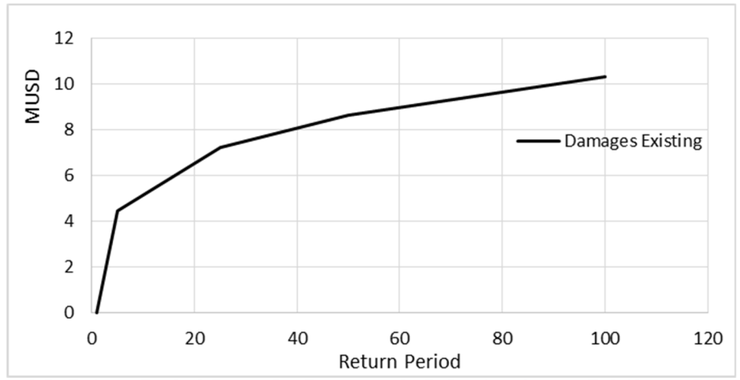

Figure 4.9: Return Period Curve for Damages in Infrastructure – Existing – Ona Basin

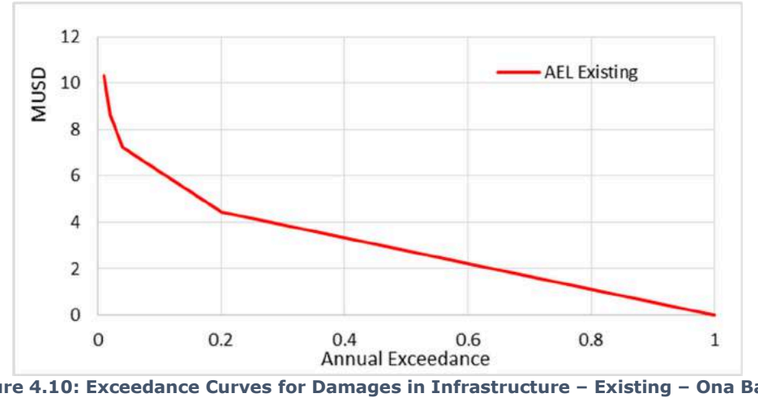

Figure 4.10: Exceedance Curves for Damages in Infrastructure – Existing – Ona Basin

The estimated Average Annual Losses in Roads and Infrastructure within Ona Basin is **2.9 MUSD**

4.2.2 Ogunpa Basin

Table 4.6 shows the losses in roads and infrastructure in different return periods for Ogunpa Basin, while Figure 4.11 and Figure 4.12 show the return period curve and loss exceedance curve respectively.

Table 4.6: Average Annual Losses in Roads & Infrastructure - Existing Situation – Ogunpa Basin

Increment	Return Period	Annual Exceedance	Losses Existing (USD)	Increment damage (USD)
1	1	1	-	
2	5	0.2	983,862	393,545
3	25	0.04	1,720,408	216,342
4	50	0.02	2,025,517	37,459
5	100	0.01	2,347,531	21,865
			AAL Existing	669,211

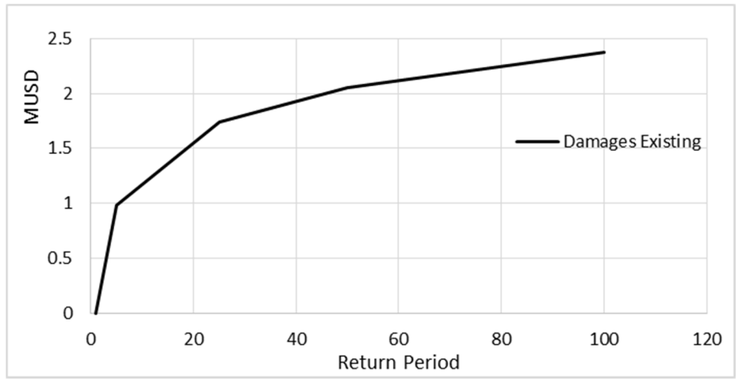

Figure 4.11: Return Period Curve for Damages in Infrastructure – Existing – Ogunpa Basin

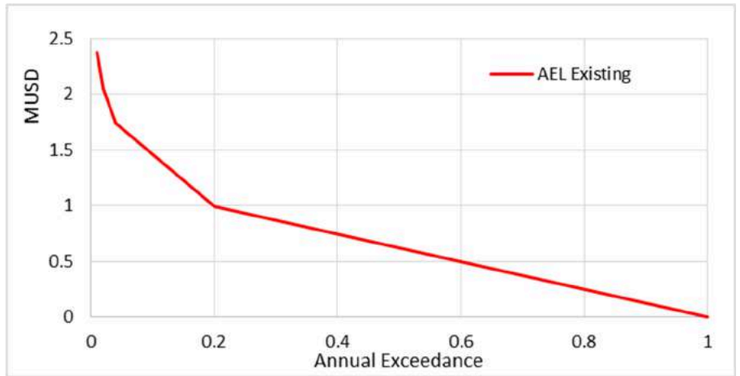

Figure 4.12: Exceedance Curves for Damages in Infrastructure – Existing – Ogunpa Basin

The estimated Average Annual Losses in Roads and Infrastructure within Ogunpa Basin is **0.67 MUSD**

4.2.3 Ogbere Basin

Table 4.7 shows the losses in roads and infrastructure in different return periods for Ogbere Basin, while Figure 4.13 and Figure 4.14 show the return period curve and loss exceedance curve respectively.

Table 4.7: Average Annual Losses in Roads & Infrastructure - Existing Situation – Ogbere Basin

Increment	Return Period	Annual Exceedance	Losses Existing (USD)	Increment damage (USD)
1	1	1	-	
2	5	0.2	864,607	345,843
3	25	0.04	1,299,804	173,153
4	50	0.02	1,626,216	29,260
5	100	0.01	1,953,985	17,901
			AAL Existing	566,157

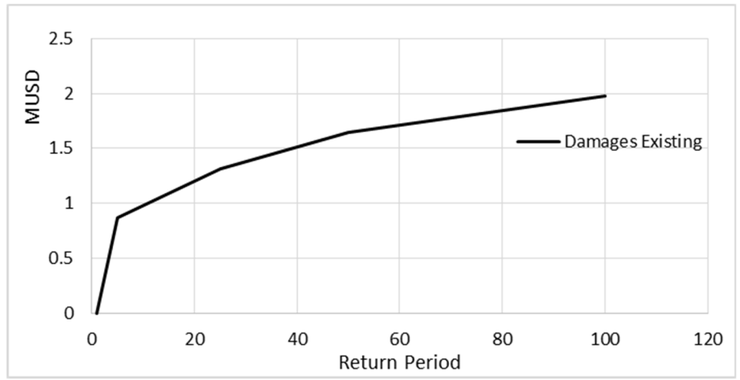

Figure 4.13: Return Period Curve for Damages in Infrastructure – Existing – Ogbere Basin

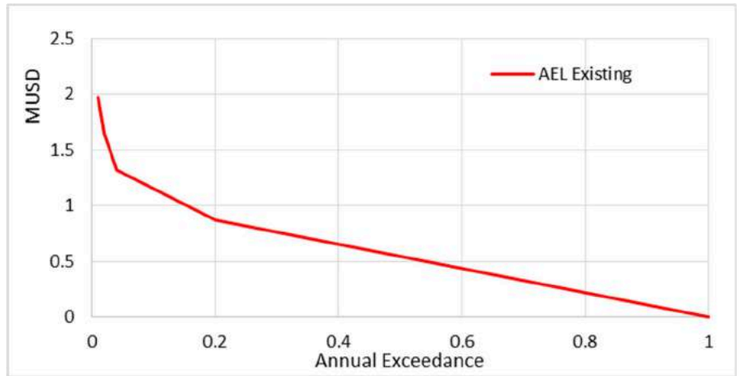

Figure 4.14: Exceedance Curves for Damages in Infrastructure – Existing – Ogbere Basin

The estimated Average Annual Losses in Roads and Infrastructure within Ogbere Basin is **0.57 MUSD**

4.2.4 Omi Basin

Table 4.8 shows the losses in roads and infrastructure in different return periods for Omi Basin, while Figure 4.15 and Figure 4.16 show the return period curve and loss exceedance curve respectively.

Table 4.8: Average Annual Losses in Roads & Infrastructure - Existing Situation – Omi Basin

Increment	Return Period	Annual Exceedance	Losses Existing (USD)	Increment damage (USD)
1	1	1	-	
2	5	0.2	1,256,789	502,715
3	25	0.04	2,256,938	281,098
4	50	0.02	2,795,832	50,528
5	100	0.01	3,356,950	30,764
			AAL Existing	865,105

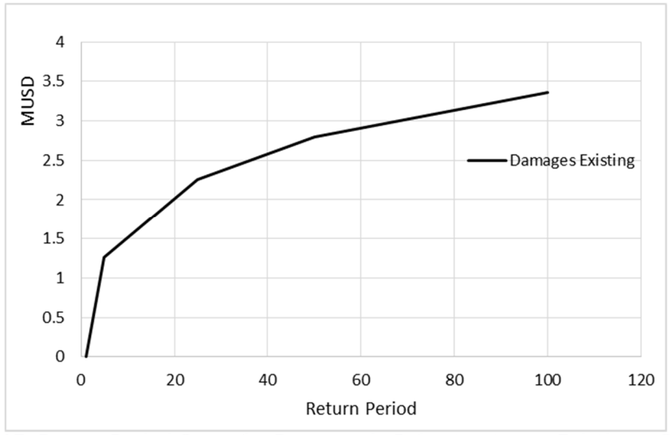

Figure 4.15: Return Period Curve for Damages in Infrastructure – Existing – Omi Basin

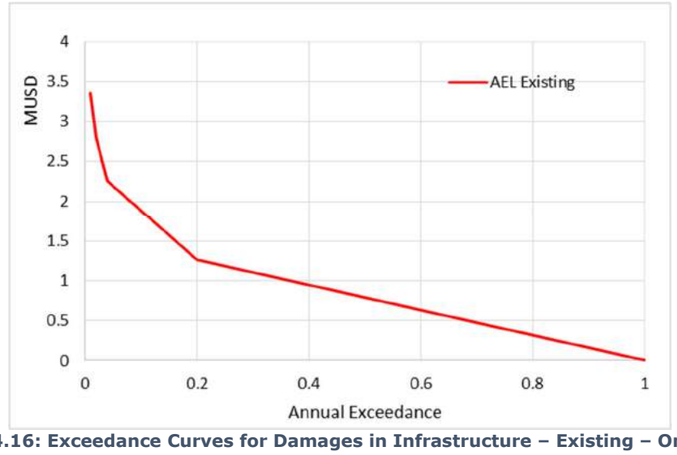

Figure 4.16: Exceedance Curves for Damages in Infrastructure – Existing – Omi Basin

The estimated Average Annual Losses in Roads and Infrastructure within Omi Basin is **0.86 MUSD**

4.3 Losses to People

4.3.1 Ona Basin

Table 4.9 shows the losses to people in different return periods for Ona Basin, while Figure 4.17 and Figure 4.18 show the return period curve for injuries and deaths respectively.

Table 4.9: Losses to People (Capita) & Average Annual Losses - Existing Situation – Ona Basin

	Return Period	Annual Exceedance	Losses (Injuries) (Capita)	Losses (Deaths) (Capita)	Total Existing Losses(USD)	Total Incremental damage (USD)
1	1	1	-	-	-	
2	5	0.2	2,568	132	45,427,595	18,171,038
3	25	0.04	4,314	303	85,376,470	10,464,325
4	50	0.02	5,135	398	106,219,380	1,915,959
5	100	0.01	6,074	519	131,177,257	1,186,983
					AAL Existing	31,738,305

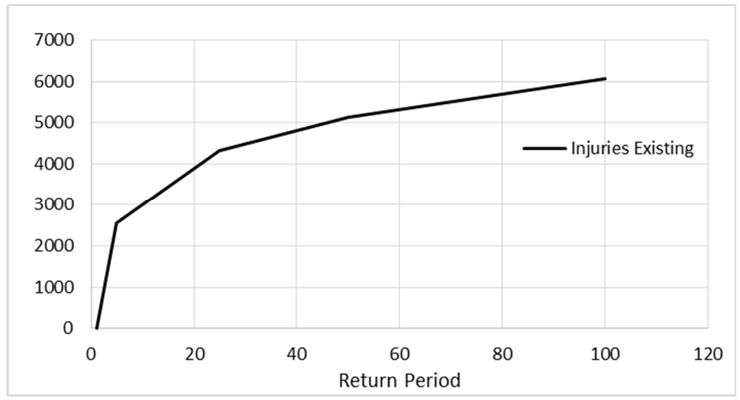

Figure 4.17: Return Period Curve for Injuries to People – Existing – Ona Basin

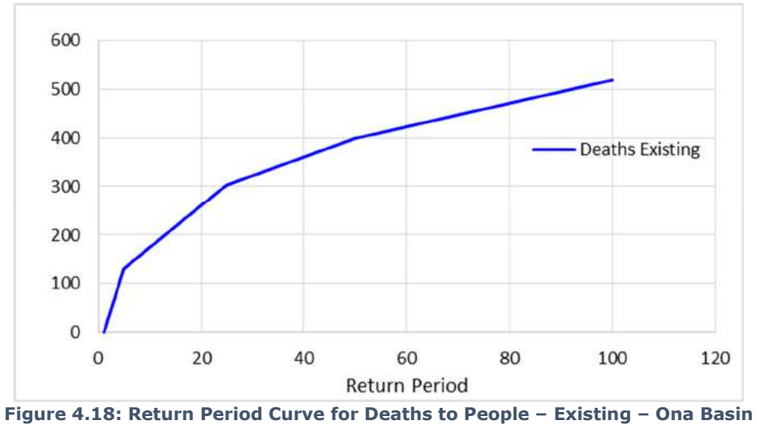

Figure 4.18: Return Period Curve for Deaths to People – Existing – Ona Basin

The estimated Average Annual Losses in People within Ona Basin is **31.7 MUSD**

4.3.2 Ogunpa Basin

Table 4.10 shows the losses to people in different return periods for Ogunpa Basin, while Figure 4.19 and Figure 4.20 show the return period curve for injuries and deaths respectively.

Table 4.10: Losses to People (Capita) & Average Annual Losses - Existing Situation – Ogunpa Basin

	Return Period	Annual Exceedance	Losses (Injuries) (Capita)	Losses (Deaths) (Capita)	Total Existing Losses(USD)	Total Incremental damage (USD)
1	1	1	-	-	-	
2	5	0.2	2,580	87	40,216,824	16,086,730
3	25	0.04	4,287	164	69,079,710	8,743,723
4	50	0.02	5,345	218	87,719,361	1,567,991
5	100	0.01	6,438	280	107,583,011	976,512
					AAL Existing	**27,374,955**

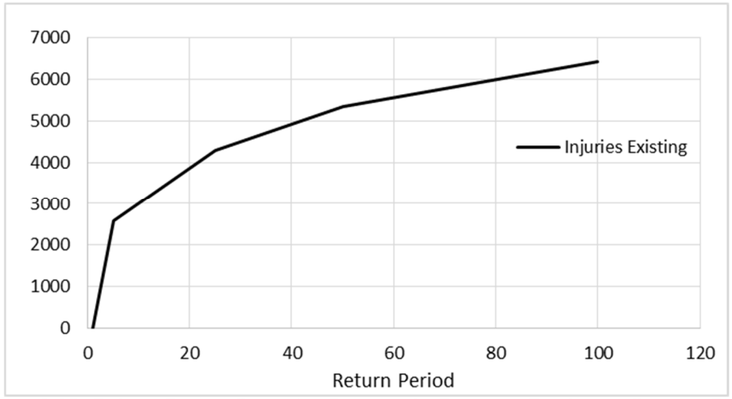

Figure 4.19: Return Period Curve for Injuries to People – Existing – Ogunpa Basin

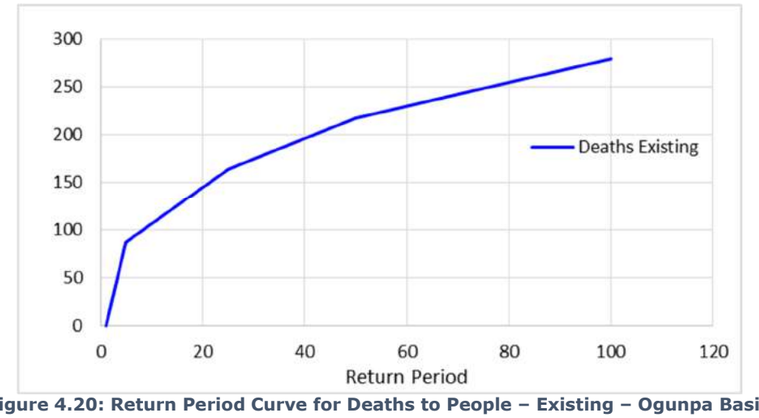

Figure 4.20: Return Period Curve for Deaths to People – Existing – Ogunpa Basin

The estimated Average Annual Losses in People within Ogunpa Basin is **27.3 MUSD**

4.3.3 Ogbere Basin

Table 4.11 shows the losses to people in different return periods for Ogbere Basin, while Figure 4.21 and Figure 4.22 show the return period curve for injuries and deaths respectively.

Table 4.11: Losses to People (Capita) & Average Annual Losses - Existing Situation – Ogbere Basin

	Return Period	Annual Exceedance	Losses (Injuries) (Capita)	Losses (Deaths) (Capita)	Total Existing Losses(USD)	Total Incremental damage (USD)
1	1	1	-	-	-	
2	5	0.2	706	21	10,794,426	4,317,770
3	25	0.04	1,153	39	17,986,829	2,302,500
4	50	0.02	1,432	51	22,521,424	405,083
5	100	0.01	1,701	65	27,405,737	249,636
					AAL Existing	**7,274,989**

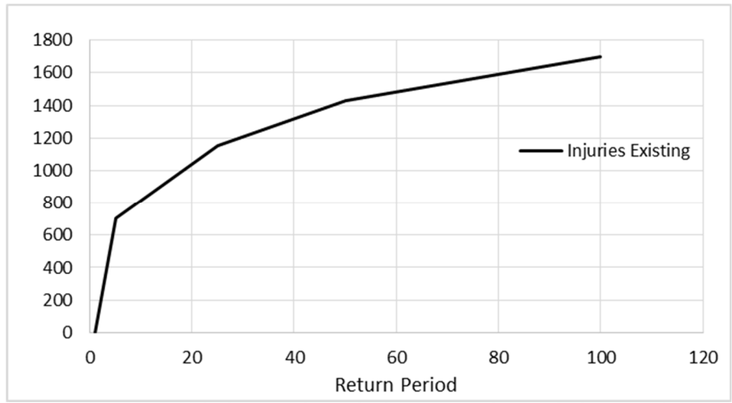

Figure 4.21: Return Period Curve for Injuries to People – Existing – Ogbere Basin

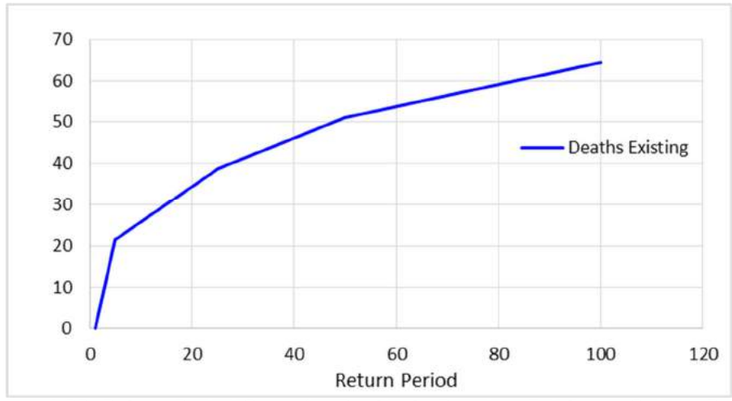

Figure 4.22: Return Period Curve for Deaths to People – Existing – Ogbere Basin

The estimated Average Annual Losses in People within Ogbere Basin is **7.3 MUSD**

4.3.4 Omi Basin

Table 4.12 shows the losses to people in different return periods for Omi Basin, while Figure 4.23 and Figure 4.24 show the return period curve for injuries and deaths respectively.

Table 4.12: Losses to People (Capita) & Average Annual Losses - Existing Situation – Omi Basin

	Return Period	Annual Exceedance	Losses (Injuries) (Capita)	Losses (Deaths) (Capita)	Total Existing Losses (USD)	Total Incremental damage (USD)
1	1	1	-	-	-	
2	5	0.2	580	21	9,092,500	3,637,000
3	25	0.04	1,046	47	17,660,449	2,140,236
4	50	0.02	1,299	65	22,486,479	401,469
5	100	0.01	1,599	90	29,002,794	257,446
					AAL Existing	6,436,152

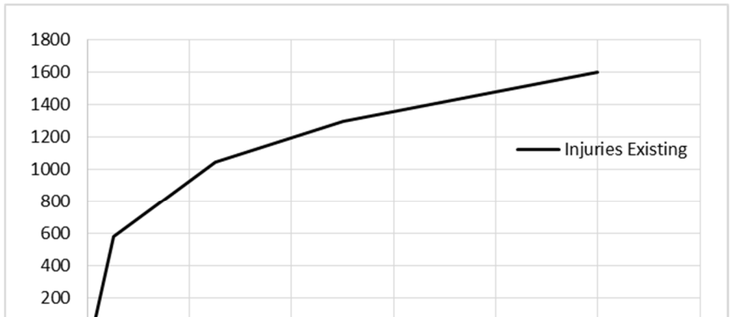

Figure 4.23: Return Period Curve for Injuries to People – Existing – Omi Basin

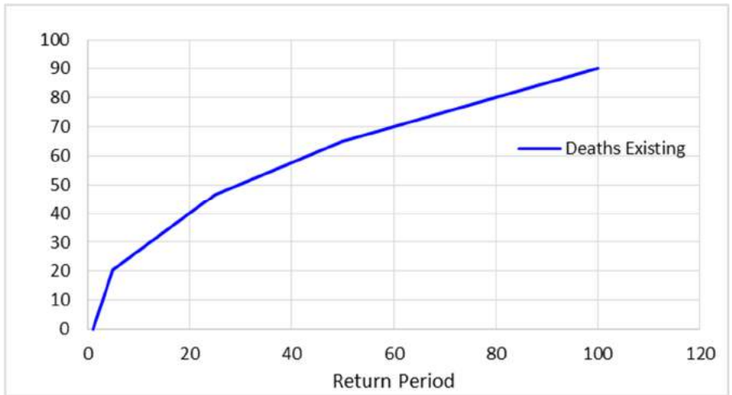

Figure 4.24: Return Period Curve for Deaths to People – Existing – Omi Basin

The estimated Average Annual Losses in People within Omi Basin is **6.4 MUSD**

4.4 Total Losses

4.4.1 Ona Basin

Table 4.13 shows the total losses in different return periods for Ona Basin, while Figure 4.25 shows the exceedance curve for the total losses.

Table 4.13: Total Average Annual Losses - Existing Situation – Ona Basin

	Return Period	Annual Exceedance	Total Existing People Losses (USD)	Total Existing Buildings Losses (USD)	Total Existing Infrastructure Losses (USD)	Total Existing Losses (USD)	Total Incremental damage (USD)
1	1	1	-	-	-	-	
2	5	0.2	45,427,595	48,151,431	4,465,862	98,044,888	39,217,955
3	25	0.04	85,376,470	80,627,327	7,207,578	173,211,375	21,700,501
4	50	0.02	106,219,380	96,191,933	8,627,317	211,038,631	3,842,500
5	100	0.01	131,177,257	112,766,858	10,297,071	254,241,187	2,326,399
						AAL Existing	67,087,355

Figure 4.25: Exceedance Curve for Total Losses – Existing – Ona Basin

The estimated Total Average Annual Losses within Ona Basin is **67 MUSD**

4.4.2 Ogunpa Basin

Table 4.14 shows the total losses in different return periods for Ogunpa Basin, while Figure 4.26 shows the exceedance curve for the total losses.

Table 4.14: Total Average Annual Losses - Existing Situation – Ogunpa Basin

	Return Period	Annual Exceedance	Total Existing People Losses(USD)	Total Existing Buildings Losses(USD)	Total Existing Infrastructure Losses(USD)	Total Existing Losses(USD)	Total Incremental damage (USD)
1	1	1	-	-	-	-	
2	5	0.2	40,216,824	23,160,550	983,862	64,361,236	25,744,494
3	25	0.04	69,079,710	38,064,918	1,720,408	108,865,036	13,858,102
4	50	0.02	87,719,361	47,000,724	2,025,517	136,745,602	2,456,106
5	100	0.01	107,583,011	56,312,755	2,347,531	166,243,297	1,514,944
						AAL Existing	43,573,647

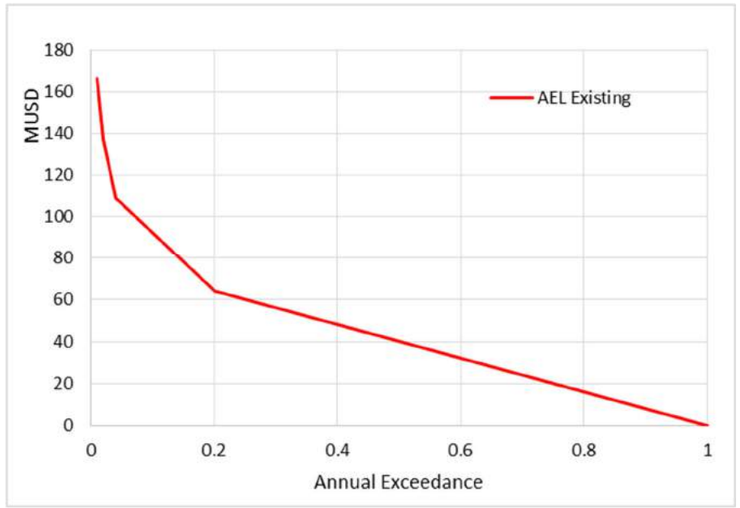

Figure 4.26: Exceedance Curve for Total Losses – Existing – Ogunpa Basin

The estimated Total Average Annual Losses within Ogunpa Basin is **43.5 MUSD**

4.4.3 Ogbere Basin

Table 4.15 shows the total losses in different return periods for Ogbere Basin, while Figure 4.27 shows the exceedance curve for the total losses.

Table 4.15: Total Average Annual Losses - Existing Situation – Ogbere Basin

	Return Period	Annual Exceedance	Total Existing People Losses(USD)	Total Existing Buildings Losses(USD)	Total Existing Infrastructure Losses(USD)	Total Existing Losses(USD)	Total Incremental damage (USD)
1	1	1	-	-	-	-	
2	5	0.2	10,794,426	12,409,849	864,607	24,068,881	9,627,553
3	25	0.04	17,986,829	19,567,801	1,299,804	38,854,434	5,033,865
4	50	0.02	22,521,424	23,944,879	1,626,216	48,092,519	869,470
5	100	0.01	27,405,737	28,066,235	1,953,985	57,425,957	527,592
						AAL Existing	16,058,480

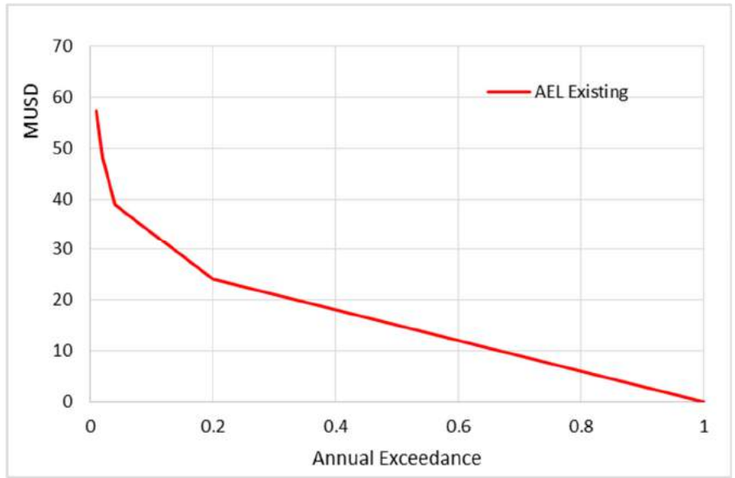

Figure 4.27: Exceedance Curve for Total Losses – Existing – Ogbere Basin

The estimated Total Average Annual Losses within Ogbere Basin is 16.1 **MUSD**

4.4.4 Omi Basin

Table 4.16 shows the total losses in different return periods for Omi Basin, while Figure 4.28 shows the exceedance curve for the total losses.

Table 4.16: Total Average Annual Losses - Existing Situation – Omi Basin

	Return Period	Annual Exceedance	Total Existing People Losses(USD)	Total Existing Buildings Losses(USD)	Total Existing Infrastructure Losses(USD)	Total Existing Losses(USD)	Total Incremental damage (USD)
1	1	1	-	-	-	-	
2	5	0.2	9,092,500	14,083,404	1,256,789	24,432,693	9,773,077
3	25	0.04	17,660,449	25,116,030	2,256,938	45,033,418	5,557,289
4	50	0.02	22,486,479	30,623,053	2,795,832	55,905,363	1,009,388
5	100	0.01	29,002,794	36,714,746	3,356,950	69,074,490	624,899
						AAL Existing	**16,964,653**

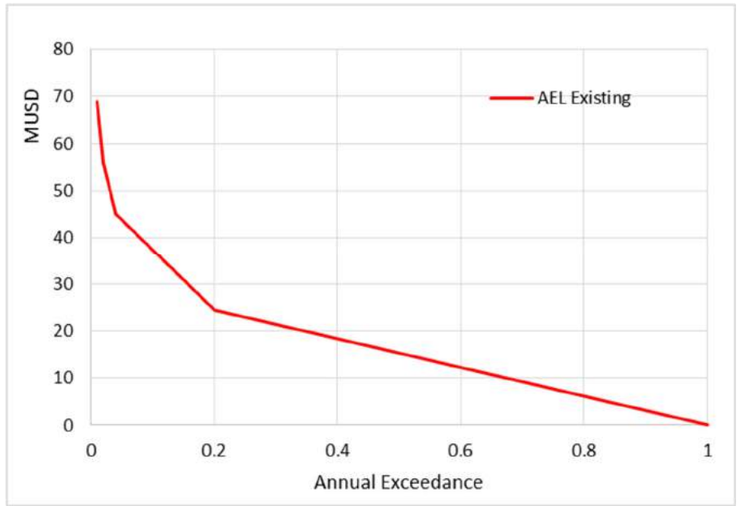

Figure 4.28: Exceedance Curve for Total Losses – Existing – Omi Basin

The estimated Total Average Annual Losses within Omi Basin is **17 MUSD**

Annex

14

Drainage Design Criteria

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1 Introduction

This annex set the required design criteria to enable the analysis and the sizing of proposed drainage elements such as channels, bridges and culverts. Storm water drainage elements should be capable of conveying the design peak flow without causing any risks or hazards on adjacent areas.

The selection of design criteria depends on the physical nature of the area, future development, and economic considerations. It is important to define the design flow for each drainage element according to its suitable return period, channel and structures sizes and their hydraulic design limitations.

1.1 Drainage Framework

The drainage framework comprises of lots of information such as climate, rainfall data, topography, aerial photos, rivers, land use, dams, waterbodies…etc. In addition, the drainage framework includes the hydrological model and the hydraulic model. Figure 1 presents the methodology block diagram.

The drainage framework and methodology includes the development of 2 models as follows:

1- A Hydrological model; and
2- A Hydraulic model

The Hydrological model includes 3 types of data as follows:

a. Meteorological data

The Meteorological data is collected from precipitation data and information of storm profiles that occur in Ibadan or similar.

- Precipitation data is collected from the Rainfall Gauge Stations available in Ibadan.
- Precipitation data is used to develop Rainfall Frequency Analysis.
- Meteorological data contributes in developing the Stormwater Runoff Calculations.

b. Topographic data

- Topographic data is collected from the LiDAR Aerial Survey.
- Topographic data is represented in the form of a Digital Elevation Model (DEM).
- The DEM is used in the catchment delineation of the basins and the subbasins of Ibadan.
- The DEM is used in the identification of the Rivers, Tributaries and Streams.
- Satellite images and site visits are also used to validate stream pathways on ground.
- The DEM is used in defining the watershed characteristics of each stream such as the longest flow path, the time of concentration…etc.
- The Topographic data contributes in developing the Stormwater Runoff Calculations.

c. Ground Surface Information

- Ground surface information is collected from urban maps, satellite images, site visits and surveys.
- The above information is used to determine the following 3 important characteristics:
  - Type of land use such as residential areas, industrial areas, vacant spaces…etc.
  - Type of land cover such as urban areas, green areas, water bodies…etc.
  - Type of soil such as sand, silt, clay and other types of soils.
- Satellite images and site visits are also used for interpretation and validation.
- The above 3 characteristics (land use, land cover and type of soil) are used to develop Curve Number Maps (CN maps)
- The CN map contributes in developing the Stormwater Runoff Calculations.

The above 3 types of data (Meteorological data, Topographic data and Ground Surface Information are used to develop the Stormwater Runoff Calculations such as the runoff depths and runoff volumes at different locations. Hydrographs are then extracted at different locations to get the design flow discharges. These design discharges are used in designing different elements of the drainage system in the hydraulic model. The hydraulic model uses the outputs from the hydrological model to design different elements of the drainage system. Ibadan Drainage system consists of 3 main elements:

1. The Water Courses
2. The Crossing Structures, and
3. The Attenuations Works.

The water courses are regarded as the backbone of the drainage system. They are classified based on their contributing catchment area to three levels, Rivers, Tributaries and Streams.

a. Rivers are identified as water courses having catchment area larger than 25 km^2, while
b. Tributaries serves catchment areas from 1 to 25 km^2, and
c. Streams contributes small catchment area (less than 1 km^2).

The crossing structures are generally located where the road section crosses a natural stream flow. These crossing structures are divided into culverts and bridges. The division is based on flow design discharges for a 100-year return period.

a. Culverts are crossing structures for runoff values less than 250 m^3/s.
b. Bridges are crossing structures for runoff values greater than 250 m^3/s.

Crossing structures are also classified based on their location, whether lying on proposed channelization, or lying on natural streams (separate structures).

Attenuation works are necessary to reduce the peak flow and decrease the proposed sizes of drainage elements. Dikes & Dams are 2 types of structures that provide attenuation.

Attenuation works are selected in undeveloped land locations where expropriation for land is at the low-side. Such systems are often termed as Sustainable Drainage Systems.

The above drainage elements are modelled using different hydraulic models to analyse their water depths, velocity and discharges.

- Channelization of water courses are proposed with adequate sizes to convey the peak flow.
- Existing crossing structures are analysed for their hydraulic and structural adequacy.
- Inadequate or undersized structures are designed based on a specified hydraulic design criteria in order to achieve an appropriate geometrical size capable of conveying the peak flow.
- Dikes are designed with appropriate heights and lengths that is capable of producing attenuation
- Dams are designed for multi-purposes; for attenuation and for water supply.

Following the design of all drainage elements, the dimensions of all channels, culverts, bridges, dikes and dams are tabulated and mapped.

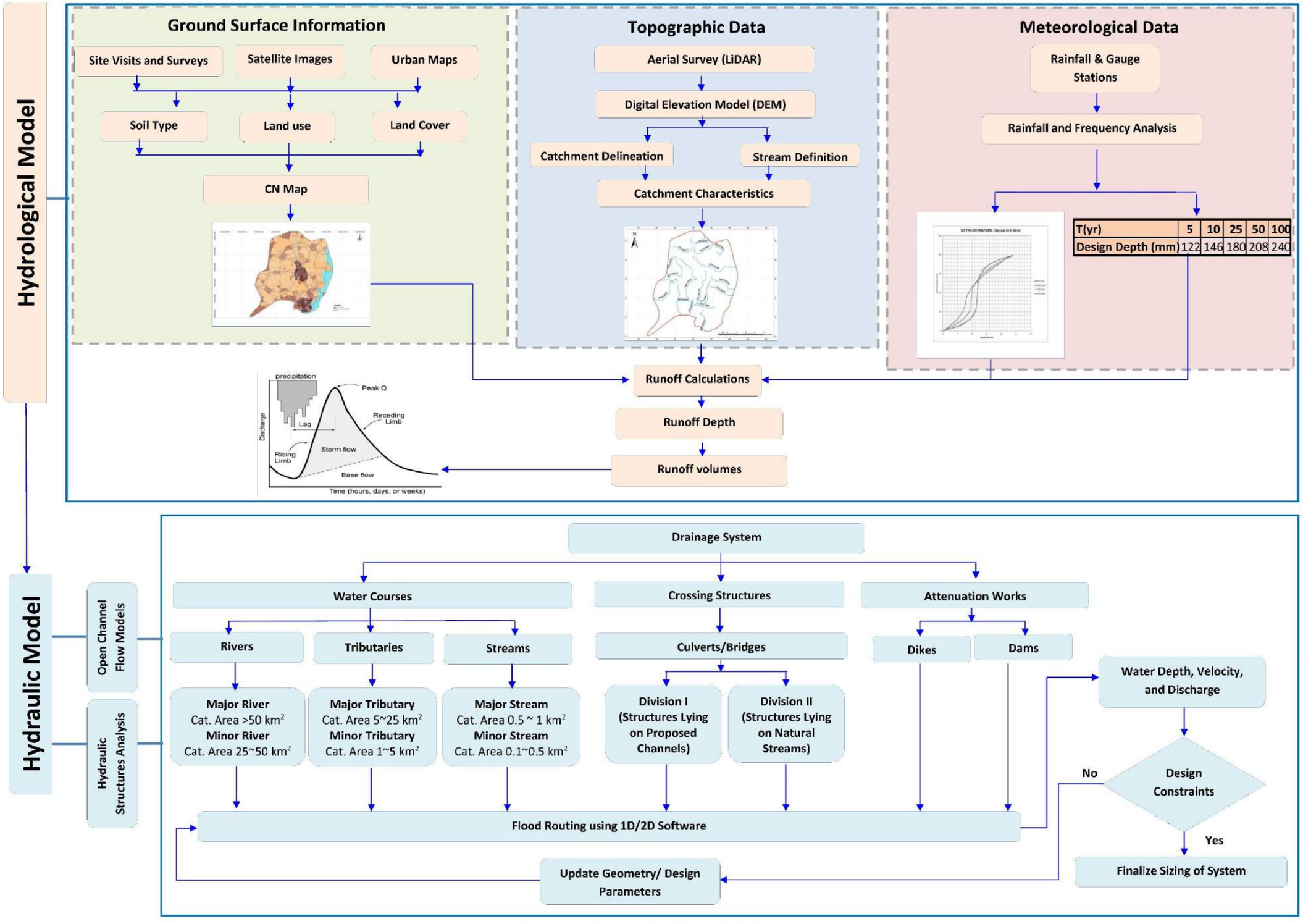

Figure 1: Drainage Methodology Block Diagram

2 Hydrological Analysis and Design Criteria

Hydrological analysis is a necessary step prior to the hydraulic analysis of drainage streams. It includes the estimation of the catchment morphological parameters and establishment of a rainfall- runoff model to estimate the discharges at different points of interest. The hydrological analysis is illustrated in details in Annex 1. However, this section highlights the hydrological design criteria used in the Masterplan.

2.1 Rainfall Frequency Analysis

The rainfall data collected from 4 stations in Ibadan and namely Ibadan New Airport, IITA, NIHORT, and Ibadan Old Airport station are used to prepare a rainfall frequency analysis. The number of years with available record data is rather small, ranging from 30 to 54 years. Results from rainfall frequency analysis can be more reliable if based on regional estimation, using all observations in the region rather than using data from single stations.

By using data from all sites in a region, Table 2.1 shows the results of the regional frequency analysis for design purposes in Ibadan. Results are already multiplied by a fixed-duration correction factor of 1.13 to compensate for the underestimation of maximum daily rainfall due to recording at fixed intervals (calendar days).

Table 2.1: Design rainfall depths for Ibadan.

T (yr)	2	5	10	25	50	100
Design Depth (mm)	91	122	146	180	208	240

2.2 Design Storm Profile

In addition to specifying a design rainfall depth and duration for a given return period, it is necessary to specify a design storm profile, i.e. a description of the variation of intensity with time during the storm. The variation of precipitation intensity over the duration of the storm is an important factor in determining the timing and the magnitude of the peak flow, especially for small watersheds. A realistic estimate of temporal distribution can be obtained only from an analysis of precipitation data from a recording gauge network.

In the absence of short duration records or any similar information, the temporal rainfall distribution could be estimated as a ratio of the daily rainfall depth based on assumed ratios and daily rainfall depth. An example of such ratios were first proposed from durations of 2-hr to 5-min by Bell (1969) based on studies in the USA. Bell ratios have been extended to the 24-hr rainfall depth by the Soil Conservation Service of the USA through their SCS type II dimensionless rainfall curve (SCS, 1986).

In the absence of reliable rainfall-runoff data, the SCS is much less data intensive than other detailed methods, while taking into account several site-specific information such as land use, soil type, watershed characteristics (as reflected by the time of concentration/lag time), etc. The SCS method was developed and is widely used in the USA, where a large part of the country is humid. The curve number (CN) tables cover a large range of climates from arid and semi-arid to forest conditions, from urban to rural, and covering a range of associated soil types. The method also allows adjustment of curve numbers to reflect dry or wet soil runoff conditions (previously antecedent moisture conditions AMC). A number of studies in Nigeria and Africa as well as tropical regions have used the SCS method.

The design storm profile used in the Masterplan will follow the SCS assumptions (SCS type-II storm) based on maximum 24hrs rainfall distribution (SCS, 1974).

2.3 Areal Reduction Factor

The design of drainage structures requires knowledge of how much rain is likely to fall within a certain amount of time and over a specific area. The rainfall depth of a design storm is estimated from a statistical analysis of a point (station) data. Design point rainfall estimates assume a uniform distribution of rainfall over a catchment, and hence are only representative for a small area.

For larger areas, the areal average rainfall depth is likely to be much smaller than at the point of the maximum observed depth due to the spatial variability of rainfall. The estimation of areal reduction factors (ARFs) is concerned with the relationship between the point and areal rainfall. The Areal Reduction Factor (ARF) is used to convert estimates of extreme point rainfall to estimates of area-averaged rainfall.

The ARF theoretically range from 0 to 1, however, the common practical range is from 0.6 to 1. The ARF varies according to storm characteristics (recurrence interval), and watershed characteristics (watershed size, shape, and geographic location). The spatial variability of rainfall must be considered, where the observations show differences between the rain gauge records for a concurrent date.

ARF estimates are based on empirical methods. This section presents an ARF developed for Ibadan based on the collected precipitation depths from 5 meteorological stations.

The developed equation used for design purposes in the Ibadan Masterplan is as follows:

$$ARF = 1 - 0.1424 \log(A + 1)$$

Where

- *ARF* is the Area Reduction Factor
- *A* is the surface area of the catchment in km^2

For example, the ARF for Ona watershed at Eleyele Dam (A =319 km^2) is 0.63

2.4 Catchment Delineation

Delineation is used to define boundaries of the drainage basins, and/or to divide the drainage basins into sub-catchments. Delineation is a part of the process known as watershed segmentation, i.e., dividing the watershed into discrete land and channel segments to analyze watershed behavior. Based on the LiDAR data, Ibadan was delineated into 4 major river basins (Ona, Ogunpa, Ogbere and Omi).

The 4 major river basins are then delineated into 38 subbasins. The delineation process was performed using a commercial software GIS package (ArcMap 10.5).

In addition, Catchment delineation was implemented for all tributaries and small streams in Ibadan in order to estimate the contributing watershed of each tributary or small stream. Figure 2 shows the watershed delineation of some tributaries in Ogunpa River Basin highlighting the watershed delineation of one of the small streams watershed (System no. 6B). Around 2000 tributaries and small streams are delineated, the watershed area of each is available in the GIS Geodatabase.

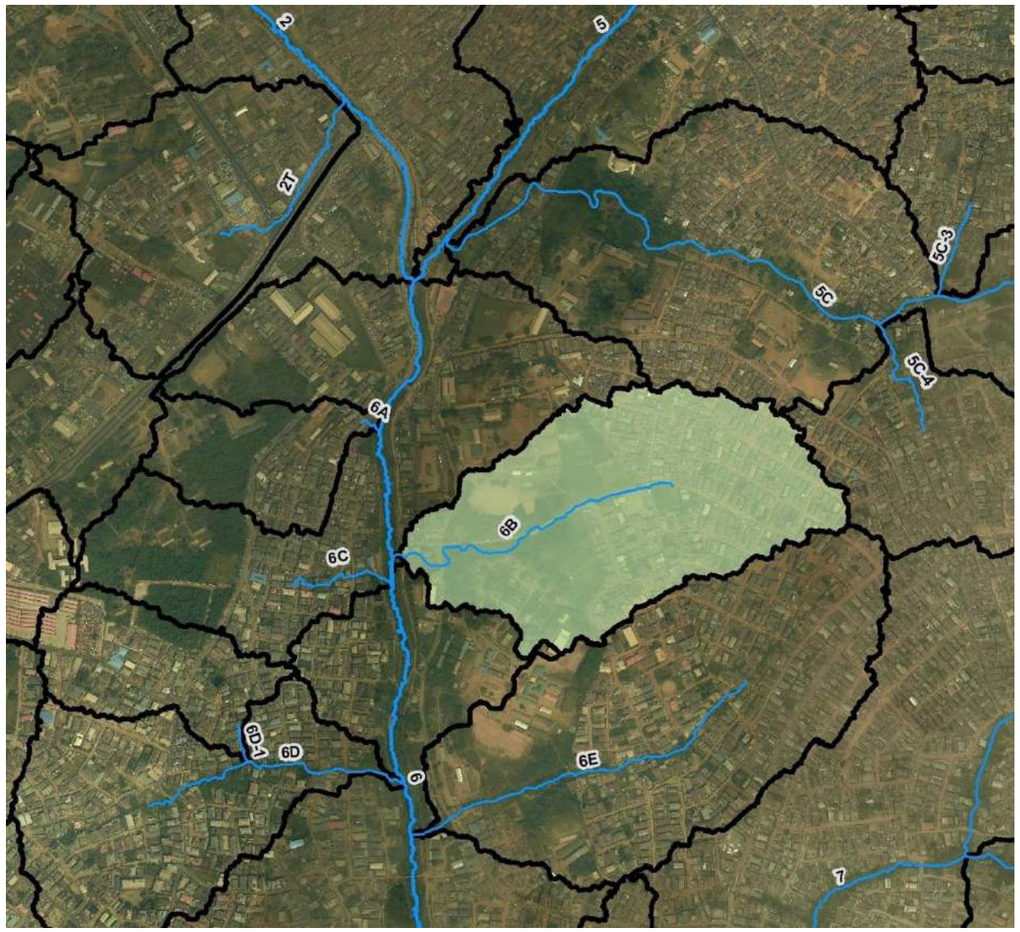

Figure 2: Delineation of tributaries and small streams

Moreover, catchment delineation was also carried on for all crossing structures in Ibadan in order to estimate the contributing watershed of each structure. Around 1615 crossing structures are delineated, the watershed area of each structure is available in the GIS Geodatabase. Figure 3 shows the watershed delineation of some structures in Ogunpa basin highlighting the watershed delineation of one of the structures (Structure Id no. 395).

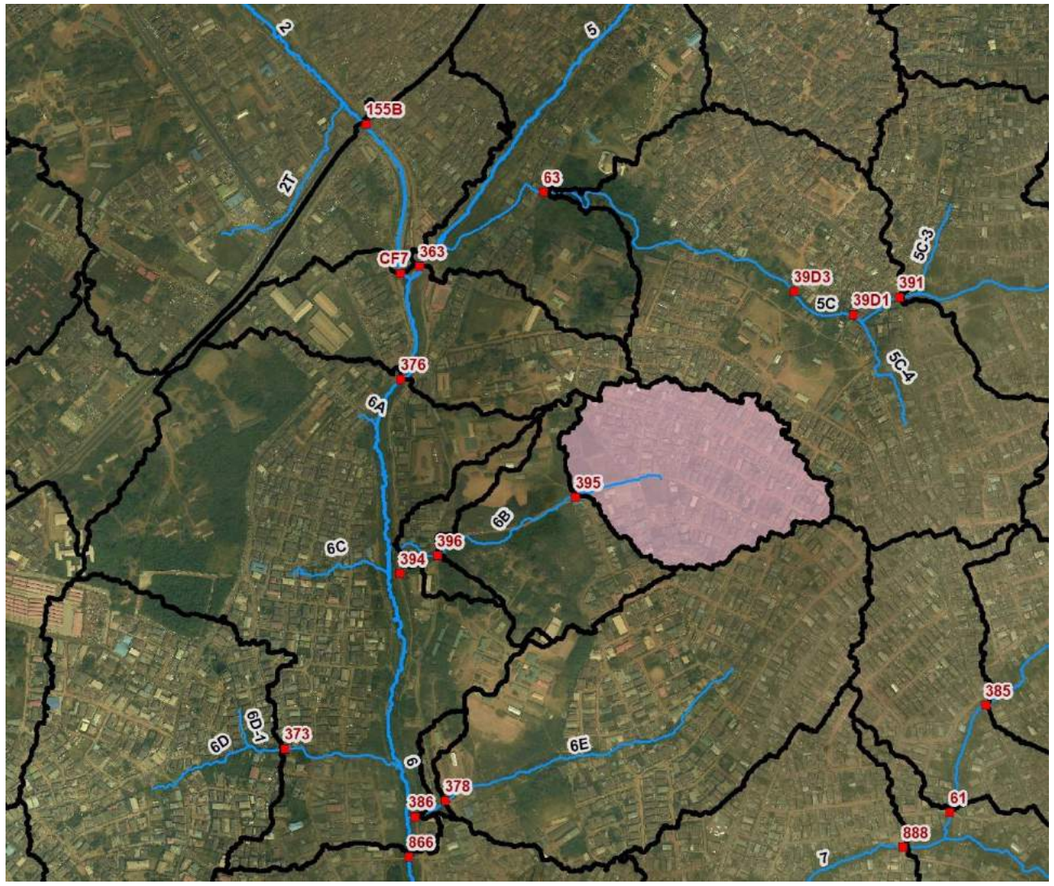

Figure 3: Delineation of crossing structures

2.5 Drainage Streams Categories

The city of Ibadan is naturally drained by a dense network of rivers and streams. These streams varies from large Rivers (e.g. Ona River) that has large watershed areas in the order of 400 km2 to minute streams with small watershed areas in the order of 0.1km^2. In this respect, it is necessary to divide these streams into a set of categories to such that it is easy to organize the various degrees of these streams.

The streams network is commonly identified by specifying a threshold area which is the minimum drainage area required to generate a channel flow; such area is identified as the stream threshold.

In the Masterplan, the streams of Ibadan are divided into 6 drainage categories according to a specific threshold. To identify each category separately, the streams of Ibadan are delineated with 6 various thresholds ranging from 0.1km^2 to 50km^2. Figure 4 shows the layout of various drainage categories at the industrial area near the confluence of Ona River with Alaro tributary. The various drainage categories are available in the GIS Geodatabase.

Table 2.2 presents the 6 drainage categories with a River Name example for each category.

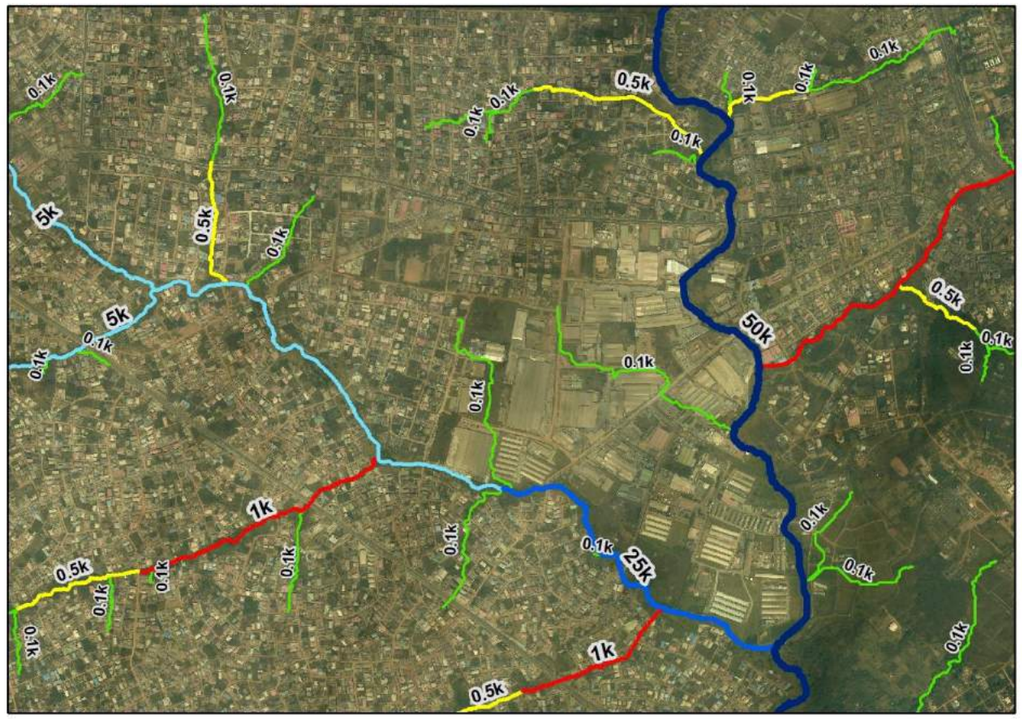

Figure 4: Drainage Categories

Table 2.2: Drainage categories and catchment area coverage

No	Drainage Category ID	Drainage Category and Catchment Area Coverage	Examples of Rivers
1	50k	Major River (>50km2)	Ona, Omi
2	25k	Minor River (25-50km2)	Alapata, Lower Alaro, Lower Ogunpa,Lower Ogbere
3	5k	Major Tributary (5 to 25km2)	Upper Alaro, Lower Kudeti, Lower Olojuoro, Middle and Upper Ogunpa, Upper Ogbere, Foworogbun, Orogun
4	1k	Minor Tributary (1 to 5km2)	Lower Yemtu, Middle Olojuoro, Lower Labelabe
5	0.5k	Major Stream (0.5 to 1 km2)	Gege, Upper Yemetu,Upper Olojuoro, Upper Labelabe, Lower Iye, Lower Aremo, Eleta, Oba, Lower Alawo
6	0.1k	Minor Stream (0.1 to 0.5km2)	Elegun, Olokun, Upper Alawo, Upper Aremo, Upper Iye

2.6 Estimation of Runoff

Various methods are available for the determination of flood hydrographs. However, the selection of a specific method depends on the project watershed and the complexity of design or level of accuracy required.

The Masterplan used the U.S. Department of Agriculture, National Resources Conservation Service (NRCS), formerly Soil Conservation Service (SCS), runoff method and Unit Hydrograph to estimate peak flood discharges. The SCS method is suited for humid, semi-arid, and arid conditions (SCS, 1985).

The hydrological analysis annex illustrates the methodology used in the Masterplan to estimate the runoff, curve number, unit hydrograph and the hydrological routing model, refer to annex 1.

3 Design Return Period

The frequency of the storm event represents the number of occurrences of an event within a specified period. The design frequency depends on the importance of the area to be drained and the location of the drainage stream. The selection of return period or design frequency is an economic question rather than a meteorological decision. Longer return periods will lead to drainage streams with greater water spreads providing higher flood risks. Consequently, on urbanization, longer return periods shall require larger channel sizes to convey such high capacities.

It is important to consider that there will always remain a risk that the design flood can be exceeded. The risk decreases with the increase in the design return period. The selection of design return periods is based on economic considerations (i.e. cost-benefit analyses of the capital and maintenance costs of improvements compared to the benefits achieved with improved drainage).

3.1 Recommended Design Return Periods for Open Channels

Reaches which serve areas of sizes 5 to 50 km^2 shall be designed for a 50-year return period. However, analysis shall be done to ensure that the proposed channel can convey a 100-year return period peak flow. This can be performed by providing an adequate free board height for that purpose.

Channels with greater watersheds (> 50 km^2) are divided into two parts, a structural section and a non-structural section:

- The structural section of the channel is designed on a 25-year return period,
- The non-structural part is the flood fringe, this part is designed to accommodate the 100-year return period.

Following the concept of "making space for water", it is to note that some locations houses are encroaching on the existing streams or lying in the flood fringe. The houses lying within the flood extents are exposed to flooding. It is necessary to determine the vulnerability of these houses with respect to flood hazards and classify these houses according to their potential flood risk.

Flood plains of channels lying in rural reaches shall be demarcated in order to restrict the construction of any buildings and to define the stream's right-of-way.

Table 31 presents the recommended design return periods for channels in Ibadan.

Table 31: Recommended design return periods for open channels in Ibadan

Watershed Area (Km^2)		Design Return Period (years)
< 5 km^2	Structural Section	25 years
5 – 50 km^2	Structural Section	50 years and checked for 100 years
≥ 50 Km^2	Structural Section	25 years
	Non-Structural Section	100 years

3.2 Recommended Design Return Periods for Structures

Design return period of a potential crossing structure (bridge and culvert) depends mainly on the degree of the road which crosses the stream. The road degree (Expressway, Highway, Secondary or Local Road) indicates the importance of the road and the risk of crossing structure's deterioration, damage or submergence.

Culverts under expressways shall be designed for a 100-year return period while main roads for 50 years, and secondary and local roads for a 25-year return period. However, it is necessary to ensure that the storm water doesn't overtop the road during the 100-year return period storm in all cases.

It is important to note that proposed culverts along proposed open channel shall be designed for return periods equal to that of its associative open channel.

On the other hand, bridges are mainly used in expressways and highways. These highly important structures usually cross main Rivers. In this respect, all bridges shall be designed for a 100-year return period. In addition, a bridge must be able to pass a 100-year flow with an adequate freeboard (75cm).

Table 2 presents the recommended design return periods for structures in Ibadan.

Table 2: Design Return Period for Structures in Ibadan

Element	Design Return Period (years)
Culverts	
Expressways	100
Main Roads	50
Secondary & Local Roads	25
Bridges	100

4 Channels Criteria

4.1 Channel Alignment

Alignment of channels are based on delineated drainage lines extracted from LiDAR survey and the high-resolution imagery, thus following the natural water course. The centerline of the streams is aligned to minimize the possible quantities for cut and fill as much as possible. Minor modifications are adopted in channel alignment in order to avoid expropriation of existing structures and large cuts and fills in the channel.

Channels are aligned such that they do not clash with existing buildings to reduce expropriation costs as much as possible. Whenever expropriation or resettlement is difficult (especially urban areas), channels can be realigned to pass through green areas (if applicable) rather than passing through their natural path through high dense populated area.

4.2 Channel Profiling

Based on LiDAR topography, a land surface is generated using ArcMap (a commercial software under the GIS environment) with a 0.1m contour. The developed surface is used to prepare the channel's profile with the help of another commercial software program (Civil 3D by Autodesk). The channel's profile is designed using the Civil 3D. The design longitudinal slopes are proposed to match the natural ground slope as much as possible to minimize earthworks, meanwhile keeping the design velocities between allowable limits.

The final reaches of the channel profiles or tapping connections with main Rivers are graded to match the natural bed level. Proposed drops are induced in the profile as multiple steps to keep the velocities within permissible limits, refer to Figure 8.

4.3 Channel Sections

Following the preparation of the channel's alignment and profiles, a channel corridor is prepared using Civil 3D environment based on pre-prepared typical channel cross-sections. The corridor is used to develop channel cross-sections each 25m. Each cross-section is investigated to assure that there are no extensive cut or fill, and that the cross-section is appropriately fitted, refer to Figure 5. The cross-section is also checked to ensure that no filling is clashing with existing buildings as applicable. Once the corridor is finalized, the corridor surface and channel boundary are used as input data for the 2D Hydrodynamic model (HEC-RAS) and the preparation of flood extents.

4.3.1 Shape

The principal options considered in the shape cross-sections of channels are basically as follows:

- Trapezoidal open channel
- Rectangular open channel

The choice of the type of section depends on many factors, like the available corridor width, value of land and existing land-use.

Trapezoidal sections are recommended in wide open spaces, while rectangular ones are recommended in high dense urbanized areas. The trapezoidal section is preferred for its economic value and its larger conveyance capacity when compared to rectangular sections. This can be illustrated as follows;

- **Economic Value:** Rectangular sections require additional structural measures such as retaining walls or sheet pile walls to support the channel's sides against lateral earth pressure. These structural measures may require larger sizes when subject to the surcharge load resulting from surrounding buildings and roads. Accordingly, this requires using large concrete dimensions and extensive reinforcement and higher costs. On the contrary, the side slopes of trapezoidal sections provide self-stability and do not require additional structural measures, which in turn is more economic.
- **Flow velocity and conveyance**: in case of trapezoidal sections, the ratio of the flow area to the wetted perimeter is higher when compared to rectangular ones. This higher ratio decreases the effect of viscous forces on the flow and consequently increases the velocity and conveyance.
- **Heavy rains:** the trapezoidal channel has its width gradually increasing towards the top. Thus, in case of heavy rains, as the water level increases, the trapezoid's geometry ensures that the channel does not overflow as the water is accommodated in the top surface wedge of the trapezoidal channel.
- **Safety:** if a person falls into a channel by accident, it is easier for him to climb the side slopes of trapezoidal channels with its mild side slopes than to climb vertical walls of a rectangular one. This is a crucial point when considering sidewalks along the channel's banks.
- **Ease of construction:** trapezoidal channels, are easier in their construction process (the side slopes gives more stability by geometry). In addition, pitching of stones can be firmly attached to the side slopes in an easy process along mild side slope (2:1). On the contrary, rectangular sections require provision of sheet piles for supporting the sides or retaining walls.

4.3.2 Side Slopes

The side slopes of channels depend on the soil conditions and practicality of construction within economical limits. Stabilization of side slopes is required in cases where poor quality soil is encountered.

The choice of the type of side-slope protection depends on many factors, like the estimated design flow at each design section, and natural slope of the terrain that affects the flow velocity in the channel or conduit.

For earth channels to be river trained, a trapezoidal section is proposed with side slopes Z:1, refer to Figure 5. The Z is variable depending on the type of channel and the protection applied. For Natural channels, the Z is between 2 and 3 depending on the type of soil. For the lined trapezoidal channels, the Z value between 1 and 2 are proposed.

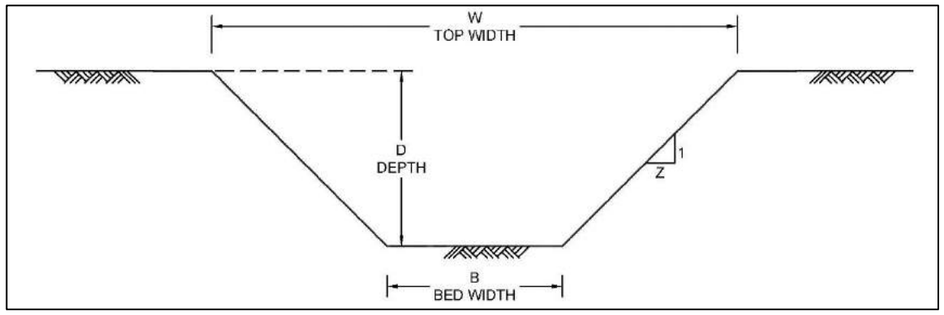

Figure 5: Typical Cross-Section for an Earth Channel

4.3.3 Lining Protection

Lined channels are usually proposed in urbanized areas where it is difficult to allocate wide right of ways. In this case, channel sizes can be reduced by lining the channels. Lining has many advantages over earth channels such as:

- Protect drainage channels against substantial damages caused by scour
- Increases the conveyance of channels and accordingly decreases their size and right of way.
- Guarantees non-encroachment of urbanization on channels and the right of way of drainage systems.

Lining is necessary to protect drainage channels against the substantial damages due to scour. Further information regarding lining alternatives for scour protection is illustrated in Annex 3 "Channel Lining Multi Criteria Analysis". This annex covers the possible design options for the drainage channels and/or the required stream training. The annex illustrates the criteria that should be considered when selecting the appropriate channel lining configuration and material. This criterion corresponds to economic considerations, structural stability, hydraulic efficiency, environmental and sociological aspects, ease of construction and maintenance and durability.

The annex recommended two alternatives that may be applied to channel's section as follows:

a) The first alternative is the complete lining of the channel sides and bed with concrete

b) The second alternative is the protection of the channel side slopes and use of natural bed.

The section may be completely lined with concrete (bed and sides) for small channel widths such as Upper Ogunpa and Orogun Rivers or lined with concrete (sides only) for big channel widths such as Kudeti, especially when the bed natural soil is rocky, refer to Figure 6 and Figure 7.

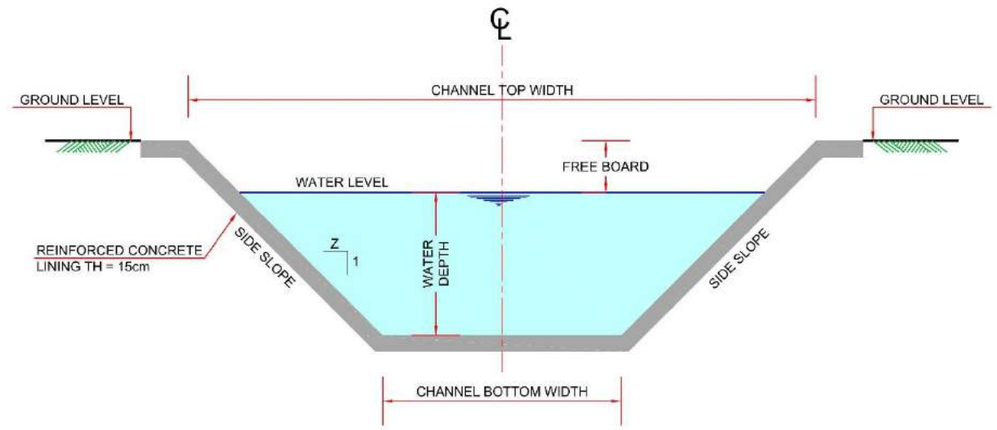

Figure 6: Typical Cross-Section for a Concrete Lined Channel (Bed and Sides)

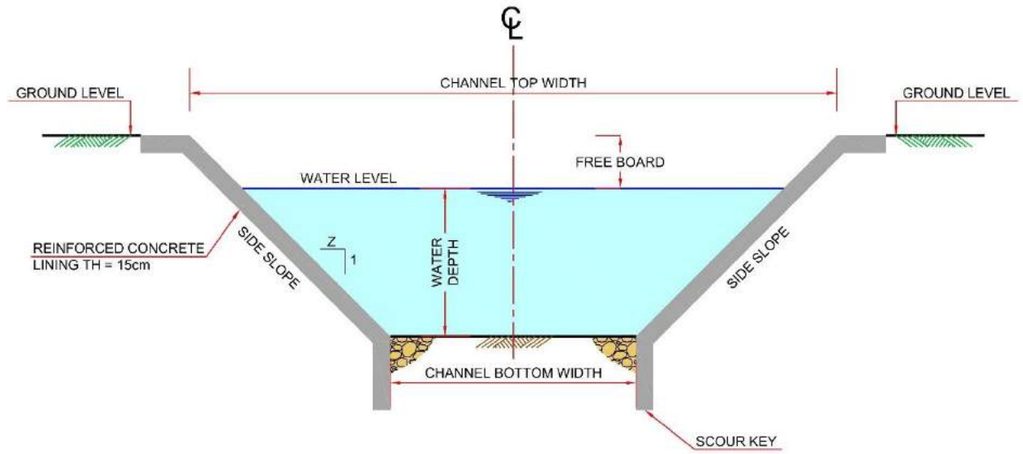

Figure 7: Typical Cross-Section for a Concrete Lined Channel Sides and Natural Bed

Concrete open channels should be provided with weep holes in locations where they are below ground water table. These weep holes are small openings designed to bleed off excess moisture collected behind the walls of drainage channels. They allow relief of hydrostatic pressure water exerted by the groundwater on the walls by allowing trapped groundwater to escape. These weep holes should have a minimum diameter to permit free drainage, with an adequate spacing between weep holes to allow uniform drainage from behind the wall. Weep holes should always have a filter material between the wall and the backfill to prevent migration of fine material and loss of backfill. Maintenance of these weep holes are highly necessary to overcome clogging caused by weeds and vegetation.

4.3.4 Cross-Section Sizing

The hydraulic design of the proposed channels and conduits is performed applying the Manning Formula as follows:

$$V = \frac{1}{n} R^{2/3} S^{1/2} \text{ and}$$

$$Q = A * V$$

Where:

A = Area of wetted cross section of the channel, m^2

R = Hydraulic radius = A/P m

P = Wetted perimeter, m

S = Longitudinal slope of the channel, m/m

n = Manning roughness coefficient.

Roughness coefficient depends mainly on the soil type, vegetation intensity and whether the channel's course is meandering or straight. The manning's roughness coefficient for hydraulic design of channels are selected according to the types of lining materials

- For earth channel with concrete lined side slopes, n value is taken as 0.027
- For full concrete lined section, n value is taken as 0.017

Table 41 summarizes the adopted Manning "n" values in the hydraulic models.

Table 41: Manning Roughness Coefficient (n)

Item	Manning n
Concrete lined channels	0.017
Earth Channels with Concrete Lined Side Slopes	0.027
Concrete culverts	0.017
Natural Earth Channels	0.040

4.3.5 Free Board

Freeboard is the vertical distance between the design water level and the top edge of the channel or conduit. The freeboard is a safety margin for carrying either higher frequency storms or to cater for the change of water surface due to wave action. For channels, a freeboard of 15% of the water depth in channel is adopted.

4.3.6 Channel bends

The minimum radius of curvature for natural channel bends is 2.5 the channel top width. For concrete lined channels this criterion can be relaxed. However, the bends radius of curvature criteria maintained in the study is 2.5 the top width.

4.3.7 Velocity Limitations

The design velocities in the channels and conduits should be kept within a permissible range between the maximum and minimum limits. The minimum allowable velocity is set to attain self-cleaning in the design channels while the maximum allowable velocity will keep the velocity below the scouring limit.

Such velocities are hard to maintain as they depend on the runoff in the channel. The amount of the runoff varies with the rainfall intensities and consequently a wide range of velocities can be expected to occur. Practice in the field of drainage has proven that there are certain maximum and minimum limits that should be considered in the design. The slope of the concrete channels/conduits is set to provide a minimum velocity of 0.75 m/s to maintain self-cleansing action. The maximum allowable velocity for earth channels is set as a maximum value of 1.5 m/s. The velocity limits can increase if the soil is rocky soil. The maximum allowable velocity for the different types of channel lining are presented in Table 42.

Table 42: Maximum allowable velocity

Lining Material	Permissible Velocities (m/sec)
Earth	1.50
Grouted Riprap	2.50
Gabions	3.65
Reinforced Concrete	5.50
Concrete Cables	5.00
Concrete Canvas	10.7

4.4 Channel Right of Way and Setbacks

The flood extents of a stream are areas near a river or a stream which floods when the water level reaches the flood stage. The identification of flood corridors is necessary for the demarcation of right of ways for channel streams.

4.4.1 Right of Ways

The Right of Way (ROW) is a reserved no-build area running along the length of the drainage stream. In the Masterplan, the 100-year flood extent is adopted as the high discharge flood event and used in defining the Right of Ways.

4.4.2 Setbacks

All setbacks are calculated in the MP as the distance from the channel's centerline to the boundary of the flood extent.

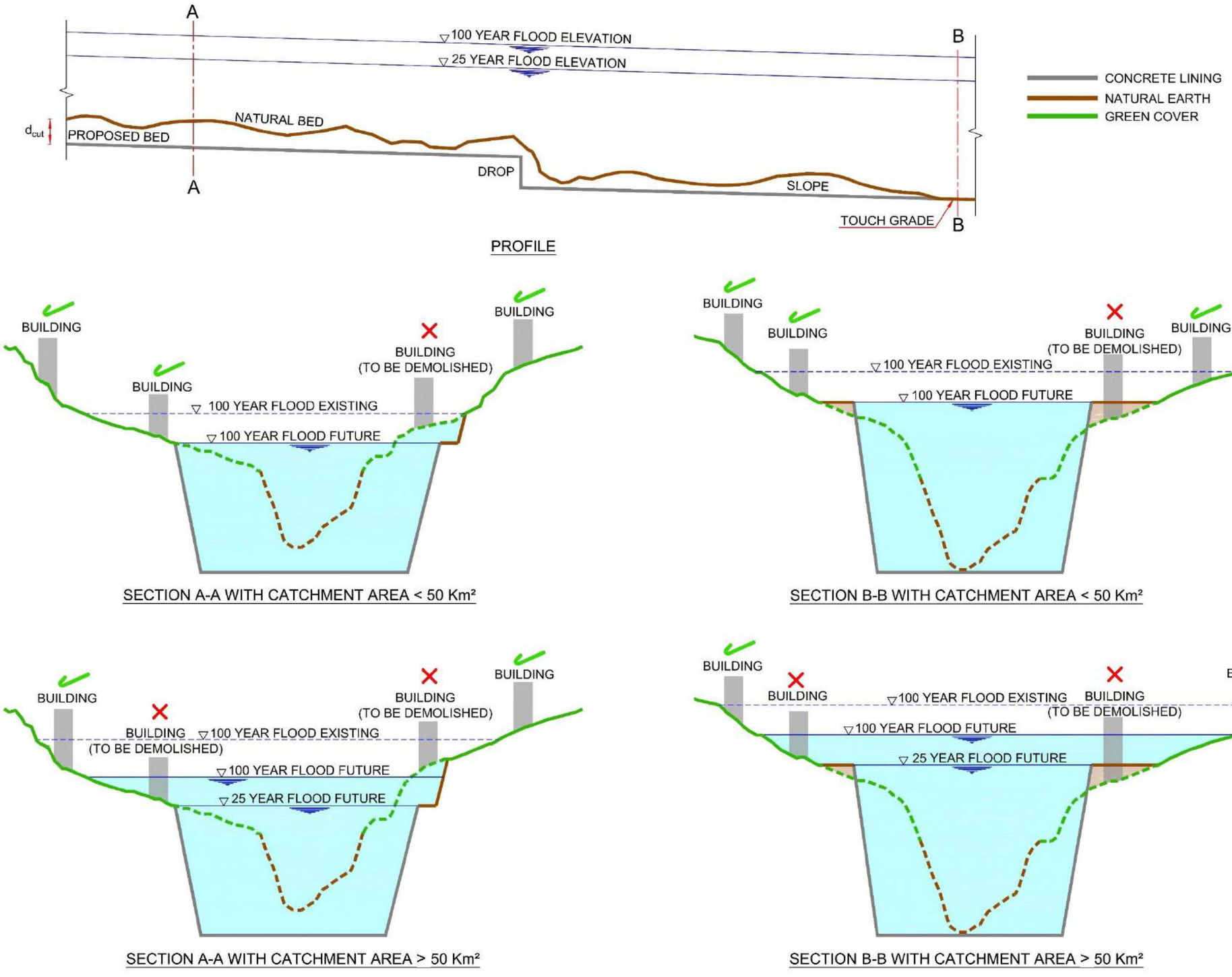

Figure 8: Profile and Cross-Sections

4.4.3 Natural Streams

The ROW of natural streams is estimated according to flood extents of the 100-year return period for existing conditions, refer to Figure 9. The flood extents vary in width according to the terrain's topography, leading to flood extents with a non-uniform geometrical shape. In this respect, ROWs along natural stream sections vary according to widths of the 100-year flood extent; thus, on-site demarcation is necessary to define them. The flood extents of the 100-year return period is available in the GIS geodatabase.

The conservation of existing flood plains is necessary by applying and executing strict penalties for such violations. Houses within floodway should be demolished to make space for water.

Make Space for Water

On the other hand, local flood protection is necessary, where demolishing is not applicable. In areas with a large number of houses and where resettlement or demolishing is not a reasonable solution, channelization provides a better solution to protect existing houses from flood hazards.

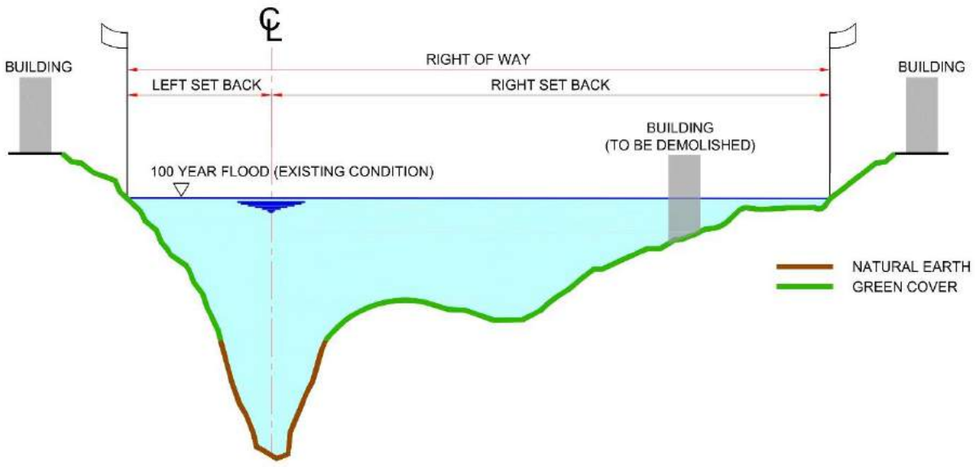

Figure 9: Right of Way and Setbacks of Natural Rivers

4.4.4 Channels

As mentioned previously in section 3.1, channels having a watershed area of less than 50 km^2 are checked to convey the 100-year flow within their structural section. The ROW of these channels is estimated based on the channel's top width, in addition, a 3m bank width is added to the either side of the drainage channel. The 3m bank width is necessary to account for a pedestrian path, landscape area and necessary infrastructure purposes, refer to Figure 10. The limit of landscape works is proposed within the channel right of way. Demarcation marks and fences are necessary to preserve the allocated right of way.

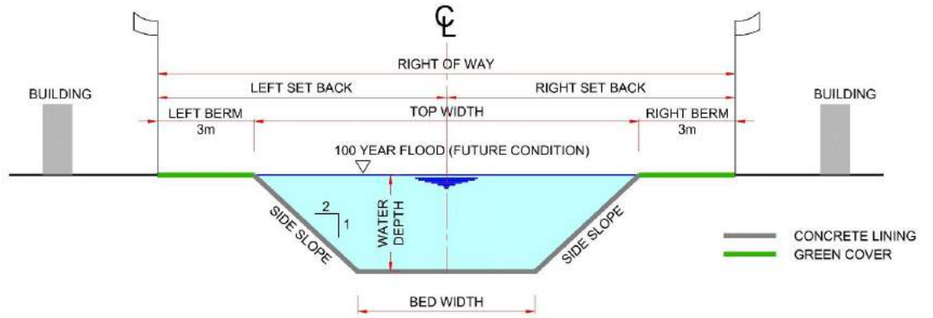

Figure 10: Right of Way and Setbacks of Channelized Rivers with watershed areas less than 50km^2

On the other hand, channels having a watershed area greater than 50 km^2 are designed to convey the 25-year flow within their structural section and the 100-year within both the structural sectional and the non-structural section (the flood fringe). The ROW of these channels is estimated based on the flood extents of the 100-year return period for future conditions. Demarcation marks and fences are necessary to preserve the allocated right of way (refer to Figure 11).

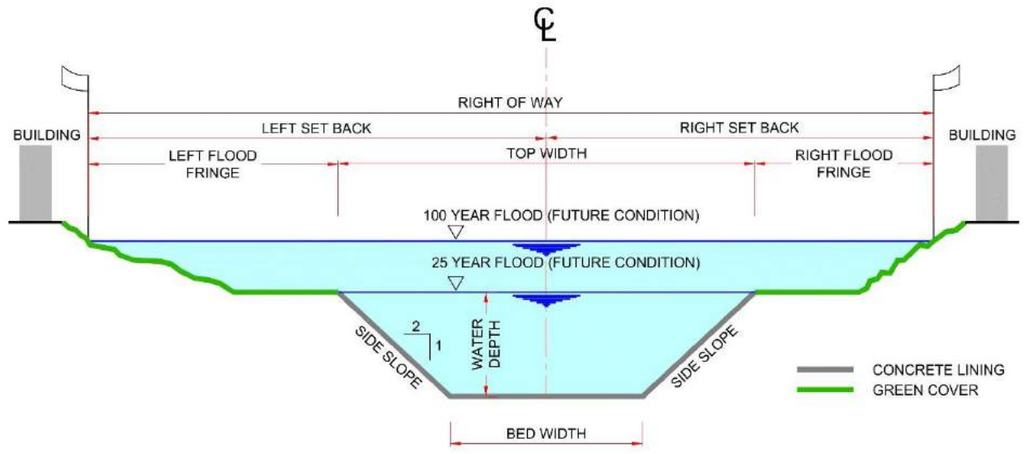

Figure 11: Right of Way and Setbacks of Channelized Rivers with watershed areas greater than 50km^2

4.4.5 Protected Land after channelization

The land gained after channelization can be estimated by subtracting the proposed channel's ROW from the natural stream's ROW, refer to Figure 12.

The existing statutory set-backs to the major streams and rivers appear to be inadequate in the face of increased urbanization in the city. It is highly necessary to review existing laws and regulations to accommodate the extent of natural flood plains of the streams and rivers for flood control.

The ROW should always include the necessary width for roads and infrastructural elements. The ROW may include potential areas for landscape and attenuation; these areas are allocated adjacent to the

drainage system. Figure 12 shows a sample for the proposed Right of Way for System no. 9 (a tributary of Lower Ogunpa).

In Figure 12, the red line shows the proposed ROW for the present condition (incase channelization did not take place), while the dark black line with yellow filling shows the proposed ROW for the future condition (in case of channelization). It is clear that many buildings can be protected after channelization.

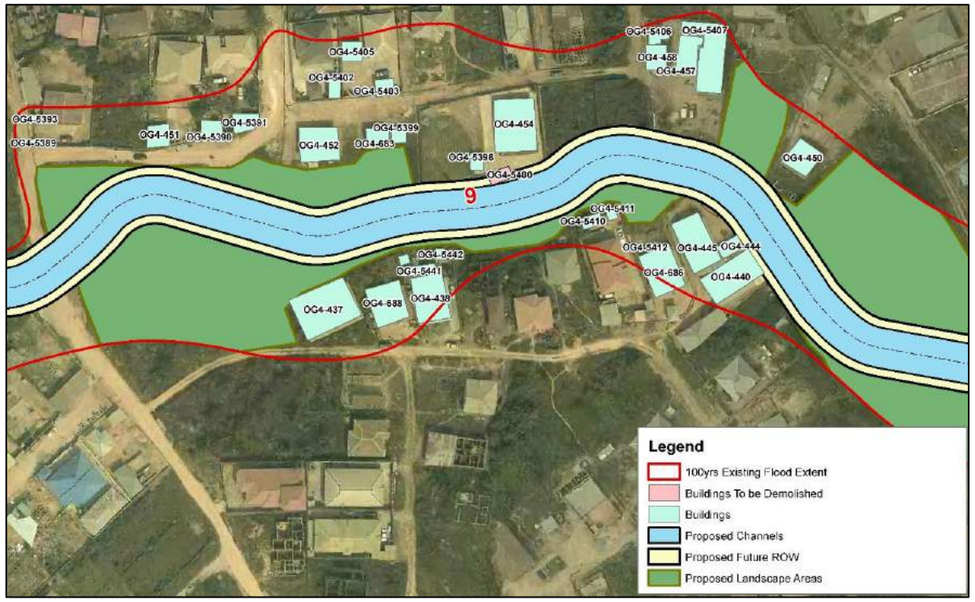

Figure 12: Right of Way and Setbacks of Channelized Rivers with watershed areas less than 50km²

4.4.6 Potential Areas for Attenuation and Landscape

It is necessary that all existing green areas lying adjacent to Rivers and stream banks are allocated for attenuation and landscape purposes in order to prevent new illegal settlements in flood prone areas and dangerous locations.

In the Masterplan, all available areas lying within the 100-year flood extents are determined for both attenuation and landscape purposes. Each allocated area is identified with a unique code with the characters LA to refer to Landscape and attenuation areas. The identity code includes a prefix to relate it to its subbasin Id and a suffix to identify its serial number within its subbasin.

e.g. Og4-LA49 presents a land adjacent to the proposed channelization of System 9 (a tributary of Lower Ogunpa) that can be used for either Landscape or Attenuation, the land is in Og4 Subbasin (Lower Ogunpa) with the serial number 49 within its subbasin. An example for this area and other nearby areas is presented in Figure 13. The shapefile with all the potential areas for Landscape and Attenuation is copied to the geodatabase of the masterplan.

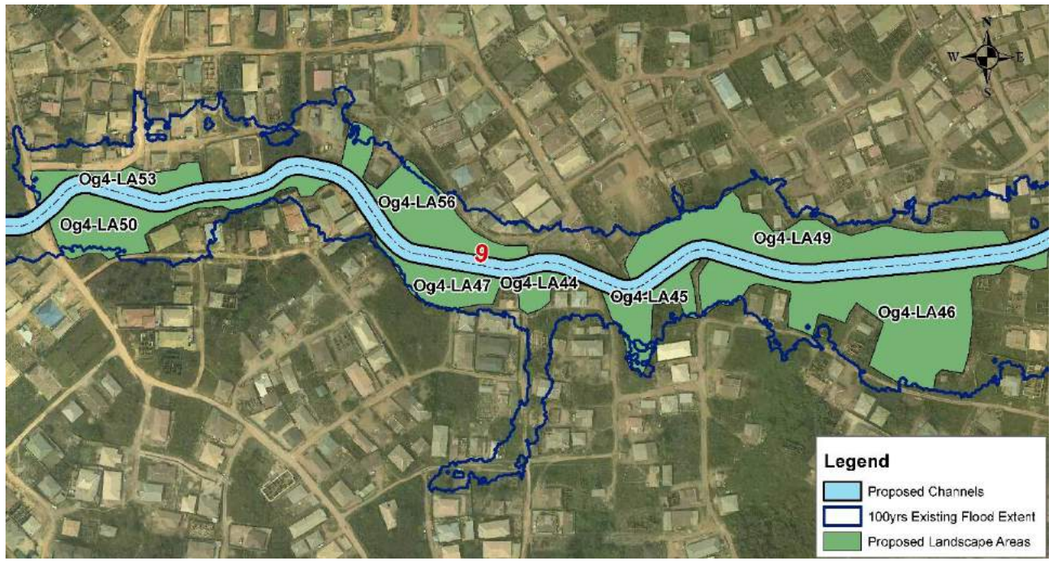

Figure 13: Potential Areas for Landscape and Attenuation

4.4.7 Proposed Landscape and Attenuation Areas

During the development of the pool of priority works, landscape and attenuation area along the proposed channels were identified in Upper Ogunpa, Kudeti, Orogun and Ogbere. These areas are coded with their same Id, yet a prefix to relate to its subbasin Id is added to distinguish it from other subbasins. An example for these areas are presented in Figure 14.

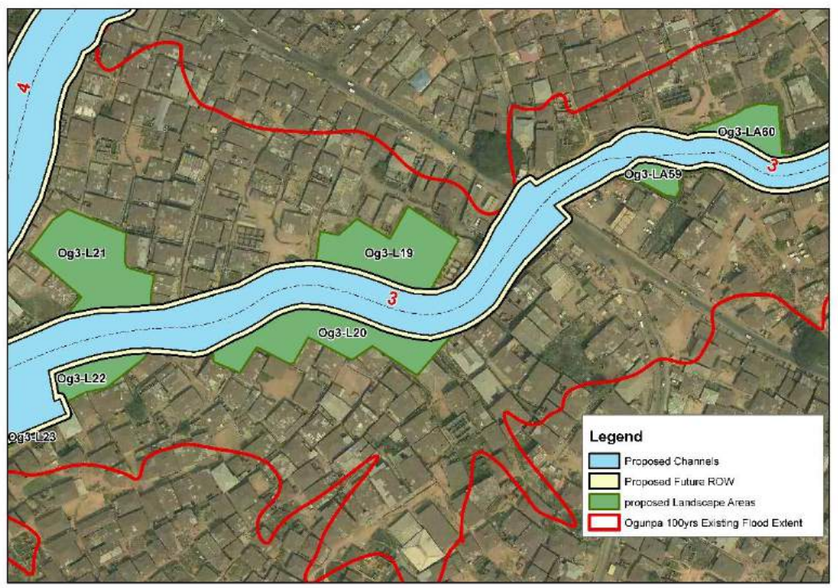

Figure 14: Potential Areas for Landscape and Attenuation for the Pool of Works

5 Crossing Structures

The hydraulic design of drainage structures aims to provide structures of adequate capacities that could safely convey the design flow without significant damages or inconveniences.

The drainage structures include the following elements:

a) Culverts
b) Bridges

Culverts are generally located where the road section crosses the natural stream flow for runoff values that are less than 250 m^3/s based on a 100-year return period. Bridges are considered for larger flows.

5.1 Culverts

Culverts, refer to Figure 15, are located on either natural streams (separate structures) or proposed channelization. For culverts located on natural streams, the hydraulic design is verified using a commercial software programs such as Culvert Master. For culverts located on proposed channels, the hydraulic design is based on Manning's Equation for a 25-year flow or using one of the commercial software programs such as FlowMaster. The design is verified for the 100-year flow based on a hydrodynamic model using one of the commercial software programs such as Storm and Sanitary Analysis by Autodesk (SSA). The preliminary sizing of these culverts is shown on the Masterplan drawings, refer to Volume 3.

Sizing of culverts considers using wider cells in order to decrease the probability and percentage of clogging or blockages by solid waste. This is achieved by reducing of number of culvert cells and consequently reduces the number of culvert walls. The minimum allowable culvert size is not less than 1m x 1m to avoid clogging problems.

Culvert skews shall not exceed 45 degrees as measured from a line perpendicular to the roadway centreline.

5.1.1 Culvert Headwater

The culverts generally constrict the natural stream flow, which results in a rise of the water surface in the upstream side. The headwater elevation for the design discharge should be at least 0.35m below the embankment edge, which corresponds to the thickness of the pavement layers.

The headwater depth (H) to the water depth (D) ratio (H/D) should be equal to or less than 1.2 (at the 100-year flow event).

The maximum allowable headwater for major culverts is calculated based on the depth of water that can be ponded at the upstream end of the culvert during the 100-year event, which will be the minimum of one or more of the following constraints or conditions:

(a) The allowable headwater must not damage upstream property.

(b) The ponding depth is to be no greater than the lowest point in the road grade.

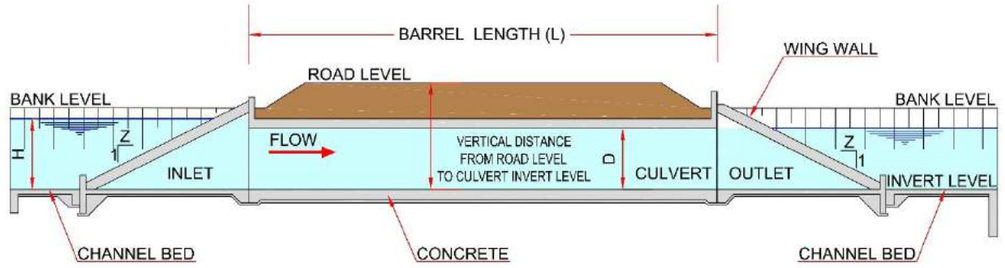

Figure 15: Longitudinal Section in a Culvert

5.1.2 Velocity Limitation

The outlet velocity may cause stream bed scour and bank erosion for a limited distance in the downstream side of the culvert (in case of culverts located on natural streams). As outlet velocities increases, the need for channel stabilization increases. The maximum allowable velocity is limited to 6 m/s at the 100-year flood. Protection measure are proposed at culvert's outlet for the case of non-exceeding exit velocity is "loose riprap bed protection". The mean size of the riprap boulders (D50) of the mattress depends on the outlet flow velocity. The thickness of the protection layer is usually taken as 1.5 to 2 times (D50). If the velocity exceeds the allowable limits, additional protection measures are proposed at culvert's outlets.

To ensure self-cleansing during partial depth flow, culverts shall have a minimum velocity of 0.75m/s at design flow, with a minimum slope of 0.3%.

5.2 Bridges

Bridges' spans are sized considering the design flow of a 100-year return period. The minimum permissible free board should be at least 0.75m below the Bridge's supports. Bridges are located on either natural streams (as separate structures) or lying on proposed channelization.

For bridges located on natural stream, the span of the bridge is based on the flood extent of the 100-year return period, refer to Figure 16.

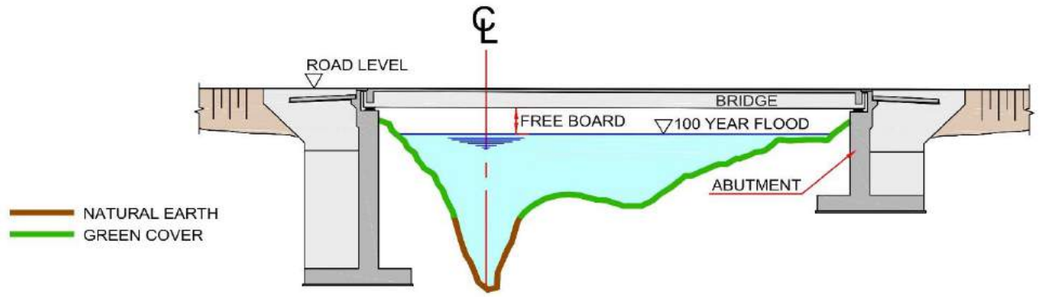

Figure 16: Bridges located on Natural Streams

For bridges located on proposed channels, the span of the bridge is based on the proposed channel's top width. For channels with catchment areas less than 50 km^2, the flow is fully conveyed within the structural section of the channel, the abutment of the bridge does not constrict the flow, refer to Figure 17.

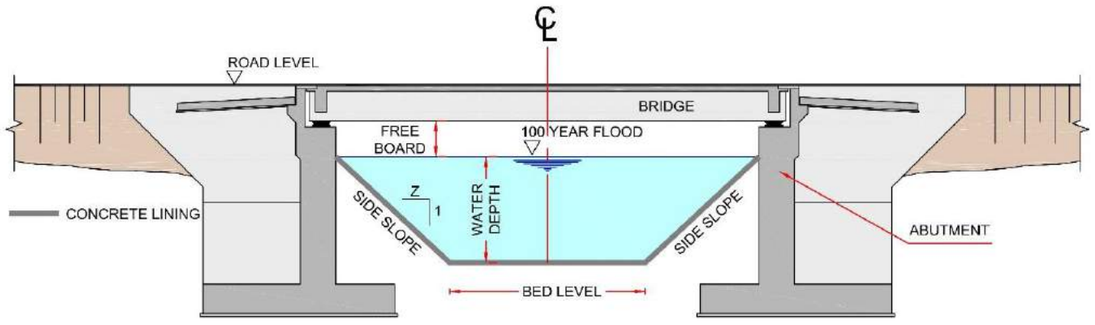

Figure 17: Bridges lying on proposed channels with catchment area less than 50 km^2

For channels with catchment areas greater than 50 km^2, the flow is conveyed within the structural section of the channel and the bridge's abutments. In this case, the flow is partially constricted by the bridge's abutments. The minimum free board should be at least 0.75m below the Bridge's supports.

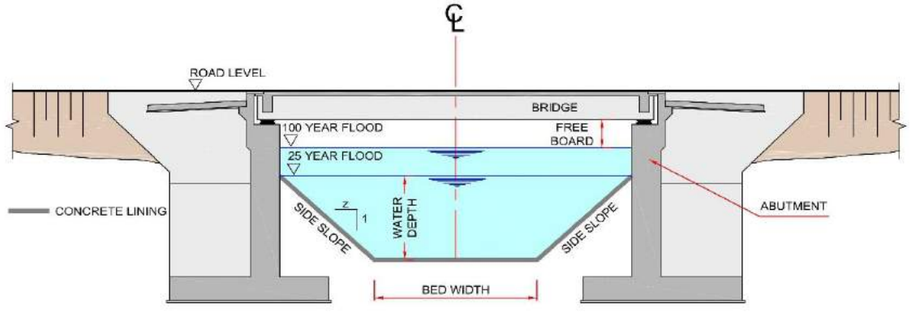

Figure 18: Bridges lying on proposed channels with catchment area greater than 50 km^2

It is most recommended that the bridge is placed perpendicular to the flow. However, in cases where the roadway/railway crosses a stream at some angle, then the bridge should ordinarily be a skew bridge. Moreover, the abutments and bridge piers' alignment should always be parallel to the flow direction.

The hydraulic design is performed using HEC-RAS hydraulic modelling software. The depth of foundation is at least = (2.67 d_s -upstream water depth); where d_s is the Lacey's normal scour depth. Other methods include CSU equation and FHWA NHI -2001 guidelines.

6 Roads Design

The design criteria and standards for the proposed roads are based on the "Recommended Geometric Design Standards for Roads in Nigeria" and on "A Policy on Geometric Design of Highways and Streets" published by the "American Association of State Highway and Transportation Officials" (AASHTO), 2011.

7 Structures Design

The design criteria of proposed structures are based on the AASHTO LRFD Bridge design Specifications, 6th Edition, 2012.

Annex

15

Assessment of Flooding Causes

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1 Introduction

The objective of this section is to review the causes of flooding and their impact on different locations in Ibadan, and to give a brief overview on the current situation to mitigate existing systems capacity deficiencies and highlight stormwater drainage problems in different regions of Ibadan. These causes can be discussed as follows:

Natural causes: these include high rainfall intensity, low land elevations, growth of grass and weeds in channels and climate change.

Man-made causes: these include encroachment of buildings in flood plains, deforestation, land use change which caused an increase in runoff and depletion of flood storage area, inadequate planning of the physical environment, the construction of buildings on flood plains in the form of rapid urbanisation, under-sized and deteriorated culverts along some roads that were damaged in past flooding events, the insensitive dumping of solid waste in streams and rivers which disrupts the free flow of water and the lack of comprehensive maintenance for natural watercourses.

The above reasons affect the hydraulic efficiency and causes a reduction in the drainage system capacity and flooding of the areas upstream the drainage elements.

2 Natural Causes

2.1 High Rainfall Intensity

The amount of annual rainfall is considerably high. The maximum value of daily rainfall over the last 68 years was recorded as 274.1mm on August 31st, 1980. The period from March to October is considered as the rainy season and experiences heavier rainfall intensity than other months of the year. The wettest month is June. Parts of Ibadan receive an annual average of over 1400mm rainfall.

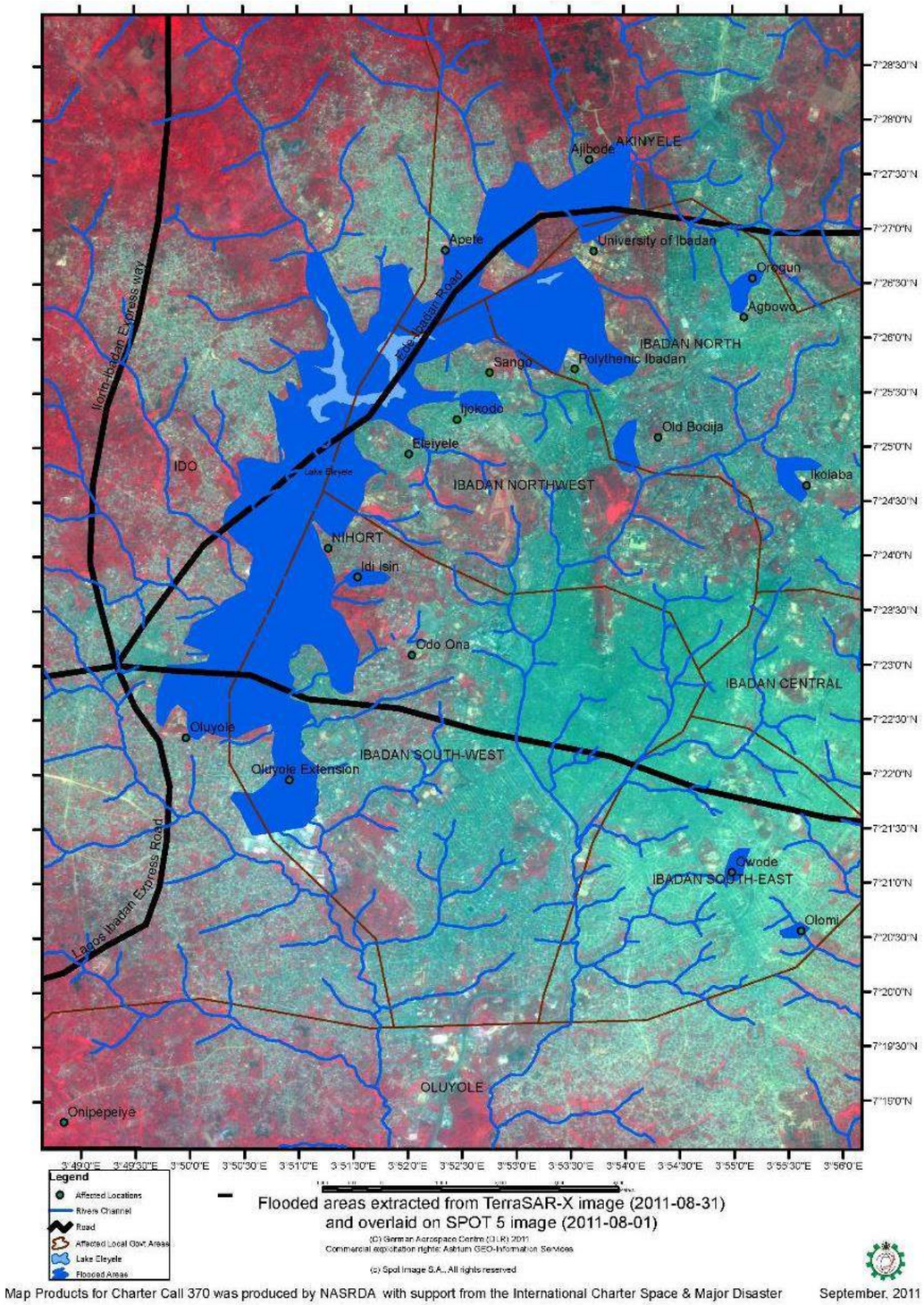

Figure 2.1: Flooding Area in Ibadan Metropolis - August 2011[1]

[1] http://www.disasterscharter.org/web/charter/activation_details?p_r_p_1415474252_assetId=ACT-370

2.2 Low Land Elevations

The available digital terrain models (DTM) of Ibadan identifies many points with elevations lower than their surroundings. These areas are exposed to flooding because water is collected in these locations resulting in deep water levels, which cause many problems, including:

- The development of wetlands and swampy areas that are subject to flooding,
- There is great difficulty in supporting them with an adequate drainage system.

During the site visit, it has been observed that many settlement and communities lie in low land areas. After the interviews with the communities and the affected residents by frequent flooding events, it has been noted that those location suffer from increased flood hazard caused by the potential of these areas to accumulate water during heavy rainfall events. These areas are identified as flood prone areas. These areas along with their associative buildings are presented in the flood hazard/risk maps, refer to Figure 2.2.

These areas are recommended to be elevated by filling processes for urbanization or protected by high walls or regarded as green areas.

It is worth to note that locations of flood prone areas were coordinated with the City Masterplan. All flood prone areas in the City Masterplan were eliminated from the future urban extension. Flood prone areas were reserved for open spaces or green areas.

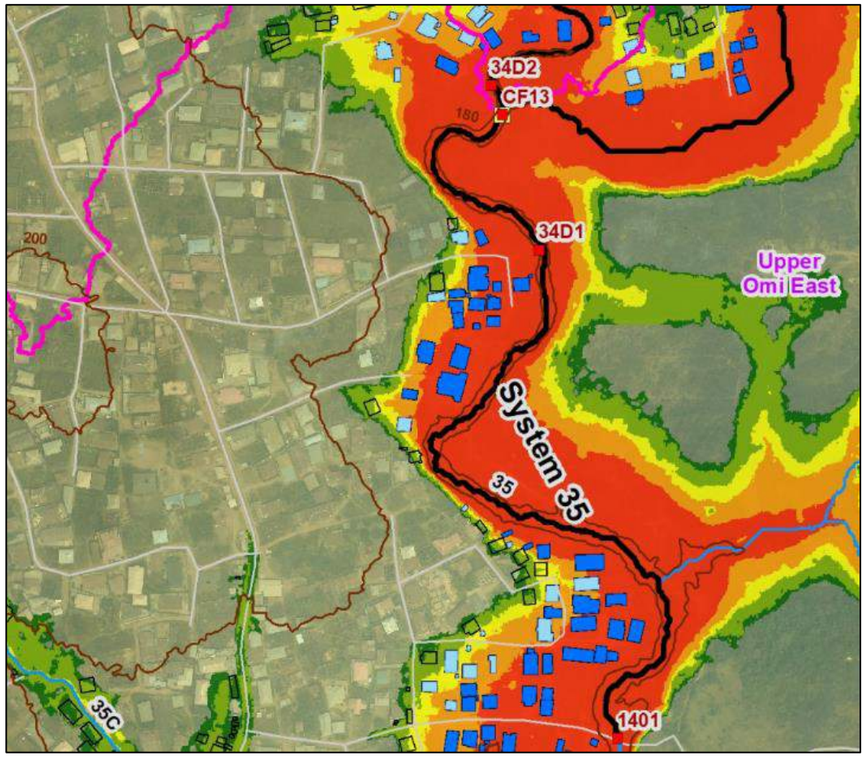

Figure 2.2: Flood Hazard/Risk Map – Omi River - System 35

2.3 Growth of Grass and Weeds in Channels

Due to the fertility of soil in Ibadan, grass and weeds naturally grow on channel beds and embankments, causing an increase in the roughness of the streams – this decreases the hydraulic capacity of the system causing flooding upstream stream congestions. It is recommended to dredge channels from continuous growth of grass and weeds especially in the urban areas. In addition, continuous monitoring should be conducted to ensure that channels are regularly maintained.

Plate 2.1: Grass and Weeds in Channels - Life Forte Road

Plate 2.2: Grass and Weeds in Channels - Onireke road

3 Man-made Causes

3.1 Encroachment of buildings in flood plains

Flood plains are the areas along streams or rivers that are likely to experience repeated flooding. The risk of flooding is increased due to human tendency to use the river floodplain to cope with community demands; as water is easily available for drinking or commercial uses and also floodplain land is often flat and easier to develop than hilly land.

The operational efficiency of Ibadan's rivers and streams is significantly affected by encroachment in flood plains. The encroachment in flood plains takes the form of blockage of the channel alignment by direct construction across the main drainage system.

With insufficient understanding about the occurrence of large floods and a lack of appreciation of their consequences, people are often tempted by the apparent benefits of utilizing such areas. As a result of developing within the floodplain, these people are the first victims of any flood occurrence.

In order to ensure that development does not encroach on the floodplains, the floodplain should be periodically monitored especially in the dry season. Monitoring of buildings encroachment on the flood plains can be conducted by an official community floodplain administrator. The community floodplain administrator must have legal authority to enter private property to enforce the community floodplain ordinance and ensure no encroachment on the flood plains. The conservation of existing flood plains is necessary by applying and executing strict penalties for such violations.

Houses within flood plains should be demolished to make space for water. On the other hand, local flood protection is necessary, where demolishing is not applicable. In areas with a large number of houses

and where resettlement or demolishing is not a reasonable solution, channelization provides a better solution to protect existing houses from flood hazards.

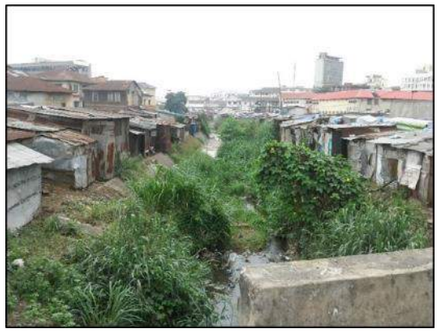

Plate 3.1: Encroachment of buildings in flood plains- Dugbe, Ibadan Abeokuta Road

Plate 3.2: Encroachment of buildings in flood plains- Segun Akinsanya Street, Kuola – Apata

3.2 Deforestation

Deforestation is the destruction of forests and standing trees in order to make the forest land available for other uses. Ibadan city has suffered from the deforestation of many forests such as the Agala and Igbo Agala forests. The two Figures (Figure 3.1 and Figure 3.2) presents 2 satellite imageries for the core area of Ibadan in 1984 and 2016 respectively. High urbanization in noticed in Figure 3.2 as a result of deforestation. The destruction of these forests and use of the land for other purposes changed the land cover and reduced infiltration rates and retention capacity. This resulted in a greater value of water runoff, which in turn has increased the probability of flooding.

The existing forested areas in the north and south of Ibadan should be preserved from deforestation in order to limit the impacts of flooding in the city especially in the north where the land is higher, this could be applied by implementing policies to protect these areas from any further tree removal.

Re-vegetation and planting of trees should be considered in any scenario for flood prevention. In fact, a program of tree planting should be encouraged.

3.3 Rapid Poorly Unplanned Urbanization

Urbanization with its attributes, including impervious city surfaces such as roads and concrete pavements, causes serious flood problems in the urban areas of Ibadan. The two Figures (Figure 3.3 and Figure 3.4) presents 2 satellite imageries for a flood plain in Eleyele in 2006 and 2015 respectively. High urbanization in noticed in Figure 3.4 as a result of the encroachment of buildings on the flood plains. This causes poor water infiltration through the soil. This means that older infrastructure will increasingly be inadequate. In this respect, rainwater falling on this area has the potential to create floods where drainage streams are inadequate to accommodate the storm water. Re-vegetation and planting of trees should be considered for flood prevention.

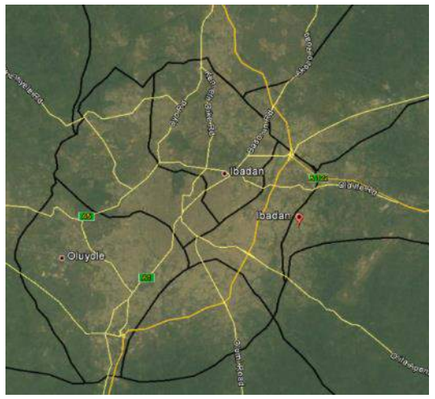

Figure 3.1: Satellite imagery - The core area of Ibadan, 1984

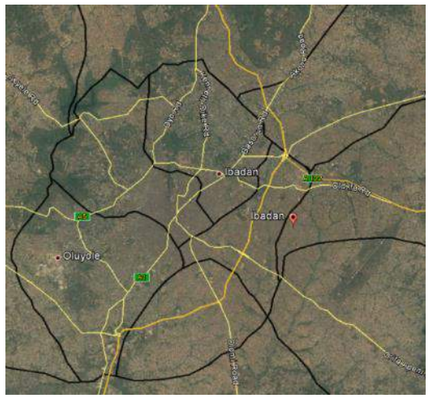

Figure 3.2: Satellite imagery - The core area of Ibadan, 2016

Figure 3.3: Eleyele – System 79M – Before Urbanization, 2006

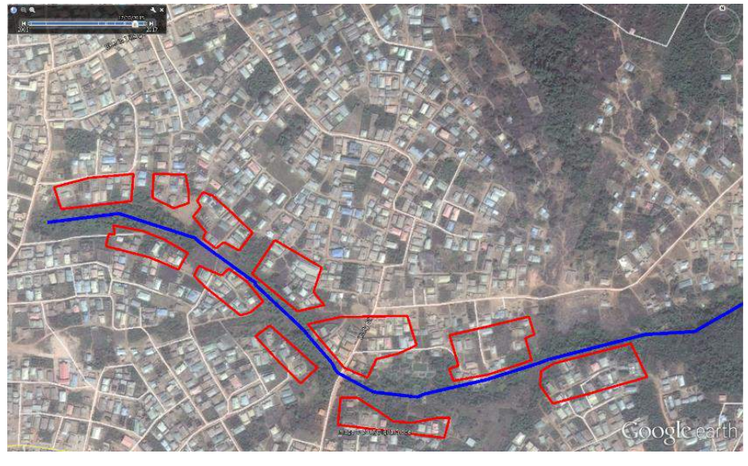

Figure 3.4: Eleyele – System 79M – After Urbanization, 2015

3.4 Under-sized and deteriorated culverts

Some culverts are either undersized or deteriorated which cause a reduction in the capacities of drainage systems and flooding. The rehabilitation or maintenance of old culverts is essential along with the construction of larger sized culverts when needed in some locations. In addition, there are many culverts, drains and even bridges which doesn't meet the design of safety regulations, such as damaged or missing safety barriers, parapets and railings. In other locations, inadequate materials are used for the construction. This pose safety risks to pedestrians and other users of the hydraulic structures when crossing especially during flooding rains.

Plate 3.3: Under-sized culvert - Jerusalem, Arulogun

Plate 3.4: Deteriorated culvert - Ashi Road, Bodija Stream

Plate 3.5: Deteriorated culvert - Jerusalem, Arulogun

Plate 3.6: Deteriorated culvert - Akura - Express Road towards Apata Road with Gbadamosi Oloko Street

3.5 Dumping of Solid Waste in Streams

It is common in Ibadan and its environs that solid waste is dumped into streams and no attempt is made to clear the stream. Solid waste causes a slowdown in the free flow of water movement downstream. As it moves with the flow, waste flocks into the drainage structures such as culverts resulting in blockages. The water drainage system is subsequently affected and water is not drained, which causes water to flow out of the system, flooding surrounding areas.

Periodic cleaning and maintenance of these channels is highly necessary. Public awareness and education to understand the impact of dumping refuse is a must. It is recommended to use different media streams to convey the message and inform the public about the seriousness of dumping refuse in the water streams.

Plate 3.7: Dumping of Solid Waste - Ode Aye Kosodo Channel

Plate 3.8: Dumping of Solid Waste - Bembu road – Aba-Alamu

Annex 16

Prioritization of Separate Structures

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2. Selection of Prioritized Separate Structures 2

1. Introduction

This annex presents the criteria for prioritization of all separate structures in Ibadan along with tables presenting the prioritization plan. The structures were given weights and arranged from highest to lowest priority. A proposed implementation year is proposed for each structure. The rehabilitation cost for each structure is also estimated. Finally, all separate structures are sorted and presented in prioritization order and hence classified among the 20-year action plan for the drainage masterplan. This annex should be read in conjunction with section 6.1.8 (Prioritization of Drainage Masterplan).

2. Selection of Prioritized Separate Structures

There are other inadequate separate crossing structures lying on natural streams which needs to be rehabilitated. Based on the structure's assessment in annex 15, there are 855 crossing locations needs to be rehabilitated with a total cost estimate of around 61 MUSD. Annex 12 presents the design of all identified crossing locations located on natural streams (Crossing structures of the 2nd Division).

The Methodology for selection of prioritized separate structures depends on assigning a weighted scoring values for each structure, the following factors have been taken in consideration:

- **Population:** Structures serving the largest population and highest density are given higher values, while rural areas are given lower values. Refer to Table 1re the different population densities are given special percentage.
- **Transport facilities:** The roads and railway facilities are divided into three main levels; major roads/facility (Lagos Ibadan Expressway, Federal Trunk Road etc..), secondary roads, and minor roads/facility (local roads).
- **Channel Degree:** Main channels are considered as the backbone of the drainage system and as such takes the highest importance, 30%. On the other hand, minor streams get lower importance. Refer to Table 1 the different channel degrees.
- **Importance of Location:** Locations that experience **previous flooding**, causalities or the location includes public offices of special importance, high importance will be given to them.
- **Structure Condition:** the condition of the structures like culverts and bridges is one of the evaluation parameters, structures with bad conditions will be given high importance, while structures with good conditions will be given lower importance.

Table 1 presents the different levels of this criteria.

Table 1: Proposed weighted criteria

Criteria	Proposed Weight	Criteria Levels	Proposed Weighted Criteria for structures (culverts & bridges) (Units)
Population	20%	High Intensity (Core Area)	20
		Medium Intensity	15
		Low Intensity	10
		Rural	0
		NO	0
Transport	20%	Expressways and Major Roads	20
		Secondary Roads	10
		Local Roads	0
Channel degree	30%	Major Tributary >5k	30
		Minor Tributary <5k and >2K	20
		Major Stream <2k and >1k	10
		Minor Stream < 1k	0
Previous flooding	20%	Flooded	20
		No Flooding Reported	0
Structure Condition	10%	Poor structure conditions	10
		Good structure conditions	0

The next tables present the weights given to each structure, implementation year and estimated rehabilitation cost. Based on these criteria, the separate structures were prioritized and sorted and presented in the next tables.

Structure No.	Location	Subbasin	Population Weight 20	Previous Flooding 20	Transport Weight 30	Stream Degree 30	Condition 10	Overall Priority 100	Cost of Culvert/Bridges (USD)	Total Cost of Structures / Year (USD/YEAR)	Year	Phase
1211	Alagbayun Akobo	On20 Lowest Ona	20	20	20	30	10	100	478,400.00			
1212	Anifalaje	On20 Lowest Ona	20	20	20	30	10	100	182,400.00			
1506	Kolapo Ishola GRA	Iddo Basin	15	20	20	30	10	95	259,200.00			
1280	Oluwatedo estate	Ob6 Lower Ogbere South	15	20	20	30		85	241,600.00			
1463	Kolapo Ishola GRA	Om8 Lower Omi	15	20	10	30	10	85	150,400.00			
1446	Omolayo	Om8 Lower Omi	15	20	20	30		85	300,800.00			
179	Abake estate-Akobo	On3 Odo Oba	5	20	20	30	10	85	259,200.00			
1479	Anifalaje	On3 Odo Oba		20	20	30	10	80	280,000.00			
144B	Ajimututu Gas land	Og2 Middle Ogunpa	15		20	30	10	75	464,000.00			
1461	Bashorun Estate Akobo	Om8 Lower Omi	15	20		30	10	75	140,800.00			
1462	Sawmill	Ob2 Upper Ogbere	15	20		30	10	75	140,800.00			
1464	Ido Oro Ayekale	Om8 Lower Omi	15	20		30	10	75	150,400.00			
1449	Ayetoro Ifelodun Baba rere	Om8 Lower Omi	15	20		30	10	75	190,400.00			
136	AYEPE	On10 Middle Ona North	15		20	30	10	75	174,400.00			
86D	Bashorun	Ob3 Middle Ogbere	20	20	20		10	70	40,000.00			
781	Ogbere Idi osan Efun Kobiowu	Og2 Middle Ogunpa	20	20	20		10	70	64,000.00			
348	Kajola	Og3 Kudeti	20	20	20		10	70	76,800.00			
722	Ona-Ara	Om3 Upper Omi West	20	20	20		10	70	67,200.00			
574	Olopo Meta	Om3 Upper Omi West	20	20	20		10	70	76,800.00			
55D1	Old Ife Road	On10 Middle Ona North	20	20	20		10	70	40,000.00			
49D	Kajola Agric	On15 Alaro	20	20	20		10	70	40,000.00			
1209	Bashorun	Ob2 Upper Ogbere	20	20		20	10	70	120,000.00			
1489	Agbakin	On3 Odo Oba		20	20	20	10	70	137,600.00			
1496	Orisunbare	On4 Upper Ona North		20	10	30	10	70	355,200.00	7,480,000.00	2021	
632	Maku	On9 Orogun	20	20	20		10	70	92,800.00			
1278	Bashorun	Ob6 Lower Ogbere South	15	20		20	10	65	129,600.00			
108	Agbakin	Om1 Omi Headwaters North	15		20	20	10	65	137,600.00			
1447	MANATAN/IWO ROAD	Om8 Lower Omi	15	20	20		10	65	32,000.00			
1472	Aromolaran	Om8 Lower Omi	15	20		20	10	65	76,800.00			
1458	ACADEMY/IWO ROAD	Om8 Lower Omi	15	20		20	10	65	120,000.00			
1462 Prime	Bashorun	Om8 Lower Omi	15	20		30		65	99,200.00			
1448 Prime	Tujuka Area	Om8 Lower Omi	15	20		30		65	190,400.00			
1448	BASORUN/IWO ROAD	Ob2 Upper Ogbere	15	20		30		65	219,200.00			
608	IWO ROAD	On11 Alapata South	15	20	20		10	65	56,000.00			
161	AKERE/IWO RAOD	On4 Upper Ona North	5	20		30	10	65	492,800.00			
455	SAWMILL / ALARERE	On5 Alapata North	5		20	30	10	65	259,200.00			
456	AKERE/IWO RAOD	On5 Alapata North	5		20	30	10	65	617,600.00			
1396	NEW IFE ROAD	Osun Basin	5	20	20	10	10	65	105,600.00			
803	Akinyele	Ob2 Upper Ogbere	20	20	20			60	156,800.00			
434	Fagbamile Area	Ob3 Middle Ogbere	20	20	10		10	60	38,400.00			
921	Olorunshogo	Ob4 Foworogbun	20	20	10		10	60	27,200.00			
341	MUFULANIMUN	Ob4 Foworogbun	20	20	10		10	60	35,200.00			
338	AMUDA OOJERE/IWO ROAD	Ob4 Foworogbun	20	20	10		10	60	43,200.00			
785	Agbala Itura Fagbamila Area	Ob2 Upper Ogbere	20	20	10		10	60	17,600.00			
644	Ogbere	Og1 Upper Ogunpa	20	20	20			60	84,800.00			
392	Agbala Itura	Og3 Kudeti	20	20	10		10	60	17,600.00			
349	Oremeji C.A.C	Og3 Kudeti	20	20	10		10	60	38,400.00			
879	OLOMI	Og4 Lower Ogunpa	20	20	10		10	60	32,000.00			
451	Ogbere housing Estate, akanran road.	Om1 Omi Headwaters North		20	20	10	10	60	96,000.00			
1339	Akanran	Om1 Omi Headwaters North		20	10	20	10	60	110,400.00			
1338	Binukonu Zone	Om1 Omi Headwaters North		20	10	20	10	60	129,600.00			
1340	Akanran	Om1 Omi Headwaters North		20		30	10	60	275,200.00			
953	AYEDAADE/AGRIC/OLOMI	Om3 Upper Omi West	20	20	10		10	60	33,600.00			
718	OLORUNKEMI	Om3 Upper Omi West	20	20	10		10	60	38,400.00			

Structure No.	Location	Subbasin	Population Weight 20	Previous Flooding 20	Transport Weight 30	Stream Degree 30	Condition 10	Overall Priority 100	Cost of Culvert/Bridges (USD)	Total Cost of Structures / Year (USD/YEAR)	Year	Phase
1050	Akanran	Om3 Upper Omi West	20	20	10		10	60	48,000.00			
989	Orisunbare	Om4 Upper Omi East	20	20	10		10	60	33,600.00			
999	Irepodun Street	Om6 Middle Omi West	20	20	10		10	60	48,000.00			
53D2	MOBOLORUNDURO/OMIYALE	Ob3 Middle Ogbere	20	20	10		10	60	32,000.00			
21D2	Ogbere housing Estate, akanran road.	Om8 Lower Omi	20			30	10	60	219,200.00			
865	Ogbere housing Estate, akanran road.	On17 Lower Ona East	20	20	10		10	60	38,400.00			
1206	Ogbere housing Estate, akanran road.	On18 Lower Ona South	20	20	10		10	60	32,000.00			
1197	Mushin	On18 Lower Ona South	20	20	10		10	60	32,000.00			
1219	Ifelodun	On18 Lower Ona South	20	20	10		10	60	35,200.00			
1217	Akilapa Ogbere	On19 Lower Ona West	20	20	10		10	60	27,200.00			
1178	Oritamerrin road	On19 Lower Ona West	20	20	10		10	60	43,200.00			
1177	Akilapa Okeogbere	On19 Lower Ona West	20	20	10		10	60	48,000.00			
1205	Ogbere	On19 Lower Ona West	20	20	10		10	60	52,800.00			
1486		On3 Odo Oba		20	20	10	10	60	105,600.00			
1482	Akanran	Ob3 Middle Ogbere		20	20	10	10	60	192,000.00			
1475	Ogbere	On3 Odo Oba		20	10	20	10	60	120,000.00			
1484		On3 Odo Oba		20		30	10	60	219,200.00			
1495	Ogbere housing Estate, akanran road.	On4 Upper Ona North		20		30	10	60	201,600.00			
1497	Ogbere	On4 Upper Ona North		20		30	10	60	492,800.00			
1252	ALABEDE OGBERETIOYA	Ob5 Lower Ogbere North	15	20	10		10	55	32,000.00			
1253	OLOMI/MOSFALA	Ob5 Lower Ogbere North	15	20	10		10	55	43,200.00			
1276	OLOMI	Ob6 Lower Ogbere South	15	20		10	10	55	86,400.00			
1277	Akanran	Ob6 Lower Ogbere South	15	20		10	10	55	86,400.00			
1391	MOSFALA ZONE 2	Om4 Upper Omi East	5	20	20		10	55	56,000.00			
1465	PAPA ELEYE	Om8 Lower Omi	15	20	10		10	55	38,400.00			
1452	Akanran	Ob3 Middle Ogbere	15	20		10	10	55	51,200.00			
1453	Airport Area	Om8 Lower Omi	15	20		10	10	55	56,000.00			
1454	Aiport -Alakia	Om8 Lower Omi	15	20		10	10	55	57,600.00			
1467	Ifeolu IGEM	Om8 Lower Omi	15	20		10	10	55	56,000.00			
612	Akoka fast fast Area	On11 Alapata South	15	20	10		10	55	35,200.00			
457	PALUPO/ASOLO	On11 Alapata South	5	20	20		10	55	64,000.00			
1301	Irapada	On15 Alaro	15	20	10		10	55	27,200.00			
1286	Aiport	On15 Alaro	15	20	10		10	55	32,000.00			
1306	Sogade Area	On16 Agara Kasumu	15	20	10		10	55	48,000.00			
181	Sogade	On3 Odo Oba	5	20	20		10	55	107,200.00			
183	Aiport	On3 Odo Oba	5		20	30		55	3,250,000.00			
454	OREDEGBE LANDLORD/LANDLADY ASSOCIATION BIOKU ADEYELU OGBERE	Ob4 Foworogbun	5		10	30	10	55	150,400.00			
177	Ogbere Idi Osan	On6 Upper Ona West	5	20	20		10	55	76,800.00			
174 prime	Aiport	On6 Upper Ona West	5	20		20	10	55	67,200.00			
1398	Aiport -Alakia	Osun Basin	5	20		20	10	55	96,000.00			
1399	Akanran	Osun Basin	5	20		20	10	55	105,600.00			
716	Melangbi -Aladi	Ob1 Ogbere Headwaters	20		20		10	50	76,800.00			
715	AIRPORT AREA	Ob1 Ogbere Headwaters	20	20			10	50	48,000.00			
707	Akinfenwa	Ob1 Ogbere Headwaters	20	20			10	50	52,800.00			
313	Gbaremu Idi Obi	Ob2 Upper Ogbere	20	20			10	50	22,400.00			
705	IDI OSAN/AMULOKO	Ob2 Upper Ogbere	20	20			10	50	32,000.00			
701 Prime	Alakia	Ob2 Upper Ogbere	20	20			10	50	35,200.00			
351	Alare/Oke Jegede	Ob2 Upper Ogbere	20	20			10	50	35,200.00			
312	ABABO OLOYA	Ob2 Upper Ogbere	20	20			10	50	33,600.00			
700	Ifewumi Esankigbe	Ob2 Upper Ogbere	20	20			10	50	38,400.00			
794	JAGUN/ NEW GBAGI	Ob4 Foworogbun	20	20			10	50	43,200.00			
308	AIRPORT AREA	Ob2 Upper Ogbere	20	20			10	50	48,000.00			
302	Olaba Kajola	Ob2 Upper Ogbere	20	20			10	50	52,800.00			
303	Fagbile Itamerin	Ob2 Upper Ogbere	20	20			10	50	52,800.00			
908	JAGUN NEW GBAGI	Ob3 Middle Ogbere	20	20			10	50	22,400.00			
347	ALAAKA	Ob3 Middle Ogbere	20	20			10	50	27,200.00			

Structure No.	Location	Subbasin	Population Weight 20	Previous Flooding 20	Transport Weight 30	Stream Degree 30	Condition 10	Overall Priority 100	Cost of Culvert/Bridges (USD)	Total Cost of Structures / Year (USD/YEAR)	Year	Phase
913	Aiport -Alakia	Ob3 Middle Ogbere	20	20			10	50	27,200.00	11,296,400.00	2022	Phase 1
435	Ifewumi Esankigbe	Ob3 Middle Ogbere	20	20			10	50	32,000.00			
912	Alawaye Area	Ob3 Middle Ogbere	20	20			10	50	35,200.00			
86D1	Gbaremu Area	Ob3 Middle Ogbere	20	20			10	50	35,200.00			
86D2	Olunloyo Area	Ob3 Middle Ogbere	20	20			10	50	35,200.00			
86D3	Ireakari	Ob4 Foworogbun	20	20			10	50	35,200.00			
410	Akinfenwa	Ob3 Middle Ogbere	20	20			10	50	35,200.00			
432	Alawaye Area	Ob3 Middle Ogbere	20	20			10	50	43,200.00			
408	ONIYEFUN	Ob3 Middle Ogbere	20	20			10	50	43,200.00			
409	Isale Olunloyo	Ob3 Middle Ogbere	20	20			10	50	43,200.00			
86D4	Akinfenwa Aroye	Ob3 Middle Ogbere	20	20			10	50	43,200.00			
907	Ife Akintunde Layout Alakia	Ob3 Middle Ogbere	20	20			10	50	52,800.00			
1053	ONIYEFUN	Ob4 Foworogbun	20		20		10	50	40,000.00			
343	Hope	Ob4 Foworogbun	20	20			10	50	27,200.00			
1125	Mosa Olunloyo Akanran	Ob4 Foworogbun	20	20			10	50	27,200.00			
1169	ALAAKA/IDI OSAN/ADEYORI	Ob4 Foworogbun	20	20			10	50	32,000.00			
54D1	Akingbade Abaede	Ob4 Foworogbun	20	20			10	50	35,200.00			
444	ALAAKA/IDI OSAN	Ob4 Foworogbun	20	20			10	50	35,200.00			
920	AGIGBOTOLUWA	Ob4 Foworogbun	20	20			10	50	33,600.00			
398	21 DIAMOND EST. AREA, IDI-AGBADO	Ob4 Foworogbun	20	20			10	50	38,400.00			
807	OLUNDE AREA	Ob4 Foworogbun	20	20			10	50	38,400.00			
436	OLUWANISOLA,AJIMASIN ONIREKE	Ob4 Foworogbun	20	20			10	50	38,400.00			
925	OBIDERE	Ob4 Foworogbun	20	20			10	50	43,200.00			
335	OLORUNTOYIN,IFESOWAPO AREA	Ob4 Foworogbun	20	20			10	50	43,200.00			
405	ALAPATA AYETORO ALONG ONULA	Ob4 Foworogbun	20	20			10	50	43,200.00			
928	FIRE FIRE AREA,AGRIC OLOMI	Ob4 Foworogbun	20	20			10	50	48,000.00			
927	JELE RD,OGORI OLOJUORO	Ob4 Foworogbun	20	20			10	50	48,000.00			
403	OKE-ELESHIN	Ob5 Lower Ogbere North	20	20			10	50	48,000.00			
922	ONIREKE, AGO OLUNDE	Ob4 Foworogbun	20	20			10	50	52,800.00			
345	BEHIND GOD MERCY APOTOLIC CHURCH, FATUNSI AREA	Ob4 Foworogbun	20	20			10	50	52,800.00			
923	ANU-OLUWAPO ARANNI, AYEGUN	Ob4 Foworogbun	20	20			10	50	52,800.00			
917	AMUERE IRE-AIKARI JOGBIN OLUNDE	Ob5 Lower Ogbere North	20	20			10	50	22,400.00			
26D2	GBAKO ISOKAN OFF OLOJUORO	Og1 Upper Ogunpa	20	20			10	50	22,400.00			
674	ABA-ASA	Og1 Upper Ogunpa	20	20			10	50	32,000.00			
25D	OJE-SANMI , AYETORO	Og1 Upper Ogunpa	20	20			10	50	38,400.00			
73D	FADIPE, IFESOWAPO	Og2 Middle Ogunpa	20	20			10	50	17,600.00			
73D1	ORISUNBARE ALAPATA, AYETORO	Og2 Middle Ogunpa	20	20			10	50	17,600.00			
250	JELE RD,OGORI OLOJUORO	Og2 Middle Ogunpa	20		20		10	50	76,800.00			
286	IFEOLUWA RD,ARAROMI	Og3 Kudeti	20		20		10	50	56,000.00			
280	LANIOKA ONIKEKE, SAMOUNJU	Og3 Kudeti	20		20		10	50	64,000.00			
288	LAKODUN EST. LAKO	Og3 Kudeti	20	20			10	50	33,600.00			
389	JAGUN,ONAYE RD	Ob6 Lower Ogbere South	20		20		10	50	59,200.00			
326	ABOLOKE,ARAROMI RD	Og3 Kudeti	20	20			10	50	38,400.00			
263	ALAPE RD, ARAROMI	Og3 Kudeti	20		20		10	50	67,200.00			
325	Secretariat	Og3 Kudeti	20	20			10	50	43,200.00			
319	LEKAN SALAMI ESTATE, BODIJA	Og3 Kudeti	20	20			10	50	43,200.00			
287	Oluwo Nla Estate	Og3 Kudeti	20		20		10	50	76,800.00			
890	BASORUN	Og4 Lower Ogunpa	20	20			10	50	17,600.00			
881	New Bodija	Og4 Lower Ogunpa	20	20			10	50	22,400.00			
900	Deeper life Ashi	Og4 Lower Ogunpa	20	20			10	50	27,200.00			
902	LALA AVENUE NEAR GLORY VIEW HOTEL KONGI BODIJA	Og4 Lower Ogunpa	20	20			10	50	27,200.00			
1194	Old Bodija Estate	Og4 Lower Ogunpa	20	20			10	50	32,000.00			
892	Ashi	Og1 Upper Ogunpa	20	20			10	50	33,600.00			
386	Oluwo Kekere Estate	Og4 Lower Ogunpa	20	20			10	50	43,200.00			
885	AGODI GRA	Og4 Lower Ogunpa	20	20			10	50	43,200.00			

Structure No.	Location	Subbasin	Population Weight 20	Previous Flooding 20	Transport Weight 30	Stream Degree 30	Condition 10	Overall Priority 100	Cost of Culvert/Bridges (USD)	Total Cost of Structures / Year (USD/YEAR)	Year	Phase
1337	Ikolaba	Om1 Omi Headwaters North		20	10	10	10	50	62,400.00			
724	DLADEJI , CLOSE	Om3 Upper Omi West	20	20			10	50	32,000.00			
723	Oluwo Kekere Estate	Om3 Upper Omi West	20	20			10	50	32,000.00			
946	Old Bodija Estate	Om3 Upper Omi West	20	20			10	50	35,200.00			
967	Deeper life Ashi	Om3 Upper Omi West	20	20			10	50	33,600.00			
1052	ASHI ROAD, BODIJA (OJU ODO ASHI ASHI RIVER)	Om3 Upper Omi West	20	20			10	50	38,400.00			
941	Bodija Adeyi Junction	Om3 Upper Omi West	20	20			10	50	43,200.00			
721	Adeyi Estate	Om3 Upper Omi West	20	20			10	50	43,200.00			
1019	IKOLABA , GRA	Og1 Upper Ogunpa	20		20		10	50	76,800.00			
84D2	ADENUGA STREET , KONGI LAYOUT	Om6 Middle Omi West	20	20			10	50	22,400.00			
83D1	Adebajo, New Bodija, Adebajo Street	Om6 Middle Omi West	20	20			10	50	22,400.00			
84D1	Mokola	Om6 Middle Omi West	20	20			10	50	22,400.00			
84D	THE COMMUNITY OF FASOLA OREDEYIN SW4/902 OKE-ADO	Om6 Middle Omi West	20	20			10	50	22,400.00			
83D3	THE COMMUNITY OF FASOLA OREDEYIN SW4/902 OKE-ADO	Om6 Middle Omi West	20	20			10	50	32,000.00			
84D3	Oke Seni	Om6 Middle Omi West	20	20			10	50	35,200.00			
27D	Amule Area	Om6 Middle Omi West	20	20			10	50	35,200.00			
1001	Foko Area	Om6 Middle Omi West	20	20			10	50	48,000.00			
1000	Mokola Housing Estate	Om6 Middle Omi West	20	20			10	50	48,000.00			
1044B	Ayeye	Om6 Middle Omi West	20	20			10	50	48,000.00			
1041	Surulere street Oke bola	Og2 Middle Ogunpa	20	20			10	50	52,800.00			
1126 Prime	Abebi Area	Om7 Middle Omi South	20	20			10	50	22,400.00			
1151	Awolowo way	Om7 Middle Omi South	20	20			10	50	22,400.00			
1165	UCH	Om7 Middle Omi South	20	20			10	50	27,200.00			
53D1	Oke Ado	Om7 Middle Omi South	20	20			10	50	32,000.00			
1143	Oke Bola	Om8 Lower Omi	20	20			10	50	33,600.00			
1144	Oke Seni	Om8 Lower Omi	20	20			10	50	52,800.00			
23D	Alawo Area	On10 Middle Ona North	20	20			10	50	22,400.00			
55D2	Ogunpa Market	On10 Middle Ona North	20	20			10	50	38,400.00			
1110	Onireke GRA	On12 Middle Ona West	20	20			10	50	48,000.00			
48D	Mokola	On13 Middle Ona South	20	20			10	50	22,400.00			
760	Mokola	On14 Lower Ona North	20	20			10	50	22,400.00			
759	Oke Ado	On14 Lower Ona North	20	20			10	50	27,200.00			
773	Agbeni Market	On14 Lower Ona North	20		20		10	50	56,000.00			
56D4	Oke Ado	Og2 Middle Ogunpa	20	20			10	50	27,200.00			
1102	ONIREKE AVENUE , ONIREKE ROAD	On15 Alaro	20	20			10	50	43,200.00			
1083	Gege	On15 Alaro	20	20			10	50	48,000.00			
1093	Alaawo	On15 Alaro	20	20			10	50	48,000.00			
1094	Jenbewon Area	On15 Alaro	20	20			10	50	48,000.00			
1183	Alaawo	On16 Agara Kasumu	20	20			10	50	32,000.00			
861	Dandaru	On16 Agara Kasumu	20	20			10	50	52,800.00			
357	Gege	On17 Lower Ona East	20	20			10	50	22,400.00			
846	PARLLAMENT ROAD	On17 Lower Ona East	20		20		10	50	48,000.00			
867	Secretariat	On17 Lower Ona East	20	20			10	50	27,200.00			
1503	DANDARU	On17 Lower Ona East		20	20		10	50	107,200.00			
364	Olunloyo	Og3 Kudeti	20	20			10	50	35,200.00			
845	Koloko Area	On17 Lower Ona East	20	20			10	50	35,200.00			
848	Ile Tuntun	On17 Lower Ona East	20		20		10	50	76,800.00			
851	Arikewuyo	On17 Lower Ona East	20	20			10	50	52,800.00			
1195	Ile Tuntun	On18 Lower Ona South	20		20		10	50	32,000.00			
1504	Ayekale Community	On18 Lower Ona South		20	20		10	50	32,000.00			
1505	Dugbe	On18 Lower Ona South		20	20		10	50	62,400.00	2,377,600.00	2023	
1190	Ode Aje	On18 Lower Ona South	20		20		10	50	40,000.00			
1188	Yemetu	On18 Lower Ona South	20		20		10	50	40,000.00			
1193	Oluyoro	On18 Lower Ona South	20	20			10	50	27,200.00			
1192	Ajegede	On18 Lower Ona South	20	20			10	50	35,200.00			

Structure No.	Location	Subbasin	Population Weight 20	Previous Flooding 20	Transport Weight 30	Stream Degree 30	Condition 10	Overall Priority 100	Cost of Culvert/Bridges (USD)	Total Cost of Structures / Year (USD/YEAR)	Year	Phase
1184	Irefin(Oje Area)	Og3 Kudeti	20	20			10	50	35,200.00			
1189	Adekile	On18 Lower Ona South	20		20		10	50	76,800.00			
1182	Elekuro	On19 Lower Ona West	20	20			10	50	17,600.00			
1179	Aperin	On19 Lower Ona West	20	20			10	50	27,200.00			
1175	ODE-AYE , KOSODO	On19 Lower Ona West	20	20			10	50	56,000.00			
1176	Yemetu	On19 Lower Ona West	20	20			10	50	43,200.00			
1210	Ile Tuntun (Mopu)	On20 Lowest Ona	20	20			10	50	38,400.00			
1490	Koloko Area	On3 Odo Oba		20	20		10	50	56,000.00			
1498	Oluyoro Oke Offa	On3 Odo Oba		20	20		10	50	110,400.00			
1478	Agugu	On3 Odo Oba		20	20		10	50	59,200.00			
1476	Total Garden	On3 Odo Oba		20	20		10	50	84,800.00			
1483	Oluyoro	Og3 Kudeti			20	20	10	50	113,600.00			
1488	Yemetu	On3 Odo Oba			20	20	10	50	352,000.00			
1493	Elekuro	On4 Upper Ona North		20	20		10	50	56,000.00			
1492	Yerokun	On4 Upper Ona North		20	20		10	50	76,800.00			
78D	Agugu	On6 Upper Ona West	20	20			10	50	17,600.00			
559	Oke -Offa Atipe	On8 Upper Ona South		20	20		10	50	56,000.00			
577	Koloko	On8 Upper Ona South		20	20		10	50	56,000.00			
548	Gate(Prison)	On8 Upper Ona South		20	20		10	50	76,800.00			
672	Isale Alfa Oje	On9 Orogun	20	20			10	50	35,200.00			
663	Onikokoro area	On9 Orogun	20	20			10	50	38,400.00			
682	Goodwill	On9 Orogun	20	20			10	50	35,200.00			
670	Isale Alfa	On9 Orogun	20	20			10	50	43,200.00			
631	Aderogba	On9 Orogun	20		20		10	50	84,800.00			
688	Oke Alfa Atipe	On9 Orogun	20	20			10	50	48,000.00			
686	Ajegede	Og3 Kudeti	20	20			10	50	48,000.00			
685	Adekile	On9 Orogun	20	20			10	50	48,000.00			
684	Odinjo	On9 Orogun	20	20			10	50	48,000.00			
683	Oke Alfa Atipe	On9 Orogun	20	20			10	50	52,800.00			
1074	Akatapa	Iddo Basin	20	20			10	50	43,200.00			
1068	ALAFARA	Iddo Basin	20	20			10	50	48,000.00			
1073	Odo Oba	Iddo Basin	20	20			10	50	48,000.00			
1071	Gbenla Area	Iddo Basin	20	20			10	50	52,800.00			
41D1	Adekile	Iddo Basin	20	20		10		50	62,400.00			
1077	Oje Igosu	Iddo Basin	20		20	10		50	113,600.00			
41D2	SOKA/SANYO	Iddo Basin	20			20	10	50	129,600.00			
1273	SOKA/SANYO	Og4 Lower Ogunpa	15	20			10	45	27,200.00			
1257	ALABA-KAN, AGBAMU SANYO AREA	Ob5 Lower Ogbere North	15	20			10	45	32,000.00			
1271	Owode Academy	Ob5 Lower Ogbere North	15	20			10	45	32,000.00			
1268	Owode Academy	Ob5 Lower Ogbere North	15	20			10	45	35,200.00			
1262	OLOMI	Ob5 Lower Ogbere North	15	20			10	45	38,400.00			
1269	OKE OLUWATEDO,KOSEUNTI JUCTION	Ob5 Lower Ogbere North	15	20			10	45	38,400.00			
1259	RED ROOF AREA, TOLL GATE	Ob5 Lower Ogbere North	15	20			10	45	38,400.00			
1275	SURULERE,FARIA OFF SANYO	Ob6 Lower Ogbere South	15	20			10	45	48,000.00			
36	HERBERT MARCARULARY WAY, SURULERE	Og2 Middle Ogunpa	15		20		10	45	76,800.00	3,060,800.00	2025	
1420	ANU-OLUWAPO ZONE 28,SOKA	Om7 Middle Omi South	5	20	10		10	45	38,400.00			
1457	Molete	Om8 Lower Omi	15	20			10	45	27,200.00			
1450	IDI MANGORO	Og4 Lower Ogunpa	15	20			10	45	27,200.00			
1459	SANYO	Om8 Lower Omi	15	20			10	45	32,000.00			
1456	ANTONIO VILLAGE	Om8 Lower Omi	15	20			10	45	32,000.00			
1468	FELELE	Om8 Lower Omi	15	20			10	45	32,000.00			
1455	Odinjo Area	Om8 Lower Omi	15	20			10	45	35,200.00			
1469	SOKA	Om8 Lower Omi	15	20			10	45	43,200.00			
1470	OLOMI/ABA AFAA	Om8 Lower Omi	15	20			10	45	48,000.00			

Structure No.	Location	Subbasin	Population Weight 20	Previous Flooding 20	Transport Weight 30	Stream Degree 30	Condition 10	Overall Priority 100	Cost of Culvert/Bridges (USD)	Total Cost of Structures / Year (USD/YEAR)	Year	Phase
1471	BOLUWAJI	Om8 Lower Omi	15	20			10	45	48,000.00			
1451	AJAWALE RD,AGBON ESTATE	Om8 Lower Omi	15	20			10	45	52,800.00			
1528	AJOFEEBO, AGBAMU SANYO	Om8 Lower Omi	15			20	10	45	83,200.00			
69	Owode Academy	Om8 Lower Omi	15			20	10	45	129,600.00			
1460	Ibadan Grammar School	Og4 Lower Ogunpa	15			20	10	45	129,600.00			
1529	IREWOLE, AJIYO -OLUNDE	Om8 Lower Omi	15			30		45	150,400.00			
600	Owode Academy	On10 Middle Ona North	15	20			10	45	43,200.00			
603	ELERE	On10 Middle Ona North	15	20			10	45	48,000.00			
590	Ibadan Grammar School	On12 Middle Ona West	5	20	10		10	45	35,200.00			
614	FELELE ONIGARI	On13 Middle Ona South	15	20			10	45	33,600.00			
607	NEW FELELE	On13 Middle Ona South	15	20			10	45	43,200.00			
1288	ELERE	On15 Alaro	15	20			10	45	27,200.00			
1302	Molete	On15 Alaro	15	20			10	45	38,400.00			
1292	BOLUWAJI	On15 Alaro	15	20			10	45	43,200.00			
27	BOLUWAJI	On15 Alaro	15	20			10	45	48,000.00			
1285	IDI-ORO IFESOWAPO, ASIWAJU	On15 Alaro	15	20			10	45	48,000.00			
1287	BOLUWAJI ELERE	On15 Alaro	15	20			10	45	52,800.00			
1314	BOLUWAJI	On16 Agara Kasumu	15	20			10	45	32,000.00			
1321	Molete	Og4 Lower Ogunpa	15	20			10	45	48,000.00			
1303	Molete	On16 Agara Kasumu	15	20			10	45	48,000.00			
152	NEW FELELE	On17 Lower Ona East	15		20		10	45	84,800.00			
188	ITESIWAJU RD, MAJE	On3 Odo Oba	5			30	10	45	1,625,000.00	1,625,000.00	2027	
160	Owode Academy	On3 Odo Oba	5			30	10	45	1,625,000.00			
185	BOLUWAJI	On6 Upper Ona West	5	20	20			45	56,000.00			
120	IDI-AGBON FELELE	On7 Upper Ona East	15		20		10	45	64,000.00	5,620,000.00	2028	
216	IDI-AGBON FELELE	On7 Upper Ona East	5		10	30		45	1,875,000.00			
215	Owode	On7 Upper Ona East	5		10	30		45	2,000,000.00			
1397	ALABA-KAN, AGO -OLUNDE	Osun Basin	5	20		10	10	45	67,200.00			
709	boluwaji	Ob1 Ogbere Headwaters	20	20				40	32,000.00			
708	soka	Og4 Lower Ogunpa	20		20			40	84,800.00			
800	IDI MANGORO/SOKA	Ob2 Upper Ogbere	20	20				40	38,400.00			
799	Eniosa	Ob2 Upper Ogbere	20	20				40	38,400.00			
793	Arulogun	Ob2 Upper Ogbere	20	20				40	43,200.00			
305	Ariyibi	Ob2 Upper Ogbere	20		20			40	172,800.00			
429		Ob3 Middle Ogbere	20		10		10	40	38,400.00			
914	Olorunda	Ob3 Middle Ogbere	20	20				40	48,000.00			
915	Irepodun Estate	Ob3 Middle Ogbere	20	20				40	52,800.00			
407	Ladojo Vilaage	Ob4 Foworogbun	20		20			40	48,000.00			
1124	OLDRUNDA / ENIOSHA	Ob4 Foworogbun	20		20			40	64,000.00			
336	Adedapo	Ob4 Foworogbun	20		10		10	40	38,400.00			
339	Akingbohun	Om1 Omi Headwaters North	20	20				40	38,400.00			
919	Keke	Ob4 Foworogbun	20	20				40	38,400.00			
806	Orita-odan	Ob4 Foworogbun	20	20				40	43,200.00			
694	Olodo	Og1 Upper Ogunpa	20	20				40	35,200.00			
698	Pagun	Og1 Upper Ogunpa	20	20				40	43,200.00	1,747,200.00	2029	
645	Begidinan-fogun Village	Og1 Upper Ogunpa	20	20				40	43,200.00			
257	Bank Olodo Area	Og2 Middle Ogunpa	20		10		10	40	33,600.00			
254	IDI-ORO VILLAGE	Og2 Middle Ogunpa	20		10		10	40	33,600.00			
238	Aloba Village	Og2 Middle Ogunpa	20		10		10	40	38,400.00			
289	Niniola Estate	Og2 Middle Ogunpa	20		20			40	84,800.00			
249	Iyana Agandi-Olodo Area	Og2 Middle Ogunpa	20		10		10	40	48,000.00			
268	Arounfayo	Om2 Omi Headwaters South	20		10		10	40	48,000.00			
262	Onigbinde	Og3 Kudeti	20		20			40	92,800.00			
899	Olorunda Abaa	Og4 Lower Ogunpa	20	20				40	35,200.00			
396	Olodo	Og4 Lower Ogunpa	20		10		10	40	35,200.00			
886	Abada	Og4 Lower Ogunpa	20	20				40	38,400.00			
884	Amero	Og4 Lower Ogunpa	20	20				40	52,800.00			

Structure No.	Location	Subbasin	Population Weight 20	Previous Flooding 20	Transport Weight 30	Stream Degree 30	Condition 10	Overall Priority 100	Cost of Culvert/Bridges (USD)	Total Cost of Structures / Year (USD/YEAR)	Year	Phase
983	kumapayi-Olodo	Om2 Omi Headwaters South	20		10		10	40	22,400.00			
1347	Jenriyin	Om2 Omi Headwaters South		20	10		10	40	22,400.00			
982	Fidelity Estate	Om2 Omi Headwaters South	20		10		10	40	35,200.00			
944	Akobo-Ojurin	Om3 Upper Omi West	20		10		10	40	17,600.00			
942	Akobo-Ojurin	Om3 Upper Omi West	20		10		10	40	33,600.00			
965	Jenriyin	Om3 Upper Omi West	20		20			40	67,200.00			
726	Agbaja	Om3 Upper Omi West	20	20				40	43,200.00			
986	Jenriyin	Om4 Upper Omi East	20		20			40	67,200.00			
808	Wofun-Ayerenti	Om3 Upper Omi West	20	20				40	35,200.00			
1015	Iyana Church Cele	Om6 Middle Omi West	20		10		10	40	35,200.00			
811	Wofun-Ayerenti	Om6 Middle Omi West	20	20				40	38,400.00			
1044	Jenriyin	Om6 Middle Omi West	20	20				40	43,200.00			
1140	Oki	Om7 Middle Omi South	20		10		10	40	22,400.00			
1438	Arulogun Alaja	Om7 Middle Omi South		20	10		10	40	22,400.00			
1017	Ajara Estate	Om7 Middle Omi South	20		10		10	40	32,000.00			
1129	Akobo-Ojurin	Om7 Middle Omi South	20		10		10	40	38,400.00			
1131	Ilupeju Estate	Om7 Middle Omi South	20		10		10	40	43,200.00			
498	Ileltuntun -Akobo Ojurin	On10 Middle Ona North	20		20			40	142,400.00			
779	Iyana Church Cele	On12 Middle Ona West	20	20				40	35,200.00			
855	Akobo-Ojurin	Om3 Upper Omi West	20		10		10	40	43,200.00			
872	Aseyori - Sese	On17 Lower Ona East	20	20				40	27,200.00			
850	Iyana Church Cele	On17 Lower Ona East	20		10		10	40	27,200.00			
354	Agbaja	On17 Lower Ona East	20	20				40	35,200.00			
833	God city estate Akobo	On17 Lower Ona East	20		20			40	76,800.00			
1473	Agbaja Olodo	On3 Odo Oba		20	20			40	142,400.00			
1485	Harmony Estate	On3 Odo Oba			20	10	10	40	176,000.00			
1481	Ajara	On3 Odo Oba			20	10	10	40	105,600.00			
1487	Agbaja Olodo	On3 Odo Oba				30	10	40	275,200.00			
1499	Idi Ishin- Akobo	On6 Upper Ona West		20		10	10	40	57,600.00			
556	Wakajaye	On8 Upper Ona South		20	10		10	40	48,000.00			
576	Akoka	Om3 Upper Omi West		20	10		10	40	48,000.00			
689	After Elewuro junction	On9 Orogun	20	20				40	48,000.00			
1067	Apata	Iddo Basin	20			10	10	40	57,600.00			
1251	Sawo	Ob5 Lower Ogbere North	5	20			10	35	27,200.00			
1249	Wakajaye	Ob5 Lower Ogbere North	5	20			10	35	32,000.00			
1250	Elewuro	Ob5 Lower Ogbere North	5	20			10	35	35,200.00			
1241	Estate Oki-Agodi estate	Ob5 Lower Ogbere North	5	20			10	35	35,200.00			
49	Okebadan Estate	Og1 Upper Ogunpa	15		10		10	35	48,000.00			
39	Iyana Church Cele	Og2 Middle Ogunpa	15		20			35	92,800.00			
72	Wakajaye	Og3 Kudeti	15		10		10	35	35,200.00			
95	Orogbangba	Og3 Kudeti	15		10		10	35	48,000.00			
1222	Barack	Om3 Upper Omi West	5	20			10	35	27,200.00			
1247	Alapata Estate	Og4 Lower Ogunpa	5	20			10	35	27,200.00			
1236	J.K Ayinde Ori-Owo, Oki, J.K Ayinde Ori-Owo	Og4 Lower Ogunpa	5	20			10	35	27,200.00			
1223	SULE-OGANLA 2	Og4 Lower Ogunpa	5	20			10	35	35,200.00			
1242	Fatumo Area	Og4 Lower Ogunpa	5	20			10	35	56,000.00			
1227	Kulodi/ife-ibadan express way	Og4 Lower Ogunpa	5	20			10	35	48,000.00			
1371	IKUMAPAYI	Om2 Omi Headwaters South	5	20			10	35	35,200.00			
1374	ADEWUNMI	Om4 Upper Omi East	5	20			10	35	17,600.00			
1406	Ifelodun Estate/Ikumapayi	Om4 Upper Omi East	5	20			10	35	22,400.00			
1387	ADELEYE	Om4 Upper Omi East	5		20		10	35	48,000.00			
1433	Ikumapayi	Om4 Upper Omi East	5	20			10	35	27,200.00			
1402	AHOYAYA-OLODO	Om4 Upper Omi East	5	20			10	35	32,000.00			
1379	Ogungbade	Om4 Upper Omi East	5	20			10	35	32,000.00			
1404	Ajoda	Om4 Upper Omi East	5	20			10	35	35,200.00			
1392	IDI-OSAN	Om4 Upper Omi East	5	20			10	35	33,600.00			
1388	Arubiewe Olodo	Om4 Upper Omi East	5	20			10	35	33,600.00			

Structure No.	Location	Subbasin	Population Weight 20	Previous Flooding 20	Transport Weight 30	Stream Degree 30	Condition 10	Overall Priority 100	Cost of Culvert/Bridges (USD)	Total Cost of Structures / Year (USD/YEAR)	Year	Phase
1431	ADEWUNMI	Om4 Upper Omi East	5	20			10	35	35,200.00			
1380	Ogundipe	Om4 Upper Omi East	5	20			10	35	38,400.00			
1375	OLODO	Om4 Upper Omi East	5	20			10	35	38,400.00			
1389	Olodo	Om4 Upper Omi East	5	20			10	35	38,400.00			
1432	OJOYEYE,OLODO	Om4 Upper Omi East	5	20			10	35	43,200.00			
1376	OLODO	Om4 Upper Omi East	5	20			10	35	48,000.00			
1377	OKE-OMI	Om4 Upper Omi East	5	20			10	35	48,000.00			
1381	Olufon-Olodo	Om4 Upper Omi East	5	20			10	35	48,000.00			
1412	Agugu village	Om5 Middle Omi East	5	20			10	35	22,400.00			
1408	Idi-osan	Om4 Upper Omi East	5	20			10	35	27,200.00			
1409	ARUBIEWE	Om5 Middle Omi East	5	20			10	35	32,000.00			
1410	Olodo	Om5 Middle Omi East	5	20			10	35	35,200.00			
1417	ALAGBEDE	Om7 Middle Omi South	5		20		10	35	142,400.00			
1419	Olodo	Om7 Middle Omi South	5	20			10	35	48,000.00			
1421	IKUMAPAYI	Om7 Middle Omi South	5	20			10	35	48,000.00			
1466	Olodo / Arubiewe	Om8 Lower Omi	15		10		10	35	43,200.00			
585	Ajoda Estate	On12 Middle Ona West	5		20		10	35	67,200.00			
145B	Ifeoluwatedo Estate	On13 Middle Ona South	15		10		10	35	17,600.00			
1283	Ajoda Estate	On15 Alaro	15	20				35	27,200.00			
1583	Oluwo	On15 Alaro	15			10	10	35	51,200.00			
1307	Ifeoluwatedo Estate	Om5 Middle Omi East	15		10		10	35	38,400.00			
28	Olorunsogo	On17 Lower Ona East	15		10		10	35	52,800.00			
1579	Adegbayi	On4 Upper Ona North	15			10	10	35	62,400.00			
1580	Oluwakeyin	On4 Upper Ona North	15		10	10		35	86,400.00			
195	Olode	On6 Upper Ona West	5	20			10	35	38,400.00			
176	Olode	On6 Upper Ona West	5		20		10	35	67,200.00			
190	Jenrola road, oke odo alapata, femitoluwa quarters	On6 Upper Ona West	5			20	10	35	105,600.00			
223	Adegbayi	On7 Upper Ona East	5		20		10	35	59,200.00			
309	IREPODUN LANDLORDS ASSOCIATION	Ob2 Upper Ogbere	20				10	30	17,600.00			
311	Jenrola road, oke odo alapata, femitoluwa quarters	Ob2 Upper Ogbere	20				10	30	27,200.00			
706	Jenrola road, oke odo alapata, femitoluwa quarters	Ob2 Upper Ogbere	20				10	30	32,000.00			
421	Isebo Alakia	Om6 Middle Omi West	20				10	30	32,000.00			
315	Olalere Zone D	Ob2 Upper Ogbere	20				10	30	32,000.00			
307	Alakia Area	Ob2 Upper Ogbere	20				10	30	32,000.00			
701	MANATAN	Ob2 Upper Ogbere	20				10	30	33,600.00			
300	Amosun	Ob2 Upper Ogbere	20				10	30	38,400.00			
424	IREPODUN LANDLORDS ASSOCIATION	Ob2 Upper Ogbere	20				10	30	52,800.00			
417	Adegbayi	Ob3 Middle Ogbere	20				10	30	22,400.00			
416	Ifesowapo	Ob3 Middle Ogbere	20				10	30	27,200.00			
414	Jenrola road, oke odo alapata, femitoluwa quarters	Ob3 Middle Ogbere	20				10	30	32,000.00			
418	ADELUBI	Ob3 Middle Ogbere	20				10	30	35,200.00			
433	Kuelu Area	Ob3 Middle Ogbere	20				10	30	43,200.00			
415	Asipa Community	Ob3 Middle Ogbere	20				10	30	43,200.00			
431	KOLAPO ISHOLA ESTATE	Ob3 Middle Ogbere	20				10	30	43,200.00	8,156,800.00	2030	Phase 2
413	Isebo Alakia	Ob3 Middle Ogbere	20				10	30	48,000.00			
412	Olode	Om6 Middle Omi West	20				10	30	52,800.00			
333	Kolapo Ishola GRA	Ob4 Foworogbun	20				10	30	22,400.00			
400	Kolapo Ishola GRA	Ob4 Foworogbun	20				10	30	27,200.00			
1126	ADOGBA/ MANATAN	Ob4 Foworogbun	20				10	30	35,200.00			
929	Adegbayi	Ob4 Foworogbun	20		10			30	38,400.00			
1058	Carlton estate GRA	Ob4 Foworogbun	20				10	30	56,000.00			
406	Olode	Ob4 Foworogbun	20				10	30	43,200.00			
397	Nigeria Brewery	Ob4 Foworogbun	20				10	30	43,200.00			

Structure No.	Location	Subbasin	Population Weight 20	Previous Flooding 20	Transport Weight 30	Stream Degree 30	Condition 10	Overall Priority 100	Cost of Culvert/Bridges (USD)	Total Cost of Structures / Year (USD/YEAR)	Year	Phase
331	Nigerian Brewery	Ob4 Foworogbun	20				10	30	43,200.00			
334	Ifesowapo commuity Aba Odan	Ob4 Foworogbun	20		10			30	48,000.00			
330	Amosun	Ob4 Foworogbun	20				10	30	48,000.00			
918	Adegbayi	Om6 Middle Omi West	20				10	30	27,200.00			
695	Aba Odan	Og1 Upper Ogunpa	20				10	30	48,000.00			
643	Kuelu Area	Og1 Upper Ogunpa	20				10	30	48,000.00			
240	adegbayi	Og2 Middle Ogunpa	20				10	30	27,200.00			
239	AROLU AREA	Og2 Middle Ogunpa	20				10	30	32,000.00			
296	Adegbayi	Og2 Middle Ogunpa	20				10	30	35,200.00			
234	Asipa-Laamo	Og2 Middle Ogunpa	20		10			30	38,400.00			
258	Oke- Odo -Alalubosa Zone A	Og2 Middle Ogunpa	20				10	30	38,400.00			
255	Nigeria Brewery	Og2 Middle Ogunpa	20				10	30	38,400.00			
283	Osun seni	Og2 Middle Ogunpa	20				10	30	43,200.00			
783	Osun Seni Zone B	Og2 Middle Ogunpa	20				10	30	43,200.00			
237	Aroko- Agoro	Om6 Middle Omi West	20		10			30	43,200.00			
259	Aiport	Og2 Middle Ogunpa	20				10	30	48,000.00			
292	Aiport	Og2 Middle Ogunpa	20				10	30	48,000.00			
317	Kupo Zone 3	Og3 Kudeti	20				10	30	27,200.00			
388	Airport	Og3 Kudeti	20				10	30	27,200.00			
321	Akintunde	Og3 Kudeti	20				10	30	27,200.00			
350	Faosin	Og3 Kudeti	20				10	30	32,000.00			
282	Ona Ara	Og3 Kudeti	20				10	30	35,200.00			
318	Irepodun	Og3 Kudeti	20				10	30	35,200.00			
320	Ejikeye-Ajia	Og3 Kudeti	20				10	30	38,400.00			
260	Aiport	Og3 Kudeti	20				10	30	38,400.00			
281	Akindele Atea	Om7 Middle Omi South	20				10	30	38,400.00			
371	Akamo/masopa	Og3 Kudeti	20				10	30	38,400.00			
284	Kuledi Area	Og3 Kudeti	20				10	30	43,200.00			
295	Aiport	Og3 Kudeti	20				10	30	48,000.00			
294	Poat	Og3 Kudeti	20				10	30	48,000.00			
370	Ejikeye-Ajia	Og3 Kudeti	20				10	30	48,000.00			
391	ROCK VIEW ESTATE RESIDENTS ASSOCIATION OFF IYANA AGBALA, NEW IFE EXPRESS WAY, BIOKU IBADAN	Og3 Kudeti	20		10			30	48,000.00			
380	ROCK VIEW ESTATE RESIDENTS ASSOCIATION OFF IYANA AGBALA, NEW IFE EXPRESS WAY, BIOKU IBADAN	Og4 Lower Ogunpa	20				10	30	22,400.00			
395	Iderade	Og4 Lower Ogunpa	20				10	30	27,200.00			
901	Faosin	Og4 Lower Ogunpa	20				10	30	35,200.00			
381	Iderade	Og4 Lower Ogunpa	20				10	30	33,600.00			
394	Ejikeye-Ajia	Og4 Lower Ogunpa	20				10	30	38,400.00			
375	Araromi-Kure	Og4 Lower Ogunpa	20				10	30	43,200.00			
62	Ifeoluwa Community	Og4 Lower Ogunpa	20				10	30	48,000.00			
1336	Aiport	Om7 Middle Omi South		20			10	30	35,200.00			
448	Amuloko	Om1 Omi Headwaters North			20		10	30	84,800.00			
985	Egbeda	Om2 Omi Headwaters South	20				10	30	27,200.00			
1367	Ifesowapo Community	Om2 Omi Headwaters South		20			10	30	27,200.00			
1368	Amuloko	Om2 Omi Headwaters South		20			10	30	35,200.00			
1366	Oluwo	Om2 Omi Headwaters South		20			10	30	43,200.00			
1349	Ifesowapo Area	Om2 Omi Headwaters South		20			10	30	43,200.00			
984	Olorunsogo	Om2 Omi Headwaters South	20		10			30	43,200.00			
1364	Fakayode Area	Om2 Omi Headwaters South		20			10	30	48,000.00			
1365	Araromi	Om2 Omi Headwaters South		20			10	30	48,000.00			
1354	Airport	Om3 Upper Omi West		20			10	30	22,400.00			
1051	Olorunsogo community	Om7 Middle Omi South	20				10	30	27,200.00			
954	Olorunsogo community	Om3 Upper Omi West	20				10	30	27,200.00			

Structure No.	Location	Subbasin	Population Weight 20	Previous Flooding 20	Transport Weight 30	Stream Degree 30	Condition 10	Overall Priority 100	Cost of Culvert/Bridges (USD)	Total Cost of Structures / Year (USD/YEAR)	Year	Phase
978	Olode/Ajamoro	Om3 Upper Omi West	20				10	30	32,000.00			
988	Akindele Atea	Om3 Upper Omi West	20				10	30	32,000.00			
977	Egbeda	Om3 Upper Omi West	20				10	30	35,200.00			
968	Bioku - Araba	Om3 Upper Omi West	20				10	30	35,200.00			
976	Inuege	Om3 Upper Omi West	20				10	30	35,200.00			
945	Ogo Oluwa Zone F	Om3 Upper Omi West	20				10	30	35,200.00			
963	Idi- Oro	Om3 Upper Omi West	20				10	30	35,200.00			
940	OLORUNGUNWA	Om3 Upper Omi West	20				10	30	38,400.00			
964	Odeyale-Ifesowapo	Om3 Upper Omi West	20				10	30	38,400.00			
969	Oke-elesin	Om8 Lower Omi	20				10	30	38,400.00			
970	Ifeloju	Om3 Upper Omi West	20				10	30	43,200.00			
1350	Orisunmbare	Om3 Upper Omi West		20			10	30	43,200.00			
971	Oke-Elesin	Om3 Upper Omi West	20				10	30	43,200.00			
947	Oke-odo/Olu-awo	Om3 Upper Omi West	20				10	30	43,200.00			
975	Ifeloju	Om3 Upper Omi West	20				10	30	43,200.00			
948	Amuloko/Oke-elesin	Om3 Upper Omi West	20				10	30	48,000.00			
949	Olupo Estate	Om3 Upper Omi West	20				10	30	48,000.00			
958	Araromi-Lapiti	Om3 Upper Omi West	20				10	30	48,000.00			
950	Oke-Odo	Om3 Upper Omi West	20				10	30	48,000.00			
573	Olokonla Road	Om3 Upper Omi West			20		10	30	84,800.00			
1353	Alagbede	Om8 Lower Omi		20			10	30	52,800.00			
1357	Egbeda-Atuba	Om4 Upper Omi East		20			10	30	22,400.00			
987	Alagbede	Om4 Upper Omi East	20				10	30	43,200.00			
1358	Baale Village,Kobomoje Olomiyeye	Om4 Upper Omi East		20			10	30	43,200.00			
1057	Oke-Odo	Om6 Middle Omi West	20				10	30	17,600.00			
1011	Thy-will	Om6 Middle Omi West	20				10	30	22,400.00			
1022	Gbenle Estate	Om6 Middle Omi West	20				10	30	22,400.00			
1003	Gbenle Estate	Om6 Middle Omi West	20				10	30	22,400.00			
1046	Thy-will	Om6 Middle Omi West	20				10	30	27,200.00			
1013	Olomiyeye	Om6 Middle Omi West	20				10	30	27,200.00			
1026	Orisunmbare/Olorire Estate	Om6 Middle Omi West	20				10	30	27,200.00			
809	Gbenle Estate	Om6 Middle Omi West	20				10	30	32,000.00			
1047	Amuloko	Om6 Middle Omi West	20				10	30	32,000.00			
1002	OKE-ODO OLUAWO	Om6 Middle Omi West	20				10	30	32,000.00			
1018	Olu-awo	Om8 Lower Omi	20				10	30	32,000.00			
1030	Tokotaya Bus-stop	Om6 Middle Omi West	20				10	30	35,200.00	385,600.00	2032	
1054	Abonde	Om6 Middle Omi West	20				10	30	35,200.00			
1024	Amuloko	Om6 Middle Omi West	20				10	30	35,200.00			
727	Aba Okubiyi	Om6 Middle Omi West	20				10	30	38,400.00			
1044A	Gboro village/Idi-ose	Om6 Middle Omi West	20				10	30	43,200.00			
1048	Olorungbebe	Om6 Middle Omi West	20				10	30	43,200.00			
1014	Odeyale-Ifesowapo	Om6 Middle Omi West	20				10	30	48,000.00			
1029	Ifesowapo-Omolere Estate	Om6 Middle Omi West	20				10	30	48,000.00			
1042	IFESOWAPO LANDLORD AND LANDLADIES ODEYALE IFESOWAPO COMMUNITY AKANRAN ROAD	Om6 Middle Omi West	20				10	30	48,000.00			
1012	Ifesowapo-Omolere Estate	Om6 Middle Omi West	20				10	30	52,800.00			
1171	Ifelere/Agbena	Om8 Lower Omi	20				10	30	17,600.00			
1171 Prime	Ojoo-Ajibode	Om7 Middle Omi South	20				10	30	22,400.00			
1127	Aro-Meta Eleyele	Om7 Middle Omi South	20				10	30	22,400.00			
1134	Abangbe Ajibode	Om7 Middle Omi South	20				10	30	22,400.00			
1128	Apete	Om7 Middle Omi South	20				10	30	22,400.00			
1172 Prime	ODO-BAALE, LOKOAREA SANGO	Om7 Middle Omi South	20				10	30	27,200.00			
1157	OKE-ODAN-POLY QUARTERS LANDLORDS ASSOCIATION, APETE, IBADAN IDO LGA	Om7 Middle Omi South	20				10	30	32,000.00			
1172	University of Ibadan	Om7 Middle Omi South	20				10	30	32,000.00			

Structure No.	Location	Subbasin	Population Weight 20	Previous Flooding 20	Transport Weight 30	Stream Degree 30	Condition 10	Overall Priority 100	Cost of Culvert/Bridges (USD)	Total Cost of Structures / Year (USD/YEAR)	Year	Phase
1439	Ajibode	Om7 Middle Omi South		20			10	30	32,000.00			
1163	Agbaje Ijokodo	Om7 Middle Omi South	20				10	30	32,000.00			
1152	Ojoo	Om7 Middle Omi South	20				10	30	32,000.00			
1162	Apete	On10 Middle Ona North	20				10	30	32,000.00			
1440	Sango	Om7 Middle Omi South		20			10	30	32,000.00			
1137	Abatakan	Om7 Middle Omi South	20				10	30	35,200.00			
1156	Mojoda	Om7 Middle Omi South	20				10	30	35,200.00			
1125 Prime	Apete	Om7 Middle Omi South	20				10	30	38,400.00			
1138	Ojoo	Om7 Middle Omi South	20				10	30	38,400.00			
1434		Om7 Middle Omi South		20			10	30	43,200.00			
1148	Oguntula	Om7 Middle Omi South	20				10	30	43,200.00			
1167	Samanda	Om7 Middle Omi South	20				10	30	43,200.00			
1153		Om7 Middle Omi South	20				10	30	43,200.00			
1135	Alaro	Om7 Middle Omi South	20				10	30	43,200.00			
1435		On10 Middle Ona North		20			10	30	48,000.00			
1166	Anu Oluwa Quarters	Om7 Middle Omi South	20				10	30	48,000.00			
1136	OKE-ODAN-POLY QUARTERS LANDLORDS ASSOCIATION, APETE, IBADAN IDO LGA	Om7 Middle Omi South	20				10	30	52,800.00	2,278,400.00	2034	
1016	Sango	Om7 Middle Omi South	20				10	30	52,800.00			
1149	Ojoo	Om7 Middle Omi South	20				10	30	52,800.00			
1145		Om8 Lower Omi	20				10	30	27,200.00			
1146	Okoro	Om8 Lower Omi	20				10	30	32,000.00			
658	Sode-Jamade Apete	On10 Middle Ona North	20				10	30	32,000.00			
648	NISER	On10 Middle Ona North	20				10	30	33,600.00			
660	Ojoo-Gospel/Total	On10 Middle Ona North	20				10	30	38,400.00			
650	Old oyo Road	On10 Middle Ona North	20				10	30	38,400.00			
649	Okoro	On10 Middle Ona North	20				10	30	43,200.00			
1105	Isale School the way	On12 Middle Ona West	20				10	30	17,600.00			
1113	Eleyele	On12 Middle Ona West	20				10	30	27,200.00			
736	University of Ibadan	On10 Middle Ona North	20				10	30	35,200.00			
737	Oke Odan	On12 Middle Ona West	20				10	30	35,200.00			
1106	Ojoo	On12 Middle Ona West	20				10	30	38,400.00			
1109	Ile Alli	On12 Middle Ona West	20				10	30	38,400.00			
1112	Apete	On12 Middle Ona West	20				10	30	38,400.00			
1107	UI	On12 Middle Ona West	20				10	30	38,400.00			
1108	UI	On12 Middle Ona West	20				10	30	43,200.00			
1114	UI	On12 Middle Ona West	20				10	30	43,200.00			
1111	IJOKODO , APETE ROAD	On12 Middle Ona West	20				10	30	43,200.00			
1115	Awotan Apete-Life Forte	On12 Middle Ona West	20				10	30	48,000.00			
748	Onigbaketun	On13 Middle Ona South	20				10	30	35,200.00			
747	Alapata	On11 Alapata South	20				10	30	38,400.00			
746	Alatare Zone C	On13 Middle Ona South	20				10	30	43,200.00			
761	Owala	On14 Lower Ona North	20				10	30	17,600.00			
750	Agunbiade	On14 Lower Ona North	20				10	30	22,400.00			
754	Ogbagba Area	On14 Lower Ona North	20				10	30	32,000.00			
820	Ologuneru	On14 Lower Ona North	20				10	30	32,000.00			
233	Owode Apata Aba Ege	On14 Lower Ona North	20				10	30	35,200.00			
229	Oladele Face 2	On14 Lower Ona North	20				10	30	38,400.00			
228	Abanla Zone B2	On14 Lower Ona North	20				10	30	38,400.00			
359	Oladele face 2	On14 Lower Ona North	20				10	30	38,400.00			
231	Gbekuba	On14 Lower Ona North	20				10	30	43,200.00			
291	Gbekuba	On12 Middle Ona West	20				10	30	43,200.00			
230	Olohungbebe Ido	On14 Lower Ona North	20				10	30	48,000.00			
765	Elenusonso	On14 Lower Ona North	20				10	30	48,000.00			
752	Olohungbebe Ido	On14 Lower Ona North	20				10	30	48,000.00			
755	Ogbagba Area	On14 Lower Ona North	20		10			30	52,800.00			

Structure No.	Location	Subbasin	Population Weight 20	Previous Flooding 20	Transport Weight 30	Stream Degree 30	Condition 10	Overall Priority 100	Cost of Culvert/Bridges (USD)	Total Cost of Structures / Year (USD/YEAR)	Year	Phase
768	Apata	On15 Alaro	20				10	30	22,400.00			
1066	Ifeleye Apata	On15 Alaro	20				10	30	22,400.00			
1103	Powerline Ido	On15 Alaro	20				10	30	22,400.00			
1092	Powerline Ologuneru	On15 Alaro	20				10	30	27,200.00			
823	Ogbagba Area	On15 Alaro	20				10	30	32,000.00			
1104	Powerline Ologuneru	On15 Alaro	20				10	30	32,000.00			
826	Adebisi Area	On12 Middle Ona West	20				10	30	35,200.00			
1081	Egbodi Apata	On15 Alaro	20				10	30	35,200.00			
1091	Owode Apata	On15 Alaro	20				10	30	38,400.00			
1100	Apata	On15 Alaro	20				10	30	38,400.00			
828	Apata	On15 Alaro	20				10	30	43,200.00	1,224,000.00	2035	
1101	Iletuntun Area	On15 Alaro	20				10	30	43,200.00			
1120	Teacher Estate	On15 Alaro	20				10	30	43,200.00			
1082	NIHORT , GBEKUBA	On15 Alaro	20				10	30	43,200.00			
822	IFELAGBA LANDLORDS AND RESIDENT ASSOCIATION,UPPER ADETOKUN, NEW ERUWA ROAD	On15 Alaro	20				10	30	43,200.00			
1084	Jericho	On15 Alaro	20				10	30	48,000.00			
26	Aba Pan	On15 Alaro	20				10	30	52,800.00			
1085	Ologuneru	On15 Alaro	20				10	30	52,800.00			
859	Adetokun Ologuneru	On16 Agara Kasumu	20				10	30	43,200.00			
853	Sijuade	On16 Agara Kasumu	20				10	30	48,000.00			
860	Eleyele	On13 Middle Ona South	20				10	30	48,000.00			
361	Idi Osan -Ologuneru	On17 Lower Ona East	20				10	30	27,200.00			
835	Adetokun Eleyele	On17 Lower Ona East	20				10	30	35,200.00			
849	Ologuneru	On17 Lower Ona East	20				10	30	35,200.00			
355	Odo Ona	On17 Lower Ona East	20				10	30	33,600.00			
863	Oluyole Extension	On17 Lower Ona East	20				10	30	38,400.00			
873	Iyaganku GRA	On17 Lower Ona East	20				10	30	38,400.00			
864	Odo Ona	On17 Lower Ona East	20				10	30	43,200.00			
356	Ring Rod	On17 Lower Ona East	20				10	30	43,200.00			
356 Prime	Odo Ona	On17 Lower Ona East	20				10	30	43,200.00			
852	Iyaganku GRA	On17 Lower Ona East	20				10	30	43,200.00			
840	Odo Ona	On14 Lower Ona North	20				10	30	48,000.00			
834	Aleshinloye	On17 Lower Ona East	20				10	30	52,800.00			
1187	Ago Taylor	On18 Lower Ona South	20				10	30	17,600.00			
1207	Aleshinloye Market	On18 Lower Ona South	20				10	30	22,400.00			
1191	Ring Road	On18 Lower Ona South	20				10	30	38,400.00			
1213	Iyaganku	On18 Lower Ona South	20				10	30	48,000.00			
1326	Kuole North	On19 Lower Ona West		20			10	30	32,000.00			
1331	Joyce B	On19 Lower Ona West		20			10	30	35,200.00			
1327	Road B	On19 Lower Ona West		20			10	30	56,000.00			
1218	Ogunleye	On19 Lower Ona West	20				10	30	43,200.00			
1328	Subulade Streeet	On19 Lower Ona West		20			10	30	43,200.00			
1332	Liberty	On14 Lower Ona North		20			10	30	43,200.00			
1334	Apata	On19 Lower Ona West		20			10	30	48,000.00			
1324	Apata	On19 Lower Ona West		20			10	30	52,800.00			
1220	Oluyole estate	On20 Lowest Ona	20				10	30	27,200.00			
1208	Joyce B	On20 Lowest Ona	20				10	30	38,400.00			
1477	Oluyole	On3 Odo Oba			20		10	30	48,000.00			
1474	Oluyole Estate	On3 Odo Oba			20		10	30	142,400.00			
1491	Federal college of Animal health & Production Technology	On4 Upper Ona North			20		10	30	76,800.00			
1494	Oyeshina Layout	On4 Upper Ona North		20		10		30	62,400.00			
449	Oluyole	On7 Upper Ona East		20			10	30	22,400.00			
447	Moore Plantation	On7 Upper Ona East			20	10		30	96,000.00			
504	Aleshinloye	On14 Lower Ona North			20		10	30	48,000.00			
538	Oluyole Estate	On8 Upper Ona South		20			10	30	32,000.00			

Structure No.	Location	Subbasin	Population Weight 20	Previous Flooding 20	Transport Weight 30	Stream Degree 30	Condition 10	Overall Priority 100	Cost of Culvert/Bridges (USD)	Total Cost of Structures / Year (USD/YEAR)	Year	Phase
542	Kuola Apata	On8 Upper Ona South		20			10	30	32,000.00			
543	Apata	On8 Upper Ona South		20			10	30	38,400.00			
666	IFESOWAPO COMMUNITY LANDLORDS/LANDLADIES ASSOCIATION LAYAN VILLAGE,APATA	On9 Orogun	20				10	30	27,200.00			
671	BESIDE C.A.C REVIVAL CENTRE AKINPELU AREA	On9 Orogun	20				10	30	32,000.00			
691	ORITA MERIN-ELEBU (AHUN-GESTIMANY ROAD-ABESE ESTATE-ASAKKA WAY)	On9 Orogun	20				10	30	35,200.00			
664	AKOGI LAYOUT , BESIDE ELIZABETH GRP OF SCH,	On9 Orogun	20				10	30	33,600.00			
662	Apata	On9 Orogun	20				10	30	38,400.00			
635	BESIDE ELEBU HEALTH CARE	On9 Orogun	20				10	30	43,200.00			
1076	OPPOSITE KIDDIES PRIVATE SCH, SHARPCONER/REVIVAL AREA	Iddo Basin	20				10	30	32,000.00			
1079	Oluyole Extension Zone 6	Iddo Basin	20				10	30	33,600.00			
1075	Apata	Iddo Basin	20				10	30	38,400.00			
1072	AJALA LAYOUT, ALAGO VILLAGE	Iddo Basin	20				10	30	48,000.00			
1070	Oluyole Extension	On15 Alaro	20				10	30	52,800.00			
1078	Apata	Iddo Basin	20			10		30	62,400.00			
1069	Apata	Iddo Basin	20			10		30	62,400.00			
88	OLUSETAN ESTATE, AKURO	Ob2 Upper Ogbere	15				10	25	43,200.00			
85	Bembo Area	Ob2 Upper Ogbere	15				10	25	48,000.00			
75	OFF UNITY STREET RD3, POWERLINE, ABA-PANU	Ob3 Middle Ogbere	15				10	25	48,000.00			
1525	Oluyole Extension	Ob4 Foworogbun	15				10	25	48,000.00			
77	Alexander Apata	Ob4 Foworogbun	15				10	25	52,800.00			
1254	Aba Alamu Apata	Ob5 Lower Ogbere North	15				10	25	38,400.00			
1272	Aba Alamu Apata	Ob5 Lower Ogbere North	15				10	25	43,200.00			
1279	Oluyole	Ob6 Lower Ogbere South	15				10	25	43,200.00			
48	Meridian Apata	On15 Alaro	15				10	25	43,200.00			
50	IDI-AHUN, ELEBU	Og1 Upper Ogunpa	15				10	25	48,000.00			
47	Oluyole Extension	Og1 Upper Ogunpa	15				10	25	52,800.00			
1551	Owode Apata	Og2 Middle Ogunpa	15				10	25	48,000.00			
1556	Akala Area	Og3 Kudeti	15				10	25	43,200.00			
1558	Apata	Og3 Kudeti	15				10	25	48,000.00			
1557	IRE-AKARI ESTATE OFF AKAUA ROAD	Og3 Kudeti	15				10	25	48,000.00			
1229	Apata	Og4 Lower Ogunpa	5	20				25	22,400.00			
1564	BESIDE EZRA HOTEL, IDI-OBI JANKATA	Og4 Lower Ogunpa	15				10	25	48,000.00			
1390	WALE ADEOYE LAYOUT, OLUYOLE EXTENSION	Om4 Upper Omi East	5	20				25	43,200.00			
1531	Meridian Apata	Om4 Upper Omi East	15				10	25	48,000.00			
1533	Ire Akari Estate	On15 Alaro	15				10	25	48,000.00			
1532	Apata	Om4 Upper Omi East	15				10	25	52,800.00			
1519	BOLA, IDI-AHUN AREA, HUOLA RD	Om6 Middle Omi West	15				10	25	43,200.00			
1518	Oluyole extension-Akuru	Om6 Middle Omi West	15				10	25	48,000.00	5,939,200.00	2036	
112	Tanimowo Area	Om6 Middle Omi West	15				10	25	48,000.00			
617	OFF AYODELE BLOCK INDUSTRY, ADEBOMI RD	On10 Middle Ona North	15				10	25	22,400.00			
616	BANKOLE/ODO ONA ELEWE	On10 Middle Ona North	15				10	25	32,000.00			
610	ESTATE EXTENSION, OFF ADEBOMI RD	On10 Middle Ona North	15				10	25	32,000.00			
134	ALONG TOLATOSE EST. RD	On10 Middle Ona North	15				10	25	32,000.00			
613	ABA APATA, ALONG MOGANNA'S ESTATE.	On11 Alapata South	15				10	25	43,200.00			
605	Odo Ona Elewe	On11 Alapata South	15		10			25	48,000.00			
615	Oko- Odo Zone 2	On16 Agara Kasumu	15				10	25	32,000.00			
1542	AYEGUN, OLEYO	On12 Middle Ona West	15		10			25	52,800.00			
620	Apampa Moberi Idi- Ishin	On13 Middle Ona South	15				10	25	38,400.00			

Structure No.	Location	Subbasin	Population Weight 20	Previous Flooding 20	Transport Weight 30	Stream Degree 30	Condition 10	Overall Priority 100	Cost of Culvert/Bridges (USD)	Total Cost of Structures / Year (USD/YEAR)	Year	Phase
606	OLOFA	On13 Middle Ona South	15				10	25	48,000.00			
1281	FEDERAL HOUSING EST. AREA,ALONG HALLELUYAH HOUSE	On15 Alaro	15				10	25	35,200.00			
1315	Oko- Odo Zone 1	On16 Agara Kasumu	15				10	25	35,200.00			
1305	Isale Olosan	On16 Agara Kasumu	15				10	25	38,400.00			
153	Anfani	On17 Lower Ona East	15				10	25	48,000.00			
471	New Garage	On5 Alapata North	5		10	10		25	86,400.00			
182	CHALLENGE/FELELE	On6 Upper Ona West	5		20			25	142,400.00			
714	Ososami	Ob1 Ogbere Headwaters	20					20	32,000.00			
710	Iyana Agara-Odo Ona elewe	Ob1 Ogbere Headwaters	20					20	38,400.00			
1168	POLICE POST/CHALLENGE	Ob4 Foworogbun	20					20	43,200.00			
646	Toll Gate	Og1 Upper Ogunpa	20					20	38,400.00			
789	POLICE POST/CHALLENGE	On17 Lower Ona East	20					20	43,200.00			
390	CHALLENGE	Og3 Kudeti	20					20	43,200.00			
374	Toll Gate	Og4 Lower Ogunpa	20					20	32,000.00			
379	Idi Orogbo New Adeoyo	Og4 Lower Ogunpa	20					20	35,200.00			
895	Ososami	Og4 Lower Ogunpa	20					20	38,400.00			
453	Orita Challenge	Om1 Omi Headwaters North			20			20	48,000.00			
1341	Odo Ona elewe-IDC	Om2 Omi Headwaters South		20				20	52,800.00			
725	Anfani	Om3 Upper Omi West	20					20	38,400.00			
720	Anfani	Om3 Upper Omi West	20					20	43,200.00			
966	Odo Ona Elewe	Om3 Upper Omi West	20					20	48,000.00			
730	Odo Ona Elewe	Om6 Middle Omi West	20					20	38,400.00			
1020	LAGELU ESTATE	On17 Lower Ona East	20					20	38,400.00			
733	LAGELU ESTATE	Om6 Middle Omi West	20					20	43,200.00			
1023	CHALLENGE	Om6 Middle Omi West	20					20	43,200.00			
1009	Odo Ona Elewe	Om6 Middle Omi West	20					20	52,800.00			
629	Ring Road	On10 Middle Ona North	20					20	52,800.00			
739	Anfani	On12 Middle Ona West	20					20	32,000.00			
1116	Anfani	On12 Middle Ona West	20					20	52,800.00			
740	Oluyole New express road	On14 Lower Ona North	20					20	33,600.00			
232	Odo Ona Elewe	On14 Lower Ona North	20					20	38,400.00			
753	New Garage	On14 Lower Ona North	20					20	43,200.00			
772	CHALLENGE/ LAGELU ESTATE	On14 Lower Ona North	20					20	43,200.00			
767	NIGER WEST OLD LAGOS ROAD	On17 Lower Ona East	20					20	43,200.00			
766	Odo Ona Elewe	On14 Lower Ona North	20					20	48,000.00			
769	OLUSANYA / RING ROAD	On14 Lower Ona North	20					20	48,000.00			
824	Orita Challenge	On15 Alaro	20					20	52,800.00			
832	Challenge ring road	On17 Lower Ona East	20					20	48,000.00			
1335	Tipper Garage-Odo Ona Elewe	On19 Lower Ona West		20				20	27,200.00			
1480	ODO-ONAELEWE / OJU-EKUN ROAD	On3 Odo Oba		20				20	48,000.00			
480	Orita Challenge	On6 Upper Ona West				10	10	20	57,600.00			
175	ASABARI BRIDGE, IDI ODO/CHALLENGE, OLU AYOLA STREET	On6 Upper Ona West				10	10	20	57,600.00			
541	OPERE PODO	On8 Upper Ona South		20				20	32,000.00			
690	ODO ONA KEKERE	On9 Orogun	20					20	38,400.00			
687	Podo /Idi Ayunre	On18 Lower Ona South	20					20	48,000.00			
1248	Toll Gate	Ob5 Lower Ogbere North	5				10	15	38,400.00			
1550	AYETORO VILLAGE	Og2 Middle Ogunpa	15					15	43,200.00			
1235	OPERE PODO	Og4 Lower Ogunpa	5				10	15	27,200.00			
1228	ARAPAJA/OD ONA KEKERE	Og4 Lower Ogunpa	5				10	15	27,200.00			
1225	ABA IBEJI	Og4 Lower Ogunpa	5				10	15	33,600.00			
1382	ARAPAJA SIMISOLA	Om4 Upper Omi East	5				10	15	27,200.00			
1405	FOWOWE	Om4 Upper Omi East	5		10			15	32,000.00			
1407	ONO ONA KEKERE	Om5 Middle Omi East	5				10	15	22,400.00			
1411	ABA IBEJI	Om5 Middle Omi East	5				10	15	32,000.00			

Structure No.	Location	Subbasin	Population Weight 20	Previous Flooding 20	Transport Weight 30	Stream Degree 30	Condition 10	Overall Priority 100	Cost of Culvert/Bridges (USD)	Total Cost of Structures / Year (USD/YEAR)	Year	Phase
466	ONIPON COMMUNITY PODO	On10 Middle Ona North	5				10	15	32,000.00			
467	ABA IBEJI	On10 Middle Ona North	5				10	15	38,400.00			
464	OPERE PODO	On10 Middle Ona North	5				10	15	43,200.00			
465	ORIIRE COMMUNITY	On10 Middle Ona North	5				10	15	48,000.00			
462	ONIPON/ABA IBEJI	On19 Lower Ona West	5				10	15	48,000.00			
582	ONIPEPEYE	On12 Middle Ona West	5				10	15	27,200.00			
588	ODO ONA KEKERE	On12 Middle Ona West	5				10	15	33,600.00			
589	ALAWOYIN	On12 Middle Ona West	5				10	15	38,400.00			
587	ASUNLE AREA/ OJU EKUN ROAD	On12 Middle Ona West	5				10	15	38,400.00			
586	AYEGUN OLEYO, ODO ONA	On12 Middle Ona West	5				10	15	43,200.00			
597	UNITY ESTATE	On13 Middle Ona South	15					15	38,400.00			
596	ARIGBOJA	On13 Middle Ona South	15					15	48,000.00			
197	BOLUWADURO ESTATE	On6 Upper Ona West	5				10	15	17,600.00			
194	BOLUWADURO ESTATE	On6 Upper Ona West	5				10	15	35,200.00			
198	ARIGBOJA	On6 Upper Ona West	5				10	15	35,200.00			
174	UNITY ESTATE	On19 Lower Ona West	5				10	15	35,200.00			
199	OJU EKUN AREA	On6 Upper Ona West	5				10	15	35,200.00			
196	IRE AKARI/ BOLUWADURO	On6 Upper Ona West	5				10	15	38,400.00			
170	ABADA	On6 Upper Ona West	5				10	15	43,200.00			
193	AJAKANGA/ABA IFE	On6 Upper Ona West	5				10	15	43,200.00			
163	ASAKA 2/ OJU EKUN	On6 Upper Ona West	5				10	15	43,200.00			
169	AYEGUN	On6 Upper Ona West	5				10	15	43,200.00			
225	RATCON QUARRY	On7 Upper Ona East	5				10	15	27,200.00			
226	SOKURO/APADABA	On7 Upper Ona East	5				10	15	27,200.00			
224	FAWE COMMUNITY	On7 Upper Ona East	5				10	15	32,000.00			
227	LAGOS/IBADAN EXPRESS WAY	On7 Upper Ona East	5				10	15	43,200.00			
213	LAGOS/IBADAN EXPRESS WAY	On20 Lowest Ona	5				10	15	48,000.00			
208	ALOMAJA ROAD	On8 Upper Ona South	5				10	15	48,000.00			
452	Amusan	Om1 Omi Headwaters North			10			10	27,200.00	1,664,000.00	2038	Phase 4
1355	Moniya	Om3 Upper Omi West					10	10	35,200.00			
554	Otun Agba Akin	Om3 Upper Omi West					10	10	48,000.00			
1436	Otun Agbakin	Om7 Middle Omi South					10	10	27,200.00			
524	Moniya	On10 Middle Ona North					10	10	22,400.00			
501	Akinyele	On10 Middle Ona North					10	10	32,000.00			
523	Akinyele	On10 Middle Ona North					10	10	35,200.00			
496	Akinyele	On10 Middle Ona North					10	10	35,200.00			
522	Kara	On10 Middle Ona North					10	10	33,600.00			
521	Jeje	On3 Odo Oba					10	10	35,200.00			
520	Oniyere	On10 Middle Ona North					10	10	38,400.00			
525	Lapite	On10 Middle Ona North					10	10	38,400.00			
493	Akinyele	On10 Middle Ona North					10	10	43,200.00			
531	Akinyele	On6 Upper Ona West					10	10	17,600.00			
532	Akinyele	On6 Upper Ona West					10	10	27,200.00			
514	Akinyele	On8 Upper Ona South					10	10	22,400.00			
539	Moniya	On8 Upper Ona South					10	10	27,200.00			
562	Akinyele	On8 Upper Ona South					10	10	27,200.00			
503	Akinyele	On8 Upper Ona South					10	10	27,200.00			
558	Otun Agbakin	On8 Upper Ona South					10	10	33,600.00			
557	Oloje	On8 Upper Ona South					10	10	38,400.00			
505	Oniyere	On8 Upper Ona South					10	10	38,400.00			
506	Dominican Centre	On8 Upper Ona South					10	10	43,200.00			
513	Odo Oba	On3 Odo Oba					10	10	43,200.00			
512	Oke Oba	On8 Upper Ona South					10	10	43,200.00			

Structure No.	Location	Subbasin	Population Weight 20	Previous Flooding 20	Transport Weight 30	Stream Degree 30	Condition 10	Overall Priority 100	Cost of Culvert/Bridges (USD)	Total Cost of Structures / Year (USD/YEAR)	Year	Phase
515	Alabata	On9 Orogun					10	10	17,600.00			
516	Molarere	On9 Orogun					10	10	22,400.00			
517	Agbedo	On9 Orogun					10	10	22,400.00			
518	Olorisa Oko	On9 Orogun					10	10	27,200.00			
518 Prime	Alaagba	On9 Orogun					10	10	27,200.00			
568	Olorisa Oko	On9 Orogun					10	10	27,200.00			
519 Prime	Idi Oke	On9 Orogun					10	10	27,200.00			
519	Seriki	On9 Orogun					10	10	32,000.00			
1500	Idi Oroko	On9 Orogun					10	10	32,000.00			
566	Idiroko	On4 Upper Ona North					10	10	35,200.00			
571	Ajibade	On9 Orogun					10	10	33,600.00			
572	Araromi	On9 Orogun					10	10	52,800.00			
1244	Araromi	Og4 Lower Ogunpa	5					5	35,200.00			
1238	Araromi	Og4 Lower Ogunpa	5					5	43,200.00			
1243	Oja Agbe	Og4 Lower Ogunpa	5					5	43,200.00			
1245	IITA	Og4 Lower Ogunpa	5					5	43,200.00			
1418	AYETORO LANDLORDS ASSOCIATION	Om7 Middle Omi South	5					5	48,000.00			
162	IITA	On6 Upper Ona West	5					5	43,200.00			
168	IITA Dam Road	On6 Upper Ona West	5					5	48,000.00			
207	Elebu	On7 Upper Ona East	5					5	43,200.00			
526	IITA	On6 Upper Ona West							27,200.00			
497	Oluana Village	On10 Middle Ona North							38,400.00			
1323	Abanise	On19 Lower Ona West							27,200.00			
528	Oluana	On6 Upper Ona West							27,200.00			
529	Lagbe	On6 Upper Ona West							32,000.00			
533	Odo Igbo	On6 Upper Ona West							38,400.00			
534	IITA	On6 Upper Ona West							38,400.00			
531 Prime	IITA	On6 Upper Ona West							38,400.00			
530 Prime	Odo Igbo	On6 Upper Ona West							38,400.00			
535	IITA	On6 Upper Ona West							43,200.00			
532 Prime	IITA	On6 Upper Ona West							43,200.00			
450	IITA Dam Road	On6 Upper Ona West							38,400.00			
564	Moniya	On8 Upper Ona South							32,000.00			
563	Asanjanna	On8 Upper Ona South							35,200.00			
510	IITA	On8 Upper Ona South							48,000.00			
508	Isaleawero Okeodo	On8 Upper Ona South							48,000.00			
509	Akingbile	On8 Upper Ona South							48,000.00			
569	IITA Dam Road	On9 Orogun							27,200.00			
711	Oyerinde-Olukotun	Ob1 Ogbere Headwaters										
717	Asanjanna	Ob1 Ogbere Headwaters										
712	Isaleawero Okeodo	Ob1 Ogbere Headwaters										
314	Dagbolu	Ob2 Upper Ogbere										
804	Baale Agbe	Ob2 Upper Ogbere										
702	IITA	Ob2 Upper Ogbere										
422	Idi Ose	Ob2 Upper Ogbere										
306	Oluana	On6 Upper Ona West										
316	Akinbile Oluana	Ob2 Upper Ogbere										
791	IITA	Ob2 Upper Ogbere										
792	IITA	Ob2 Upper Ogbere										
301	Agbede	Ob2 Upper Ogbere										
423	Otiko	Ob2 Upper Ogbere										
798	Eyinolu	Ob2 Upper Ogbere										

Structure No.	Location	Subbasin	Population Weight 20	Previous Flooding 20	Transport Weight 30	Stream Degree 30	Condition 10	Overall Priority 100	Cost of Culvert/Bridges (USD)	Total Cost of Structures / Year (USD/YEAR)	Year	Phase
905	Alaja	Ob3 Middle Ogbere										
411	Arulogun	Ob3 Middle Ogbere										
430	Orieni	Ob3 Middle Ogbere										
906	Agbede	Ob3 Middle Ogbere										
1123	Balogun	On7 Upper Ona East										
346	Seriki	Ob4 Foworogbun										
399	Eyinolu	Ob4 Foworogbun										
332	Oloyin-Onilu	Ob4 Foworogbun										
903	Dabiri	Ob4 Foworogbun										
340	Yanjuade Aroro	Ob4 Foworogbun										
337	IITA	Ob4 Foworogbun										
446	Shasha	Ob4 Foworogbun										
1264	Arulogun	Ob5 Lower Ogbere North										
699	Mercy Estate	Og1 Upper Ogunpa										
790	Shasha	Og1 Upper Ogunpa										
696	Gospel Time Estate	On8 Upper Ona South										
731	Barack	Og1 Upper Ogunpa								6,138,400.00	2039	
697	sagbe	Og1 Upper Ogunpa										
637	Abutu	Og1 Upper Ogunpa							57,600.00			
782	Ojoo	Og2 Middle Ogunpa										
256	Sagbe	Og2 Middle Ogunpa										
251	Goodness Estate Ojoo	Og2 Middle Ogunpa										
293	Gospel Time Estate	Og2 Middle Ogunpa										
252	White House area	Og2 Middle Ogunpa										
784	sagbe	Og2 Middle Ogunpa										
298	Shasha	Og2 Middle Ogunpa										
247	Abatakan	On8 Upper Ona South										
352	Sagbe	Og3 Kudeti										
387	Sagbe	Og3 Kudeti										
299	Arulogun	Og3 Kudeti										
264	IITA	Og3 Kudeti										
372	Abutu	Og3 Kudeti										
420	Abutu	Og3 Kudeti										
285	UCH Quarters	Og3 Kudeti										
1563	IITA	Og3 Kudeti										
362	IITA	Og3 Kudeti										
261		Og3 Kudeti										
322	Supper	Og3 Kudeti										
377		Og4 Lower Ogunpa										
887	Ojoo	Og4 Lower Ogunpa										
877	Ojoo	On9 Orogun										
878	Barack	Og4 Lower Ogunpa										
893	Barack	Og4 Lower Ogunpa										
373	Ojokondo	Og4 Lower Ogunpa										
896	Orogun-Ojo	Og4 Lower Ogunpa										

Structure No.	Location	Subbasin	Population Weight 20	Previous Flooding 20	Transport Weight 30	Stream Degree 30	Condition 10	Overall Priority 100	Cost of Culvert/Bridges (USD)	Total Cost of Structures / Year (USD/YEAR)	Year	Phase
894	Ojoo	Og4 Lower Ogunpa										
897	Ojoo	Og4 Lower Ogunpa										
378	30/30 Sawmill	Og4 Lower Ogunpa										
898	Ojoo	Og4 Lower Ogunpa										
1508	Orogun-Ojo	Og4 Lower Ogunpa										
959	Aduloju	Om3 Upper Omi West										
951	Barack	On9 Orogun							57,600.00			
1056	Barack	Om7 Middle Omi South										
14P	Ojokondo	Om7 Middle Omi South							64,000.00			
1147	Bodija	Om8 Lower Omi										
625B	Barack	On10 Middle Ona North										
483	Agbegba	On10 Middle Ona North										
527	Agbegba	On10 Middle Ona North										
495	Kajola	On10 Middle Ona North										
494	Agbowo	On10 Middle Ona North										
661	Aduloju	On10 Middle Ona North										
499	University of Ibadan	On10 Middle Ona North										
492	30/30 Bodija	On9 Orogun										
469	Agbowo	On10 Middle Ona North										
500	Orogun/adediran junction	On10 Middle Ona North										
630	Ajao off Ojo road	On10 Middle Ona North										
655	Jakan Ajao	On10 Middle Ona North										
815 Prime	Jakan Ajao	On14 Lower Ona North										
763	Jakan Ajao	On14 Lower Ona North										
1501	Jakan Ajao	On14 Lower Ona North										
762	Jakan	On14 Lower Ona North										
253	Irepodun Ojo road	On14 Lower Ona North										
764	Ajibode	On14 Lower Ona North										
1284	Barack	On9 Orogun										
821	Orisunbare	On15 Alaro										
1569	Apata Area	On15 Alaro										
1282	Orisunbare	On15 Alaro										
1502	Orisunbare	On17 Lower Ona East										
868	Akintola Adelumo Village	On17 Lower Ona East										
876	Ire akari Estate	On17 Lower Ona East										
874	Ire akari Estate	On17 Lower Ona East										
871	Amugbekun	On17 Lower Ona East										
831	Apata Area	On17 Lower Ona East										
875	Olude	On17 Lower Ona East										
841	Ibode Igbo	On17 Lower Ona East										
869	BETHEL ESTATE LANDLORD AND LANDLADIES ASSOCIATION ABEOKUTA EXPRESSWAY BODE IGBO, APATA, IBADAN OYO STATE	On17 Lower Ona East										
180	Panada	On3 Odo Oba										
477	Ibode Igbo	Iddo Basin							2,250,000.00			
478	BETHEL ESTATE LANDLORD AND LANDLADIES ASSOCIATION ABEOKUTA EXPRESSWAY BODE IGBO, APATA, IBADAN OYO STATE	On6 Upper Ona West							2,250,000.00			
673	Ibadan Abeokuta Express	On9 Orogun										
570	OKE-ADO IGISOGBA/ANISERE/ARETU/ALARABA COMMUNITY,OMI ADIO	On9 Orogun										
665	AGUSI FATUMO	On9 Orogun								2,125,000.00	2040	
669	ARIJE	On9 Orogun										
491	ARIJE	On9 Orogun										
65D	ARIJE/ERUNMU	Iddo Basin							2,125,000.00			

Annex

17

Model Calibration and Analysis

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1 Introduction

To assess the flood extents of Ona River for a 100-year return period, it necessary to calibrate the flow through the River. Collected data from the 2011 flood event is used for calibration. In addition, two models are prepared; a hydrological and a hydraulic model, these models are updated according to the recent procured data, the LiDAR and new imagery. Two flood events are studied and analyzed, the 2011 historical flood event and the 100 years flood event.

2 Model Calibration

The Consultant followed the same hydrological and hydraulic design criteria previously presented in the Flood Hazard Assessment Report "***N17036-0100D-RPT-ENV-06-Rpt-Rev0***" in the preparation of both models, the hydrological and the hydraulic model.

Both models were calibrated taking into consideration the following parameters:

1- Precipitation values and water marks of the 2011 flood event; the Consultant calibrated two locations, one in Eleyele Waterworks and the other in Zartech Factory.
2- The Curve Number (CN) values of Ona sub-basins; these values were prepared based on the existing landuse (from the City Master Plan) and the new procured imagery. The evaluated values for CN were for the moderate soil moister content (CNII). For design purposes and due to the real condition, CN values have been modified to represent the wet condition of the soil.
3- The section parameters of the hydrological model such as the section shape, dimensions, side slopes of the rivers and tributaries, these parameters are prepared based on the new procured LiDAR.
4- The roughness values of Ona sub-basins and Ona reaches, these values are calibrated to produce a water depth that matches the wrack marks recorded in Eleyele waterworks and Zartech Factory.

These parameters were adjusted to produce a realistic head over the Eleyele spillway during the 2011 flood event. Moreover, both models (Hydrological and Hydraulic) were calibrated such that they produce the same output flow.

2.1 Design Criteria

The details of adopted parameters are shown below:

- The CN_{II} values for Upper Ona vary from 70 to 85 with an average value of 73
- A new CN_{III} values (for wet conditions) have been estimated based on the below equation;

$$CN\ (III) = \frac{23 \times CN(II)}{10 + 0.13 \times CN(II)}$$

the equation extracted from "Chow, V. T., Maidment, D. R., & Mays, L. W. (1988). Applied hydrology, 572 pp. McGraw-Hill, New York".

The storm profile used is as follows:

- SCS-Type II for a 100-years storm event
- A frequency storm for the 2011 storm event using the available information collected for this event as follows:
  - The total period of the storm is 6 hours (not 24 like the SCS-Type II)
  - The peak period of the storm is 70minutes where it was recorded that 140.63mm fell in this period.
  - The profile shape of this storm is adjusted to be similar to the SCS-Type II.

For the simulation of the 2011 flood event, the parameters of Eleyele spillway are assumed as follows:

- Spillway Length = 106m
- Spillway Crest Elevation = 200m (based on WGS1984 coordinate system)
- Spillway Discharge Coefficient = 2.2

Since the Eleyele reservoir continues spilling during the rainy season (from April to November), the Consultant assumed that attenuation in the reservoir occurs only in the volume above the spillway crest level until the peak head is achieved, this head is limited by the parapet height over the spillway crest level (2.5m).

It is worth to note that the rehabilitation of Eleyele dam considers the drawdown of the reservoir level by 2.3m using the bottom outlet or scour tunnel (to be rehabilitated). The Consultant did not consider the drawdown of the reservoir level in the hydrological model, yet it is considered as a second line of defense.

Collected data shows that the surface area of the lake is around 1.6km^2. However, based on the LiDAR DTM, the reservoir has a surface area of 1.4 km^2 at the spillway crest level.

The reservoir has an unknown storage capacity where no capacity curve exists. In addition, no bathymetric data was collected for the reservoir. In this respect, the consultant used the procured LiDAR and prepared a capacity curve for the volume above the spillway crest level. This curve is used in the hydrological model to simulate the attenuation in Eleyele reservoir, refer to Figure 1.

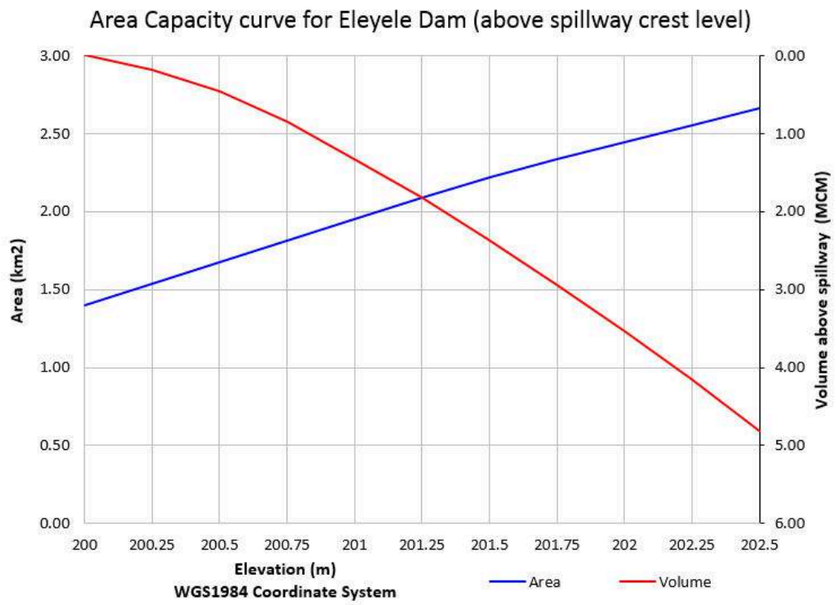

Figure 1: Area Capacity Curve for Eleyele Dam

The following sections elaborates the details of Hydrological and hydraulic modeling:

2.2 Hydrological Modelling

The Consultant developed a hydrological model using the HEC-HMS software to simulate the flow in Ona Basin, refer to Figure 3. The following parameters were used in calibrating the flow of the 2011 flood event:

- The manning roughness values of the main stream (n = 0.08), while for tributaries (n = 0.20)
- An Areal Reduction Factor (ARF) has been applied for reaches downstream Eleyele Dam based on customized equation. Developing an ARF equation for Ibdan has been shown in**" N17036-0100D-RPT-ENV-26-Rev0"** and the ARF for any catchment area in Ibadan could be calculated usin the following equation;

$$ARF = 1 - 0.1424 \log(A + 1)$$

Where

- *ARF* is the Area Reduction Factor
- *A* is the surface area of the catchment in km^2

For example, the ARF for Ona watershed at Eleyele Dam (A =319 km^2) is 0.63

To present the model results, several locations where the flow hydrograph is developed are defined. This was done for comparison purposes. The storm selected for the model calibration was the 2011 storm event. Figure 2 shows the selected hydrograph points along Ona River. These points are as follows:

1. A point at the upstream of Eleyele spillway (US Eleyele)
2. A point downstream of Eleyele spillway (DS Eleyele)
3. A point within the Industrial Area at Zartech Factory (816)
4. A point at the upstream of the confluence with Ogunpa (151B)

In addition, Table 1 presents the peak flow at the specified locations above. Moreover, Figure 4 shows the hydrographs at these points.

Table 1: Peak flow at the specified locations for the 2011 Flood Event

Location	2011 Flood Event Peak Flow (m^3/s)
Upstream Eleyele Dam	620
Downstream Eleyele Dam (Eleyele Water works)	572
Zartech Factory – Industrial Area (St. No. 816)	606
Upstream Confluence with Ogunpa (151B)	647

It is clear from Figure 4 hat different peak flow values in the flow according to the location of each hydrograph. The peak value of the flow reduces from the upstream of Eleyele from 620m3/s to 572m3/s upon attenuation within Eleyele reservoir. The reduced flow (572m3/s) overtops the spillway.

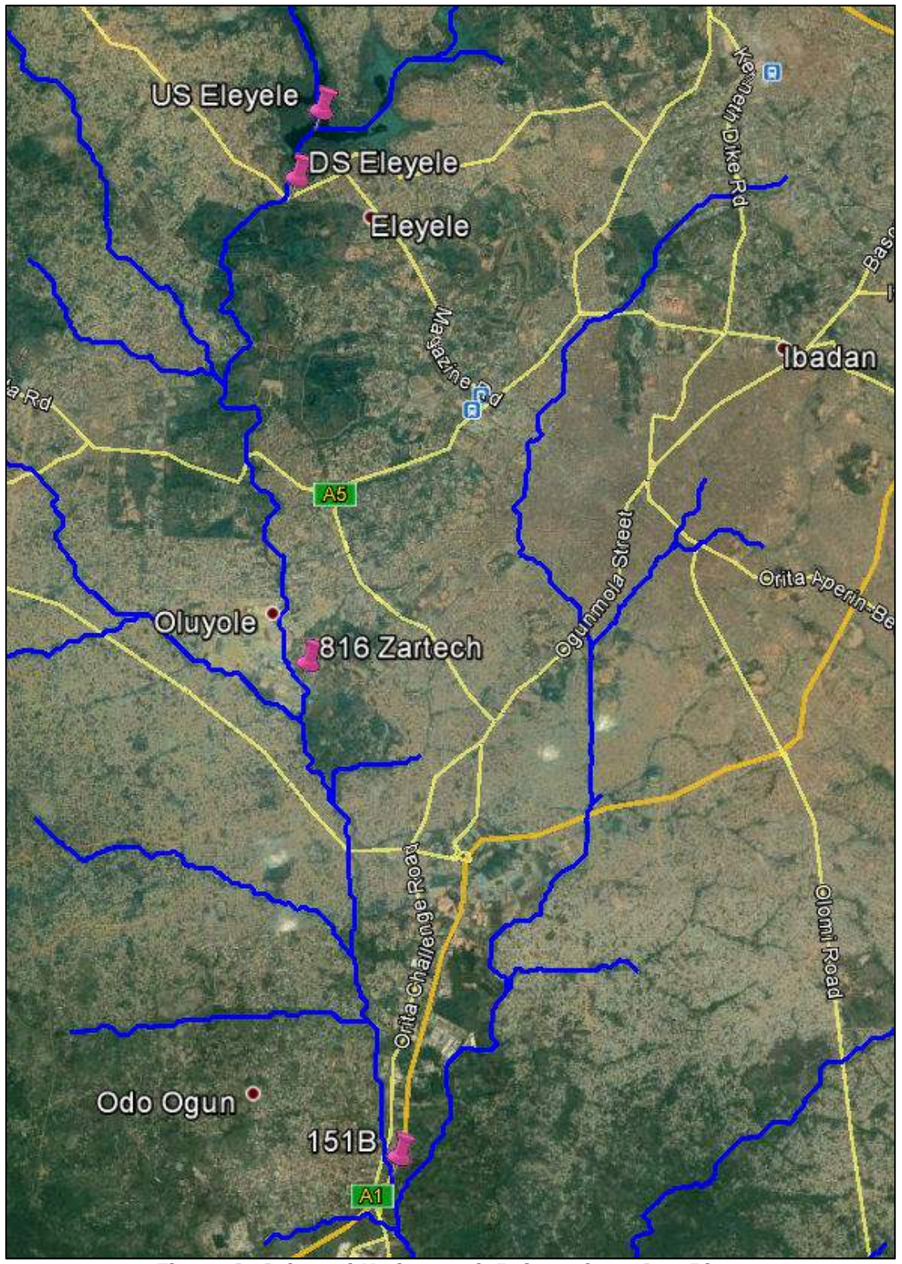

Figure 2: Selected Hydrograph Points along Ona River

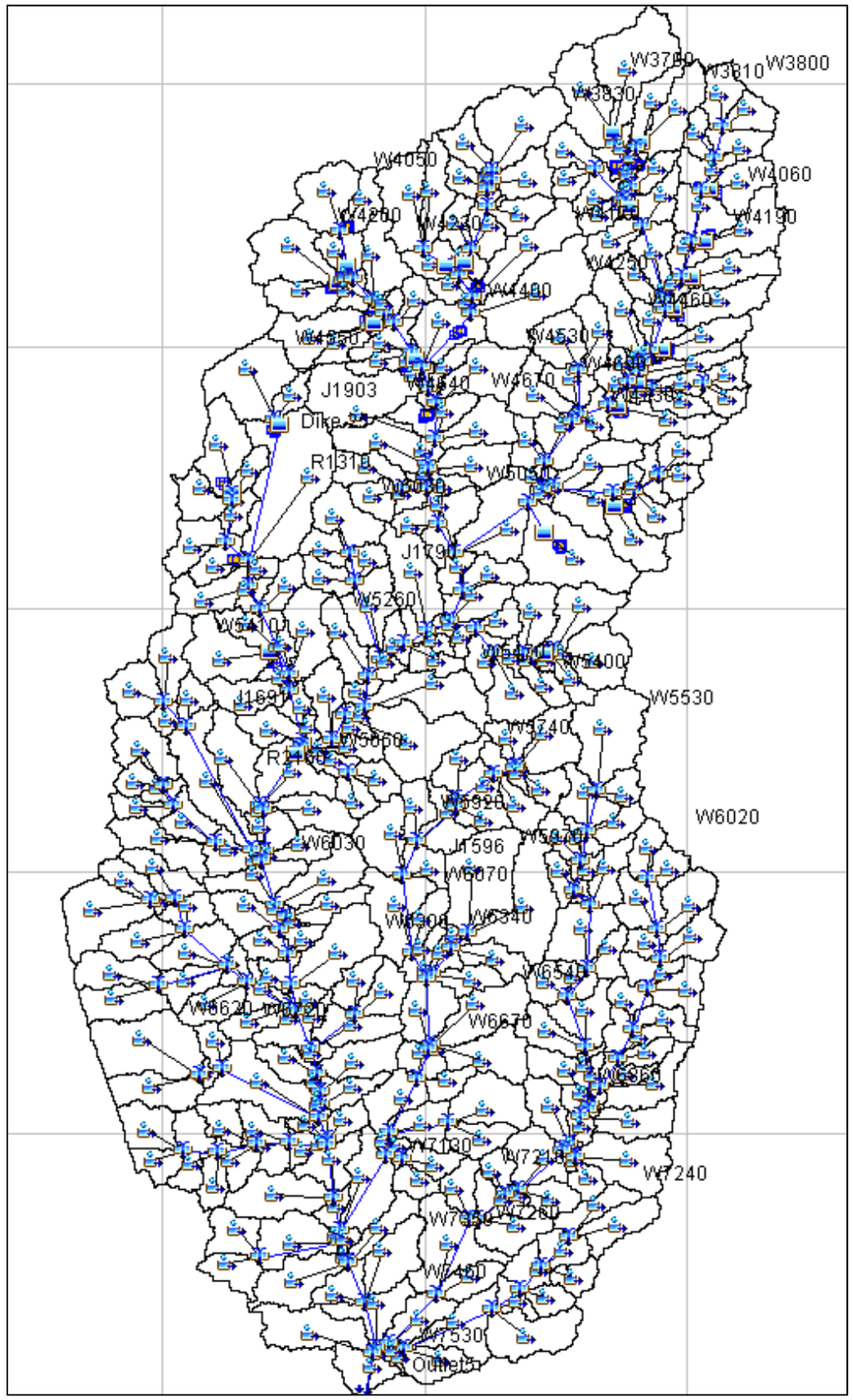

Figure 3: HEC-HMS Hydrological model for Ona River

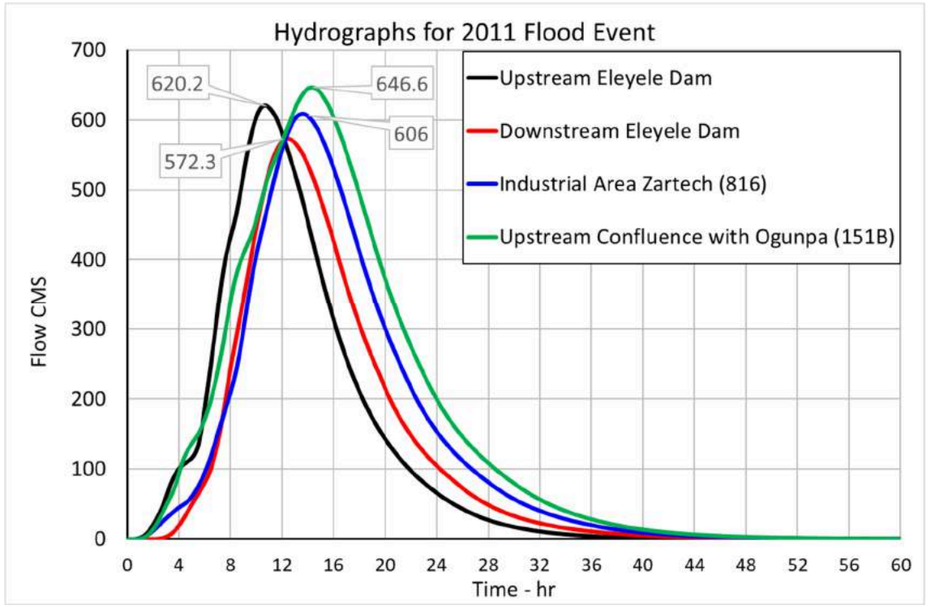

Figure 4: Hydrograph at specified points – 2011 Flood Event

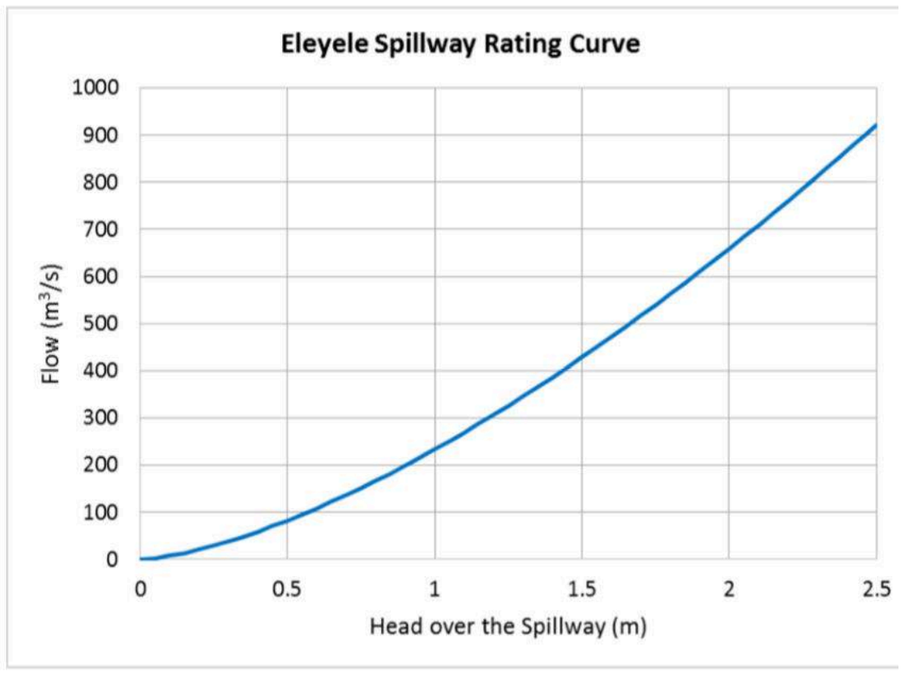

Figure 5: Existing Eleyele dam Spillway rating curve

Using the rating curve in Figure 5, this peak flow corresponds to a head over the spillway of 1.8m, this value is in the range of 1.5m to 2.5m above the spillway crest level. This value also means that around 30cm of the 1m parapet (existing over the dam) detained the reservoir level during the flood event of 2011 for a short period of time.

The hydrograph at Zartech factory (816) shows an increased flow of around 606m^3/s, while the hydrograph at (151B) shows a further increase in flow (647m^3/s) before Ogunpa joins Ona River at their confluence at the outer skirts of Ibadan.

2.3 Hydraulic Modelling

The Consultant developed a 2D Hydrodynamic model using the HEC-RAS software to simulate the flood extents in Ona Basin. To calibrate the flow of the 2011 flood event, Ona basin was divided into 3 roughness zones. Each roughness zone has a different Manning roughness coefficient (n) as follows:

- Catchment areas zone with no defined streams (n = 0.20)
- Flood plain Area zone (n = 0.10)
- Defined streams zone (n = 0.04)

The next section presents the corresponding results.

2.3.1 Results

This section shows the results of the 2D Hydrodynamic model for the 2011 historical flood event.

As previously mentioned, two locations were studied as follows:

- The first location is in Eleyele water works (Downstream Eleyele dam)
- The second location is in Zartech Factory (Industrial Area)

For both locations, the calculated flood depths from the model were compared with the measured wrack mark records collected for both locations.

Figure 6 shows a layout for the maximum flood extent and water depths in the downstream of Eleyele Dam during the 2011 Flood Event. The location of the pump house where the wrack mark is recorded is indicated in the figure. A cross-section X-X in Ona River passing through the pump house is presented in Figure 6. The extracted cross-section from the model (Figure 7) shows that that the maximum

flood depth attained at the pump house location is around 2.40m which is slightly above the wrack mark recorded in 2011 (2.20m).

Figure 8 shows a layout for the maximum flood extent and water depths in Zartech Factory during the 2011 Flood Event. The location of the building where the wrack mark is recorded is indicated in the figure. A cross-section Z-Z in Ona River passing through the Zartech building is presented in Figure 8. The extracted cross-section from the model (Figure 9) shows that that the maximum flood depth attained at the Zartech building location is around 2.60m which is slightly above the wrack mark recorded in 2011 (2.38m).

Eleyele Water Works

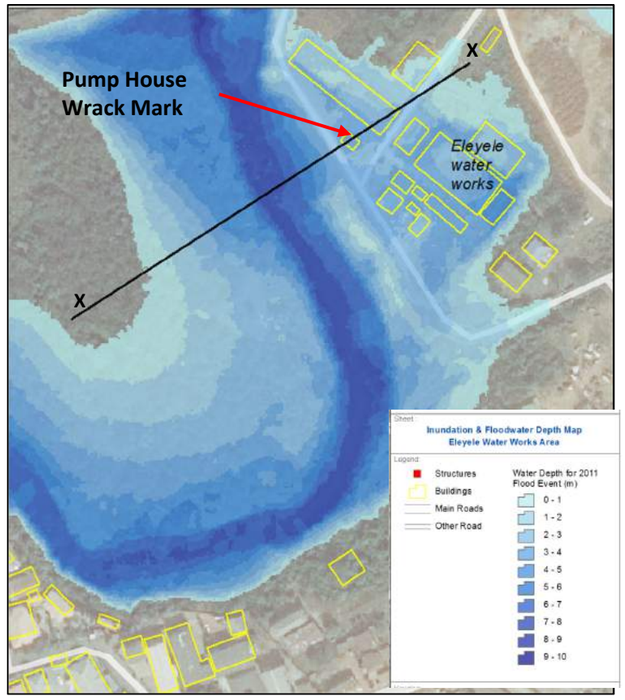

Figure 6: Flood Extent and Water Depths Layout Downstream Eleyele Waterworks 2011 Flood Event

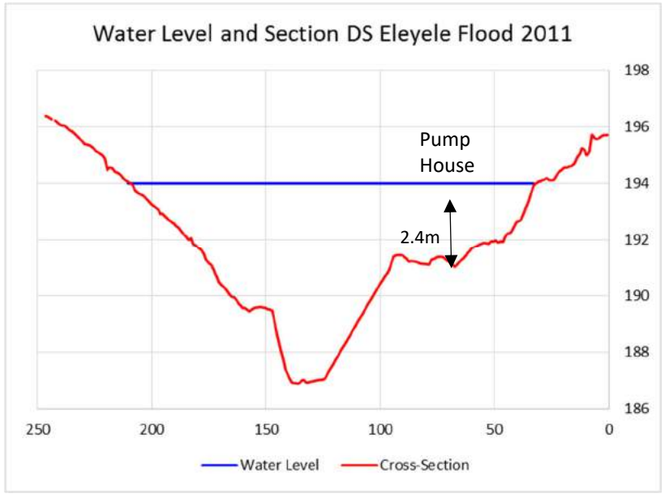

Figure 7: Ona River Cross-Section X-X and Water Depth in Eleyele Water Works – 2011 Flood Event

Zartech Factory – Industrial Area

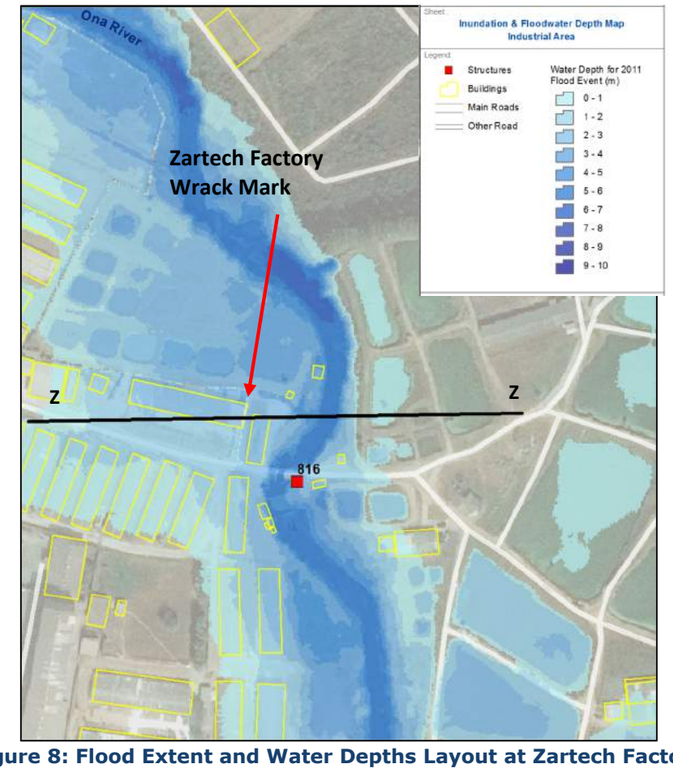

Figure 8: Flood Extent and Water Depths Layout at Zartech Factory

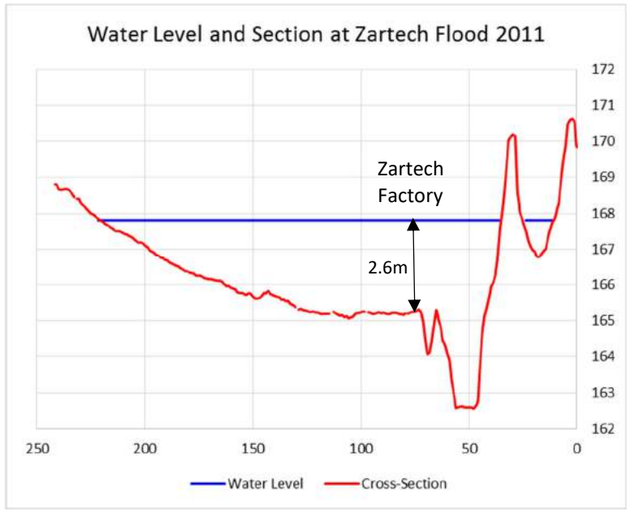

Figure 9: Ona River Cross-Section Z-Z and Water Depth in Zartech Factory Industrial Area– 2011 Flood Event

More illustrative figures for Ona River lower stretch starting from the downstream of Eleyele dam till the confluence of Ona River with Ogunpa is presented in Annex 4 for the 2011 Flood event

3 Model Analysis for a 100-year flood Event

An important step towards reduction of flood risk in Ona basin is to assess the areas exposed to flooding for a significant flood event as the 100-year event. Such areas exposed to flooding are urban ones that are concentrated in the lower reaches of Ona River. In addition, it necessary to study the capacity of the reaches that convey the flow outside Ibadan city with respect to this significant flood event.

In light of the above, the consultant used the calibrated models (hydrological and hydraulic) to estimate the peak flow and maximum flood extents corresponding to a 100-year flood event.

3.1 Hydrological Modelling

This section shows the results of the hydrological model for the 100-year event.

3.1.1 Results

For the same points indicated in Figure 2, Table 2 presents the peak flow at these locations. Moreover, Figure 10 shows their corresponding hydrographs.

Table 2: Peak flow at the specified locations for the 100-year Event

Location	100-Year Event Peak Flow (m^3/s)
Upstream Eleyele Dam	978
Downstream Eleyele Dam (Eleyele Water works)	911
Zartech Factory – Industrial Area (St. No. 816)	997
Upstream Confluence with Ogunpa (151B)	1094

It is clear from Figure 10 that the peak values of the 100-year exceed the values of the 2011 flood event. The peak values in the specified locations varies from $911m^3/s$ at the section downstream of Eleyele Dam to $1094m^3/s$ at the section upstream the confluence within Ogunpa.

The figure also shows the reduction of the flow upstream of Eleyele from $978m^3/s$ to $911m^3/s$. The reduced flow ($911m^3/s$) overtops the spillway.

Using the rating curve in Figure 11, this peak flow corresponds to a head over the spillway of 2.5m, this value exceeds the existing parapet level of the Dam. However, this value (2.5m) is accommodated within the rehabilitation works of Eleyele Dam. As previously mentioned in other reports, the dam is proposed to be heightened by 1.8m. In addition, a new parapet of 1m is proposed to be built over the dam.

The hydrograph at Zartech factory (816) shows a flow of around $997m^3/s$, while the hydrograph at (151B) shows a further increase in flow ($1094m^3/s$).

Moreover, Figure 12 shows the layout of Ona Middle Basin and the corresponding peak flow of the 100-year event in some specified locations.

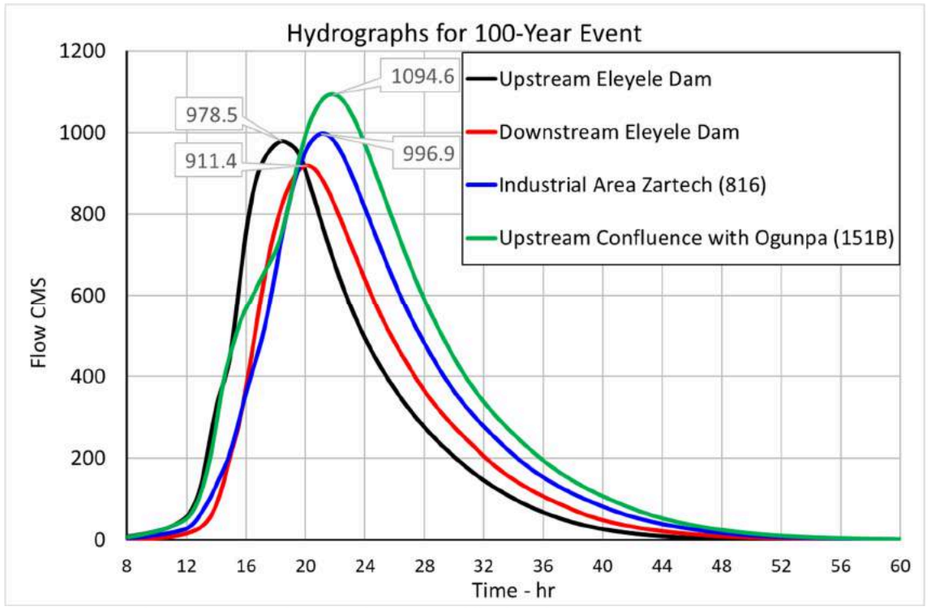

Figure 10: Hydrograph at specified points – 100 Year Event

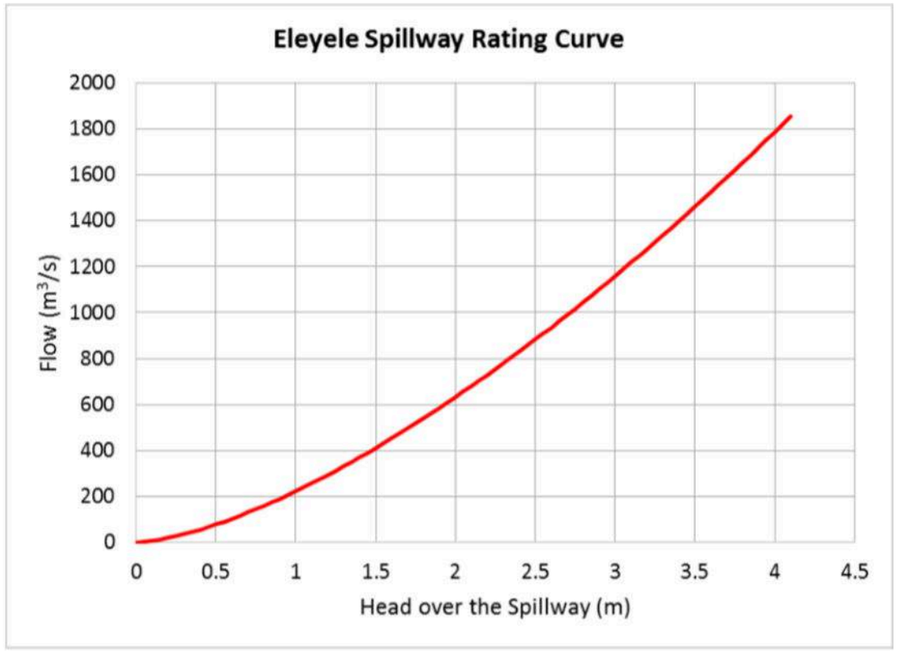

Figure 11: Rehabilitated Eleyele dam Spillway rating curve

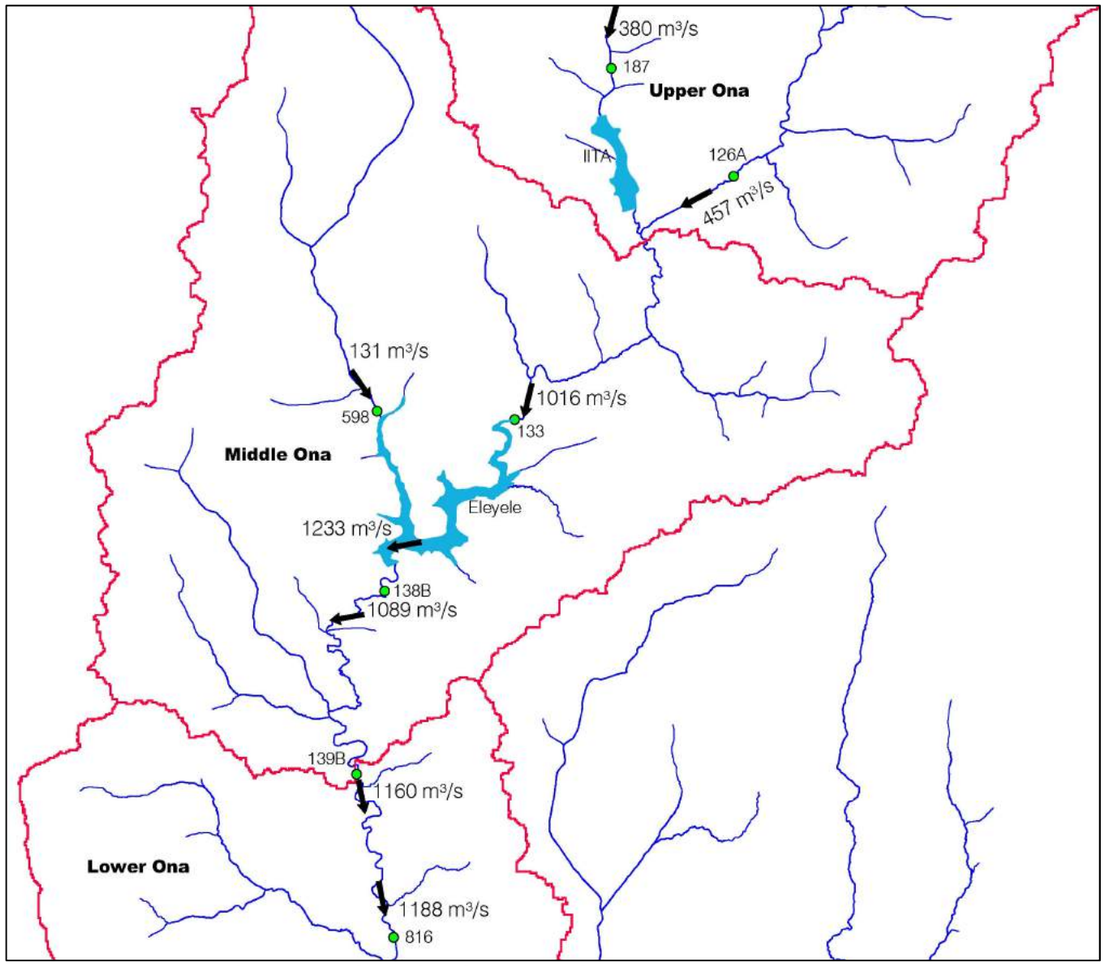

Figure 12: River Flow in Ona Basin – 100-year Storm Event

3.2 Hydraulic Modelling

This section shows the results of the 2D Hydrodynamic model for the 100-year event.

3.2.1 Results

Figure 13 shows a layout sample for the maximum flood extent and water depths in Zartech Factory during a 100-year event.

More illustrative figures for the 2011 event and 100 year storm event at Ona River lower stretch starting from the downstream of Eleyele dam till the confluence of

Ona River with Ogunpa is presented in annexes 4 and 5 of the N17036-0100D-RPT-ENV-15-Rev0 report, titled Ona Basin Flood Risk Reduction..

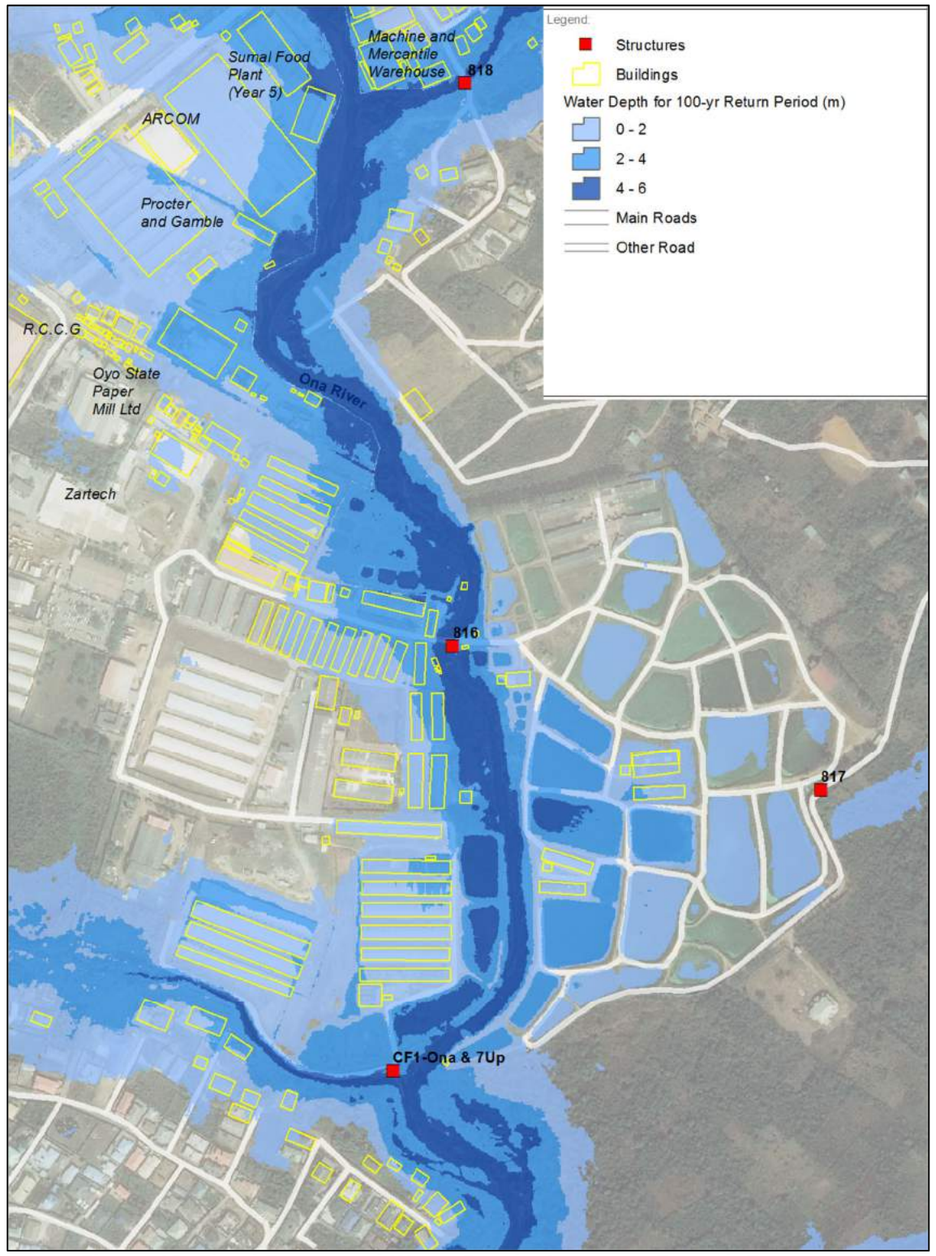

Figure 13: Flood Extent and Water Depths Layout at Zartech Factory 100 Year Event

Annex

18

Institutional Arrangements for Implementation of FRMDMP

Terminology

Terminology	Description
A&S	Administration and Supplies
BMC	Budget Monitoring Committee
BPPDC	Bureau of Physical Planning and Development Control
CBA	Community based Association
CBO	Community Based Organization
DEEB	Department of Environmental Engineering and Beautification
DES	Department of Environmental Services
DG	Director General
DH	Department of Highways
DLGI	Department of Local Government Inspectorate
DMCU	Drainage Maintenance and Coordination Unit
DWRM	Department of Water Resources Management
ExCo	Executive Committee
FMCC	Flood Management Coordinating Committee
FMENVT	Federal Ministry of Environment
Fed MoW	Federal Ministry of Works
FRMDMP	Flood Risk Management and Drainage Master Plan
FY	Financial Year
GIS	Geographic Information System
IDA	Ibadan Development Authority
IMP	Ibadan City Masterplan
IUFMP	Ibadan Urban Flood Risk Management Drainage Master Plan Project
LCDA	Local Council Development Areas
LGs	Local Governments
LGI	Local Government Inspectorate
MDAs	Ministries, Departments and Agencies
MP	Masterplan
NEMA	National Emergency Management Agency
NGOs	Non-Governmental Organizations
NIHSA	Nigerian Hydrological Services Agency
NIMET	Nigerian Meteorological Agency
MPCID	Master Plan Coordination and Implementation Department
O & M	Operation and Maintenance
OSEMA	Oyo State Emergency Management Agency
OSG	Office of Surveyor General
OSMANRRD	Oyo State Ministry of Agriculture, Natural Resources and Rural Development
OSMEWR	Oyo State Ministry of Environment and Water Resources
OSMFB	Oyo State Ministry of Finance and Budget
OSMLGCM	Oyo State Ministry of Local Government and Chieftaincy Matters
OSMLHS	Oyo State Ministry of Lands, Housing and Surveys
OSMWT	Oyo State Ministry of Works and Transportation
OSPWD	Oyo State Public Works Department
OSRUWSSA	Oyo State Rural Water Supply and Sanitation Agency
OSSWMA	Oyo State Solid Waste Management Agency
OSWC	Oyo State Water Corporation
OSADEP	Oyo State Agricultural Development Programme
PDCD	Physical Development Control Department
PIU	Project Implementation Unit
PM&E	Planning Monitoring and Evaluation
PMD	Project Monitoring Department within the Office of the Secretary to the Governor
PPP	Public-Private Partnership
PS	Permanent Secretary
PSC	Project Steering Committee
Q.C.	Quality Control
SMU	Specialist Monitoring and Coordination Unit
SWM	Solid Waste Management
TOR	Terms of Reference
URMCED	Urban Renewal Monitoring Compliance and Enforcement Department
WB	World Bank
WAE	West Africa ENRG
WCOS	Water Corporation of Oyo State

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C. Follow up list of questions from Dar 16

1. Background and Introduction

The development of a new FRMDMP requires providing institutional arrangements that is needed to define the way of managing the dynamic process whereby such a plan can be implemented. This section examines the current institutional context and proposes new institutional arrangements that seeks the most effective way of achieving a sustainable and cost-efficient way of managing the ongoing work and any future requirements.

Currently the tasks of planning, implementing and maintaining the drainage facilities lies with Project Implementation Unit (PIU), headed by a Project Coordinator and assisted by a Technical Assistance Team of consultants, under the Project Steering Committee headed by the Governor.

This is a temporary arrangement but the OSMEWR has identified the DEEB as the responsible agency to take over the role of the PIU. However, as has been pointed out, Flood Risk Management goes beyond the statutory responsibilities of the DEEB or the Ministry alone as it also involves the work of many other ministries, departments and agencies. It is also concerned with emergency management and preparation for emergencies to minimize their impacts and to aid recovery efforts, which is the responsibility of the Oyo State Emergency Management Agency (OSEMA) and Local Emergency Management authority (LEMA). Furthermore, the capacity of these agencies to fulfill their responsibilities or meet their targets depends on the budget assigned to them and hence the Budget Management Committee (BMC) under the Oyo State Ministry of Finance and Budget (OSMFB) will also play a vital role in the whole process.

A major concern, however, is the capacity of these agencies to fulfill their statutory responsibilities. This is because MDAs are very dependent on the government for recruiting and deploying staff including funding of their capital and operational expenditures. Thus, in addition to looking at the recruitment process, this report will also consider opportunities for improved revenue generation and how the use of such funds might be targeted more effectively.

The study will therefore commence with presenting the existing responsibilities and existing agencies capacities, then assesses the existing conditions considering the requirements of FRMDMP. Using the assessment and basic agencies information the study proposes the possible arrangements to improve the institutional arrangements. Finally, the study presents the actions for the long-term sustainable flood risk management capacity of the State put into a timeline.

2. Existing Responsible Agencies

In considering responsibility for the planning, design, construction and management of the FRMDMP, we need to be mindful of all existing agencies involved in the various parts and stages of development of the system[1]. The works that the existing agencies are following are:

- Works related to the Design, construction and maintenance of the drainage systems
- Works related to the regulations enforced by the land use planning and development control requirements
- Works related to the drainage system cleaning.

The agencies involved in these three categories and the responsibilities of these agencies are discussed in the following sub-sections. However, before describing them Table 2.1 outlines the agencies with the key responsibilities for each element/category.

Table 2.1: Existing Drainage System Responsible Agencies

Element	Planning & Design	Construction	Maintenance	Inspection	Cleaning
Federal Roads	Fed MOW	Fed MOW	Fed MoW or DEEB	DEEB & LG	DEEB
State Roads	OSMWT	OSMWT	OSPWD	DEEB & LG	DEEB
Rural/Local Roads	LGs/ OSMWT	LGs/ OSMW&T	LG / OSPWD / DEEB	LG/DLGI/ DEEB	DEEB/LGs
Canals	DEEB with DWRM OSMEWR	DEEB	DEEB	DEEB	DEEB
Culverts/ Bridges	OSMWT DEEB/LGs	OSMWT DEEB/LGs	DEEB/LGs	DEEB	DEEB
Embankment/ Levees	DEEB	DEEB	DEEB	DEEB	DEEB
Drainage Channels	DEEB with DWRM	DEEB	DEEB	DEEB	DEEB
River Bank Stabilization	DEEB with DWRM	DEEB	DEEB	LG	DEEB/LGs
Dredging	DWRM, MDA	DWRM/LGs	DWRM/LGs	DWRM MDA	DEEB/LGs
Dams	DWRM/OSADEP/WCOS	DWRM/ OSADEP	DWRM/ OSADEP	DWRM/ OSADEP	DEEB/ OSADEP
Emergency Activities	OSEMA				
Land Use Planning	BPPDC, MPCIU, URMCED, PDCD				

[1] Based on information gathered from replies in December 2018 to a questionnaire developed by the Consultant and from a follow-up meeting with the PS of the OSME&WR and Directors of the DEEB, Environmental Health Services and Administration on 18th January 2019.

2.1 Design, construction and management of flood management infrastructure

The design and construction of state roads, bridges and associated hydraulic structures is the responsibility of the OSMWT. However, in cases where hydraulic projects are undertaken by the OSMEWR, such as channelization, responsibility for the (re)construction of bridges and associated river bank protection lies with the OSMEWR. The design, construction and maintenance of local roads and their drainage systems are the responsibility of the Local Governments through the OSMWT. However, when funds are short, the roads are constructed by the OSMWT. The cleaning of the drains on local roads is the responsibility of the LGs[2]but likewise, it relies often on support from the DEEB. Local Governments have the power to require householders to clear the drains around their dwellings, but this is not always enforced.

The OSMEWR requires the Federal Ministry of Works and the OSMWT to undertake Environmental Impact Assessments for the roads they propose to construct. These assessments have to comply with the requirements of the OSMEWR as well as the FMENVT. Once built, they are responsible only for the repair and maintenance of the roadway while the maintenance, repairs and cleaning of the drains along both Federal and State Roads are the responsibilities of the DEEB[3].

Work on river systems, canals and channelization of rivers is undertaken by the DEEB in consultation with the Department of Water Resources Management (DWRM). In the design, advice on hydrological issues is provided by DWRM and information is supplied by institutes such as the National Institute for Meteorology (NIMET). Clearance of the same is the responsibility of the DEEB. If the work on the drainage channels includes the re-construction or relocation of bridges and associated work, responsibility for this lies with the OMEWR, whilst dredging of rivers and channels is the responsibility of the DEEB

The DEEB and also OSADEP are responsible for the cleaning of silt build up behind their respective dams, though the responsibility for monitoring of the dams is both WCOS and OSADEP. OSADEP and WCOS should also be responsible for uncontrolled water flow from the Dams and they should do this in close collaboration with OSEMA to limit the impact of this phenomenon.

The construction of new dams and the maintenance of existing dams usually involves the DWRM, WCOS and OSADEP. However, WCOS does not directly construct dams, they give them out as contracts to specialist contractors, to execute and they make use of either budgetary allocation from government or funds from international donor agencies, grants or credit facilities. Whereas OSADEP directly construct and maintain their dams as part of their statutory responsibility. Currently, it would appear that WCOS is not fulfilling its responsibilities as the 'owner' of the dams. This may largely be the result of lack of resources, but work has begun on the maintenance of the Eleyele dam using contractors CGC-CHNE Joint Venture and TRACTEBEL as consultants as part of the IUFMP, with the DWRM acting as the lead agency. TRACTEBEL has prepared a draft O&M Plan for Eleyele dam and needs to be implemented.

OSMEWR (primarily through the DEEB but also with the DWRM) is a key actor, not only in the design of the drainage system, but also in the operation and maintenance of much of that system; which usually involves routine inspection. Routine Maintenance is undertaken by technical staff of the DEEB, the Local Governments and the LGI. The procedure currently followed for routine maintenance of the drainage system is that individual citizens can report flooding problems, erosion or blockages in the system to the DEEB or the LG, the DEEB then inspects the site of the reported problem to prepare a and make recommendations for action(s) required. Given the limited resources available to the Department, the decision on which areas are to be given priority (and hence require the use of funds from the Ministry's budget) is made by the Honorable Commissioner. If additional funds are required, the decision has to be made by the Executive Council of the State Government. The effectiveness of the system depends largely on the availability of staff and the budget for operational costs. This is elaborated further in section 3.1 below.

2.2 Land use planning and development control[4]

Land use has a critical impact on flood risk and conversely, flooding has serious negative impact on users of the land affected. Planners need to take these into consideration, recognizing that extending urban development increases run off and hence pressure on the drainage systems, while development along rivers, streams or over natural drainage lines, can impair the effectiveness of the system. Land fill of low-lying lands and natural flood plains can result in flooding of previously flood free areas further downstream. Planners, therefore, need to work closely with those preparing the drainage master plan and any subsequent updating or extensions of that plan.

The foregoing was taken into consideration in the preparation of Ibadan Urban Master Plan and the importance of ensuring that the land uses comply. These are important considerations not only for the approval of new developments, but also the possible need to demolish buildings (predominantly illegal) on the flood plains and in river courses and streams or built over natural drainage lines. The Bureau of Physical Planning and Development Control (BPPDC) in the office of the Governor has, through the Master Plan Coordination and Implementation Unit (MPCIU), the primary responsibility for this. However, all four planning directorates of the BPPDC also have roles in the process.

First concern is to ensure that the planning standards and associated regulations are in place. This is the responsibility of the Strategic Physical Development Planning Unit (SPDPU); which includes determination of the standard setbacks required. These were recently upgraded[5]. The land use plan

[1] MLG estimates (response to Consultant's questionnaire January 2019) that about 40% of the task of inspecting the work and the state of the drainage system is covered
[3] Meeting of Consultant with PS of OMEWR 18 January 2019.

[4] Source: Responses to Follow Up Questions from the Consultant Jan. 2019 and meetings 18 & 23 Jan. 2019 and further questions replied to on 26 April 2019.
[5] The proposed standards proposed are:

Major River	60 to 100m	Major Branch	40m	Major Stream	20m

also takes the flood risk into consideration in terms of ensuring that suitable land uses are adopted for the affected area.

All developments must prepare a site analysis report[6] and those proposed within the IMP area are to be submitted to the Physical Development Control Unit (PDCU) who will pass it to the MPCIU for review. If the proposed use is in compliance with the planned land use and the layout complies with regulations, it is returned to the PCDU who reviews the structural integrity of the proposed structure and whether the building(s) or development comply with planning regulations. If satisfied, the PCDU can recommend approval, which is signed off by the Director General of the BPPDC. The responsibility for ensuring that the development is in compliance with the regulations is that of the Urban Renewal Monitoring Compliance and Enforcement Department (URMCED). This process applies only to State lands on which the user has a lease or Government Reserve Areas, whereas for freehold land, the approval is given by Planning Directors in the 68 Zonal Offices of Local Governments in the State. However, in cases where such land lies within the Urban Master Plan area, developments are still subject to review and approval by the MPCID. The exception for development on freehold land is for projects of significance (factory, housing or office complex etc.) which need to be referred to the Director General for approval.

Great weight is put on the Physical Development Control Department. They are responsible for receiving applications for development and approving them. In addition, in cases where the development is illegal, or not following the conditions of the permit, PDCD has power under the Oyo State Law, under the Ministry of Environment, Physical Planning and Urban Development (2015), Clauses 48, 49, 50 and 59, to issue the stop work or quit orders and ultimately demolition orders, with the approval of the DG. However, monitoring of the implementation of approved development plans lie with the URMCED, which also can use the same law and clauses to stop irregular development and require it, ultimately, to be demolished. In 2016, 1,813 units were identified as being in flood plains or along rivers, streams and canals and marked to demolition. It is claimed that none have been demolished to date, possibly due to the lack of political will[7].

The foregoing analysis suggests that there is lack of clarity over the functions and statutory responsibilities of the OSMEWR and the proposed statutory functions of the BPPDC[8].

2.3 Drainage system clearance

A major requirement for the proper functioning of any drainage system is that the drains remain clear of blockages and are maintained in good working order. This depends largely on the capacity of the DEEB, the OSMLGCM, DLGI and the Local Governments to fulfill their statutory responsibilities for monitoring the drainage system and for the responsible agencies to clear the drains. Furthermore, it depends largely on having in place an effective solid waste collection and disposal system. It is recognized that the powers for solid waste management under the Constitution reside with the Local Governments. However, under the Law Establishing the Oyo State Solid Waste Management Authority (No1. January 2008) these powers were (in clause 5) passed to the OSSWMA. Under this law, the OSSWMA had powers to appoint, register and control private refuse contractors in the State (Clause 6 – b). However, under the Ministry of Environment and Habitat Law of 2012, Environmental (Sanitation and Waste Control) Regulations No 2 of 2013, OSMEWR retains the responsibility for setting regulations covering waste separation, collection and disposal, including regulations concerning the cleaning of areas around properties and drains and through the Oyo State Environmental Protection Agency to take measures that will ensure compliance with the set standards (Clause 10 – 4). In May 2017, the powers of the Authority were transferred to solid waste management operators or agency, giving them overall responsibility for the collection and disposal of waste and the reform of the solid waste collection system in the State. OSMEWR however retains, through the OSSWMA, responsibility for policy. To date, it is reported that fee collection efficiency has risen from 2% to between 20% and 50%[9]. However anecdotal information and observation suggests that the collection system is far from being effective[10]. There appears to be a lack of functioning equipment and the Environmental (Sanitation and Waste Control) Regulations No 2 of 2013, which includes the requirement for separation at source, are not widely enforced. The main stress of the operator at this time appears to be in improving public awareness to the importance of good solid waste practices and the need for the user to pay[11].

The Regulations also propose the establishment of an Environmental Task Force to oversee enforcement of the law. With all the powers for collection transferred to the solid waste operator, there appears to be a vacuum in the oversight function of the enforcement of the regulations.

Minor River 50m Minor Branch 30m Minor Stream 10m

It should be noted that the OME&WR under the Ministry of Environment and Habitat Law of 2012 Environmental Regulation No. 2 of 2013 Schedule XX also provides alternative set back regulations.

[6] A detailed site analysis report is required, according to the 2015 law, when the development

- Is on residential land in excess of 0.5 acres or includes a building 3 or more floors:
- Factory
- Office or Commercial Building
- Place of worship
- Recreational area of more than 2,000 m^2.
- Petrol filling station
- Institutional building

Under the Bill prepared for a law establishing the Bureau of Physical Planning and Development Control, these powers are assumed by the BPPDC, including the requirement for an EIA (clause 14 of proposed BPPFC law. However, the OME&WR claim that responsibility for all Environmental Impact Assessments and Environmental Impact Analysis lies with them (meeting with PS of OME&WR, 18 Jan 2019) whereas the BPPDC queried their capacity to evaluate such reports (meeting with MPCID 18 January 2019).

[7] Meeting of Consultant with BPPDC 23/01/2019. The powers are defined in Clause 35 of the proposed law.

[8] It should be noted that according to the PS of the Ministry of Environment and Water Resources, at a meeting with the Consultant on the 18th January 2019, still believes that the physical planning function remains under the Ministry, for they argue under the law of 2015, all plans require Environmental Impact Assessments, which is their Ministry's responsibility as provided for in Clause 29 of the Environmental Regulations of 2013.

[9] PS of ME&WR quoted at meeting with Consultant 18 January 2019 and the Director of Environmental Services on 23 January 2019..

[10] WAEnrg refused to allow their staff to meet with the Consultant.

[11] 'Why we are partnering Oyo Govnt – WestAfricaENRG' Paul O'Callaghan; Web site of WestAfricaENRG, 2019.

Furthermore, the Department of Environmental Services has not been given the responsibility for overseeing the performance of the contract.

Given that changes and improvements in solid waste practices have yet to have a real impact coupled with increase in population, the task of keeping the drains and waterways clear depends heavily on the effectiveness of the Local Government and the DEEB. Inspection of state and federal road drains, as well as canals, streams and river systems is carried out by Technical Officers or reported by Local Governments to the OSMEWR. However as a result of the paucity of funds, clearance of roads drains, canals, streams and rivers systems are usually prioritized by the Hon. Commissioner. Coupled with this is the problem of lack of working equipment by DEEB, which forces the Ministry hire private contractors to clear the system[12].

With respect to clearance of drainage systems, there is the additional problem of what to do with the waste collected, which are usually removed and stacked on the side of the respective part of the drainage network. This should as a matter of fact be collected by the agency responsible for solid waste collection. However, this is not currently the case and the waste thus collected are accumulated along the sides of the drainage system and over time the waste return back into the drains. Even, where the wastes are collected, there are problems with the final disposal as the existing disposal or dump sites in the city are inadequate.. With the sub-contracting of solid waste collection and disposal, the contractor/solid waste operator need financial incentives to collect the waste taken from the drains.]

3. Capacity of Key Agencies

This sub-section covers the capacity of the key and related agencies, starting from the main agency, the DEEB, to the disaster management agency, OSEMA.

3.1 Department of Environmental Engineering and Beautification (DEEB)

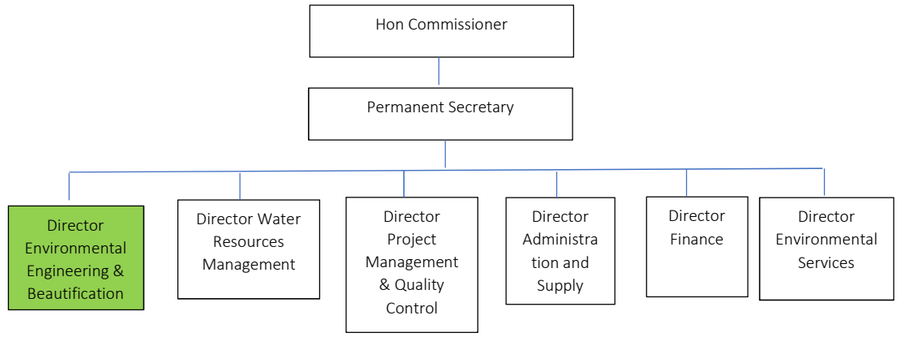

Figure 3.1: Organogram of Oyo State Ministry of Environment and Water Resources

The policy of the State Government is to have a slim government. Born of necessity with revenue insufficient to cover all costs, the Government has favored a natural reduction in staff, mainly through natural loss of retiring staff and by the increased use of short-term contracts that relieve the State of the need to pay staff health and pension benefits and minimize capital investment in equipment and subsequent operations and repair costs. The result is that many departments complain of being short of staff as identified in their staffing structures.

The staffing structure of the DEEB is given in Table 3.1 . The gross shortage is 186 positions from a total requirement of 262 identified by the department, which is based on the work program of the department. There is shortage of technical staff who are responsible for inspection of the drainage system. The equipment for cleaning the drainage system is currently not functioning and so much of the work is sub-contracted, which has led to a reduction in required staff. The PIU has taken over the detailed design of the drainage system for Ibadan, again reducing the total professional staff required. Given the current practice preferred by the Governor for sub-contracting of many of the tasks undertaken by the State, the staffing levels need to be revised to ensure that there are sufficient staff to take over the task of designing and preparing cost estimates for extensions and improvements to the system and for evaluating bids and supervising the work of the contractors from the PIU. It should be noted that the DEEB covers the whole of Oyo State and not just Ibadan.

12 Response to questionnaire prepared by Consultant, by OSME&WR, January 2019.d

Table 3.1: Staff positions DEEB. Source Department of Admin and Supplies, OSMEWR Jan 2019

Position	No. Required	No. Filled	Balance
Civil Engineers	12	4	(8)
Hydrologists	2	4	2
Technologists (Civil)	15	2	(13)
Surveyors	5	1	(4)
Geologists	5	1	(4)
Technicians	20	3	(17)
Craftsmen	30	1	(29)
Community Officers	20	2	(18)
Secretarial Assistants	10	2	(8)
Clerical Staff	8	2	(6)
Drivers	5	1	(4)
Forest/Agricultural Officers	12	1	(4)
Parks & Gardens Superintendents	15	1	(14)
Landscape Architects	3	1	(2)
Park Attendants	100	50	(50)
TOTAL	262	76	(186)

The task of regularly inspecting the system and number of technicians required for this task needs to be reviewed to ensure that inspections can be made in a regular and timely manner. Inspectors need transport, as do the professional staff involved in the design of the system and its improvement or upgrading.

Due to the shortage of staff, much of the work of clearing drains and culverts, or de-silting rivers and canals, is undertaken using sub-contractors. The result is that the response time between when a blockage is identified and clearance of the structure takes longer than when the DEEB had its own staff and equipment in sufficient number. However, it is probably more cost efficient as the department does not need to pay for staff at times when work cannot be done, nor does it have to pay for the purchase and maintenance of equipment, which might be used more efficiently by the private sector with a wider range of tasks for which the equipment and manpower can be used. The question however is whether the payment of a retainer to selected contractors will facilitate a speedy service delivery, considering the performance of the contractor.

3.2 Department of Highways, Ministry of Works and Transport

The Department of Highways (DH) has three sections, but the management 'pools' the staff so that when more staff are required for some aspects of the work of the Department, others are moved to different tasks. This also ensures that staff have a more holistic view of the tasks undertaken by the Department. The Director claimed that there was no staff shortage and it was able to undertake all its tasks, which include sub-contracting the construction and maintenance tasks. Figure 3.2 shows the current structure of the department.

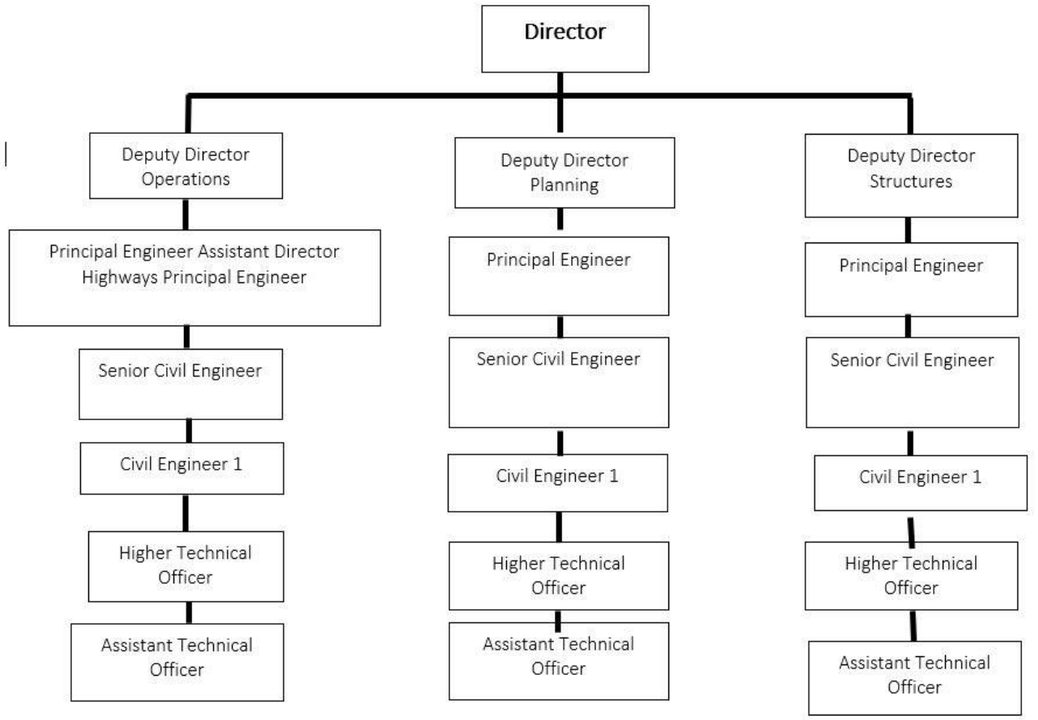

Figure 3.2: Organogram of Department of Highways, OSMW&T

The Planning, Design and Research Department is responsible for the design of roads, bridges, culverts and drainage systems associated with the roads built. Currently reported to have just three staff, the major part of the design work is done by consultants. The Structures Department is responsible for railways and roads as well as schools, government buildings and radio masts. The Operations Department is responsible for overseeing and managing the construction work for the roads and associated drainage systems.

In addition to these departments, the Geotechnical and Quality Control Laboratory serves all three departments and has a staff of about eight persons. Furthermore, there is the Oyo State Public Works Department (OSPWD), a semi-autonomous department, which is responsible for the repairs and

maintenance of the infrastructure built through the DH. OSPWD currently has three staff compared with a full complement of ten. Staff working in the Highways Department are expected to spend some time working in the Laboratory. The DH, therefore, follows the 'slim government' policy facilitated by a flexible use of the professional staff and does not believe there is a need for additional staff as staff move between the sub-directorates according to the work load and priorities[13]. As such, it is claimed to be a model department under the current policy of the Governor.

3.3 Bureau of Physical Planning and Development Control

The BPPDC has yet to be formally given legal powers. As mentioned earlier, this leads to overlapping of powers and responsibilities with other agencies of government. To forestall this and be, in compliance with the law, it is suggested that a Bill setting up BPPDC should designate the area included in the IMP as a 'Planning Area'. This will give legitimacy to the actions of the BPPDC. However, as the Bill is approved, and the area is declared a Planning Area, the three departments critical to the drainage master plan are the MPCID, the URMCED and the PDCD, all of which will have responsibility for ensuring that the land uses and planning standards (regulations) are followed and enforced.

The MPCID has four sections, each headed by a specialist, professional or expert with two support staff each. These will cover detailed plan preparation, mapping and cadastral survey, public-private partnership promotion and the GIS database management. To date the Unit has only four professional/expert staff without any assistants. It is therefore clear that the GIS and data base section at present does not have adequate staff and equipment. In addition, the office space provided does not have internet connection. Equipment is promised, the software is available, and training has been provided for six planners who it was hoped would train a further 60 people in the use of the software. However, this has not happened and in the meantime, of the six planners, only two of them are presently working in the Bureau[14]. It must be emphasized that having a good GIS and up to date data base, that is regularly updated, are essential if plans are to be implemented and enforced, especially where plans are legal documents requiring compliance. It is also important to point out that the geographic data base developed by the BPPDC is coordinated with the mapping and cadastral data base being developed by the Office of the Surveyor General and the land records of the Lands Department.

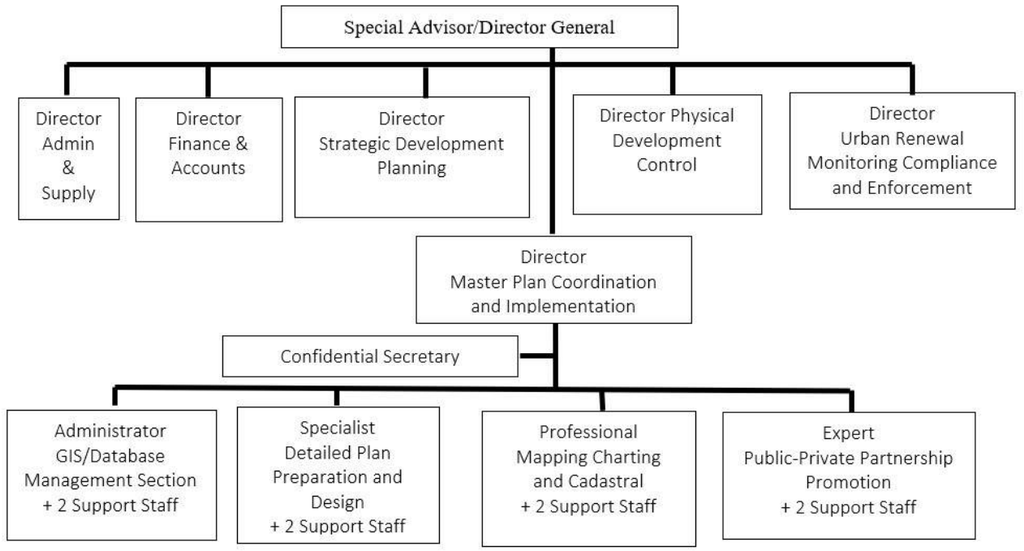

Figure 3.3: Organogram of Bureau of Physical planning and Development Control[15]

The work of the URMCED and the PDCD falls within the responsibility of the 68 Zonal Offices (33 local governments Councils and 35 LCDAs), of which 26 are within the IMP area. These offices assume the powers of these two key departments for development on freehold land. The BPPDC claim that each of these offices need at least three registered town planners who can assess the proposals and approve the plans, especially when one of the three is on leave. Furthermore, each office needs five technical officers that can make routine inspection of their area of responsibility to identify illegal construction before it is too far developed. This task is especially important on land identified as natural flood plains and for structures built along rivers, streams or over natural drainage lines. With two support staff, the total requirement would be 748 staff, while currently 156 staff are employed. However, this requirement needs to be reviewed to obtain a more realistic figure.

In so doing, a more realistic figure might be based on each office having at least two professional and three technical staff plus two support staff (driver and secretary) giving a total staffing requirement of 476, of which 182 are required for Ibadan alone. If fully staffed, the responsibility for approval and monitoring of development proposals would be decentralized, with the function of the central planning agency being primarily policy formulation, standard setting and monitoring, with the management of the data base. Direct involvement of the head office in planning would be in contracting the development of Master Plans and major forms of development as would be defined

[13] Meeting of Consultant with Director of Highways Department 21 Jan 2019

[14] Care needs to be taken in the selection of those to benefit from international and other training that they a committed to providing a minimum number of years' service.

[15] The structure of the Bureau was not finalized until, after the submission of the proposals for the coordination of the implementation of the Ibadan City Master Plan (IMP). The resulting structure came from the decision not to choose either option for the IMP but rather to 'strengthen' the Bureau with the creation of the Master Plan Coordination and Implementation Directorate, which would have responsibility for overseeing that all development within the IMP area is in conformity with the City Master Plan.

by law. Given this, the current levels of staff at the central office may be adequate if effectively deployed.

One observation is that the shortage of staff has less to do with a dearth of trained personnel, but more in the lack of positions budgeted for in the department. The Director General initiated a survey of staff in other unrelated departments and found many professional planners working in non-planning positions, even to the level of gatekeepers[16]. However, these people cannot be re-located because in their new positions their salaries would need to be increased and the positions they vacated would in many cases need to be filled.

3.4 The PIU

In order to overcome the problems of inter-Ministerial or MDA conflicts, the PIU was created in the office of the Governor. The purpose is to help the State develop capacity to manage the risk of flooding in a sustainable manner and for the detailed design and implementation of the IUFMP. The Steering Committee chaired by the Governor has the ultimate power and responsibility for the Project. Individual MDAs have contributed manpower to the PIU and are also members of the Independent Advisory Committee. The Project Manager reports to the Steering Committee. The Advisory Committee is a parallel organization with oversight responsibilities. The staff of the PIU are individual consultants hired on performance-based contracts and those drawn from the MDAs .

The PIU has eighteen (18) professional staff, six (6) of whom are hired as consultants. The others were chosen through competition of State employees and are seconded to the Unit. All selected staff were given an additional incentive performance-based stipend for the work done. It is expected that these employees will work harder and longer hours to meet the targets of the work program. The PIU has also been provided with a separate office, having a far better working environment than available to most State employees.

The PIU is responsible for a number of components that contribute to the development of suitable, sustainable flood management, but currently is not planned to have any long-term responsibility for the operation and maintenance of the system. This lies with the statutory agencies; DEEB, the DWR&M, Department of Public Works, the LGI and both the Local Governments and the LCDAs. The IUFMP has, furthermore, through the PIU, provided help to the BPPDC in training in digital mapping; to the WCOS with respect to assistance in the rehabilitation of Eleyele Dam; OSMW&T in the development of roads and bridges to improve access of communities; provided funding for the City Master Plan and a Solid Waste Master Plan development; assisted in the development of the Flood Forecast and Early Warning System for OSEMA. These are some of the areas included under the comprehensive flood management project.

The PIU, however, is seen as a temporary institution. The question is what will replace the PIU after the World Bank Loan has been expended? It must be emphasized that any institutional arrangement that replaces the PIU must be able to complete the development of the drainage systems and ensure that all works initiated by the project remain operational. Where necessary, it will have to facilitate further expansion of the system to meet the needs of the growing city, especially the flood protection infrastructure.

3.5 Other Agencies with an impact on Realization of FRMDMP

3.5.1 The Office of the Surveyor General

For land management to be effective and by implication, the sustainability of the system depends very largely on good and accurate records of land parcels and ownership. It is also important to improve the revenue of the State Government as land taxes and charges are an important source of revenue for the State and it is important in the enforcement of plans and by implication protection of areas affected by flooding. There are two agencies responsible, the Department of Lands and the Office of the Surveyor General.

The Surveyor General's Office is concerned with State Land and has recently focused on GIS referenced cadastral survey of all land holdings within Ibadan. However, these are currently stored in analogue form, as opposed to digital. Less than 1% is in digitized form17. Meanwhile a private company, GIS/Transport Ltd18 has been contracted to undertake the mapping of the urban and peri-urban areas of six cities including 1600km2 of Ibadan. The urban areas have been flown and the peripheral areas covered by satellite imagery. Maps have been produced with 10 cm resolution. These have been ortho-rectified and ground truthing completed. The next stage of the exercise is to record the analogue captured data and transfer this to digital format. This will identify all land parcels, structural footprints, heights and usage for the purpose of providing an improved base for the property tax. This has recently been regularized such that the level of tax due is based on the location, the size of the land and property and its current use. This would provide very useful information on the current land use, which should help the BPPDC in its planning and monitoring functions. It would form the basis of a digital geographic based information system for land, which the BPPDC proposes they should develop as part of the MPCID. A TOR for this part of the work has been prepared and is awaiting approval of the State Government.

One problem with the transfer of data from one form (analogue to digital and from ground surveys to georeferenced) or from one geo-referencing system such as Nigerian Transverse Mercator system to WGS-84 is that the two must be reconciled, and often this process shows marked discrepancies between the records. Further, there is the problem of the cost of the license for the software. While there are many freeware packages available, the software needs to be designed to provide all the

[16] Source: Director of MPCID 18 Jan 2019
[17] Source: Consultant meeting with Surveyor General and staff, Ibadan 22 January 2019
[18] Source: Written response to Consultant's questions, of Office of Surveyor General, received 26 April 2019

information in the way and form required by the users. However, commercial licenses restrict the number of users and need regular updating. This depends on a budget being allocated when required. Given the State's limited finances, this may be something that receives a low priority. Finally, the system requires skilled highly trained operators. This itself is a major task and is included in the proposed contract for the Oyo GIS.

For the system to be operationalized, an architecture for the system has to be fully developed and approved. This will include the protocol for the use of the system and the right to enter additional data or change the data. It will also need to decide who should have access to the data and whether there should be any fee required.

It is also unclear whether the equipment required, especially the back-up equipment should the system crash or be hacked, has been taken into account and supplied. It is clear that the training of the staff of one of the key partner agencies, BPPDC has stalled for the reasons given above.

While it is clear that such a digital data base will greatly facilitate the work of a number of agencies and help in the task of controlling inappropriate development, it is likely that the system, without considerably more financial and political support, will take years, even decades, to be up and running.

3.5.2 The Lands Department[19]

The Department of Land is responsible for land transfers of private land, land valuations, property tax assessment etc. In Oyo State, land is registered in the Deeds Register. Under the Federal 1978 Lands Act, all land belongs to the Nation and all urban land is vested in the State Government, while land in rural districts is vested in the Local Government. Individuals and organizations can receive leasehold on State land. Those that hold freehold (from before 1978) are meant to surrender the land to the Government and exchange the ownership for what is normally a 99-year lease. Under the 1978 law, land can be taken back by the State at any time when it is deemed for 'public purpose'. However, the definition of 'public purpose' is very broad and covers everything from situations where the value of the land has increased from some public investment on adjoining land, to when it is required for mining projects or access to mining sites or if required for extension or improvement of the drainage system. In reality, this law is not often enforced as it raises too much hostility. The law allows the Government to offer alternative land to the person or organization that has had their lease rescinded. But the personal nature of the land, being family land in many cases, where ancestors have lived, died and possibly been buried, makes such a swap unacceptable. Furthermore, while the State can take back land at no cost, except the replacement cost of the development on the land, which includes structures (but which also takes into account deterioration or age of the property), economic trees and crops (also based on historic prices), the compensation is way below the opportunity cost and even the investment cost, where the current owner has had to purchase the right off a previous lease holder. This formula is very unpopular and receives little political support.

In urban areas where the current owner has possibly paid the 'market price' for the remaining part of the lease, this effectively can result in huge losses, as the law, as it stands, does not compute the value of the remaining part of the lease. So, while the law provides the power to the State to force through the type of development it wants, if necessary by rescinding the leases, in reality this is not a useable law except in the most critical situations. In general, the State prefers to try and persuade the affected land-owners by explaining the need for the land and how it may benefit them when the proposed development on the re-acquired land takes place.

A major problem with coordinating land and planning is the 'primitive' method of recording existing land claims. This has for a long time been done by keeping the record of the survey, done using traditional ground surveys, on 'intelligence' sheets, paper maps, which do not use established systems of geo-referencing. The maps are subject to both distortion and deterioration. Land use maps and land titles are not digitized. To help the planners identify the potential owners affected by the plan, the survey and the plan should both be available in digital form and use a common geo-referencing system. This situation should change with the use of geo-referenced maps and digitization of land parcels under the Oyo GIS project mentioned in the previous section. However, as was stated there, the process of transferring the analogue and physical record into a digital one is very complex and time consuming and requires dispute mechanism to be in place to resolve disputes between different claimants.

The capacity of the two departments concerned with land suggest much investment is required to ensure this system can function effectively. The question of whether this might better be sub-contracted to the private sector is a sensitive one as the data recorded is confidential and very valuable, and so such a decision is not advised.

3.5.3 Oyo Water Corporation[20]

The capacity of the WCOS as the manager of two major dams in Ibadan urban planning area[21], is important to flood risk and has implications for the drainage system. The concerns are, first, the issue of monitoring water levels within the dams and being in a position to provide adequate warning of any overflow or risk of dams being breached, and second, the question of maintenance of the

[19] Based on work done for the preparation of the IMP Institutional Analysis

[20] Source: Interview by consultant of representative on the IUFMP Steering Committee from the OSWC, Ibadan, 22 January 2019.

[21] There are four major dams at Eleyele, Asejire, IITA and Ijaye/Alabata. In addition, there are around 7 small dams located on minor streams. These dams are Awba, Dandaru, Akufo, Pade, Sanusi, Eni-Oosa and Onidundu. (Source: Ibadan City Master Plan. Draft March 2017)

dams. Siltation is a major issue for dams as it reduces the capacity of the water body behind the dam. Responsibility for this lies with the Department of Environmental Engineering and Beautification. The WCOS does not have its own staff for maintenance of the dams. This need not be a problem if there were maintenance contracts with the private sector.

It is important, however, to monitor water levels within the dam. There is a need for water levels and precipitation levels and patterns to be monitored. Currently, these are not monitored by WCOS. Instruments used for measuring water and precipitation levels within and around the dams have long broken down and there appears to be no plans to replace them. The current practice for measuring levels is by mere observation. Coupled with this is the fact that there is no warning system is in place. The WCOS is not concerned with the overflow of water, but only with the draw-off and pipe network, including appurtenant structures that take water from the dam to the water treatment plants and subsequently to the consumers. This is undesirable for flood management. The responsibility for measuring water levels and flow from the water released should be part of the DWRM responsibility. The DWRM should have close contacts with the OSEMA to provide warnings for excessive flows that could cause flooding below the dam.

The WCOS is financially dependent on the State budget as its revenues are insufficient for it to be self-financing. WCOS serves approximately 30% of the population of the City.

3.5.4 Oyo State Solid Waste Management Agency (OSSWMA)

The OSSWMA was established by law in 2008, whereby all the powers and responsibilities for solid waste collection of the Local Government, were transferred to the it (clause 5). In 2017, all powers of the OSSWMA, with the exception of policy making were transferred to WAE. However, to date, the main focus of WAE appears to be in improving the rate of collection of fees. This has increased from about 2% to between 20 and 50 percent22. This was achieved through educating the public on the importance of good solid waste management and the need to pay for the services received.

The stated aim of OSSWMA is to minimize waste through the Reduce, Reuse and Recycle approach. They are developing the capacity to collect plastics, metals and paper for recycling and to use non-recyclable materials for power production. The strengthening of the collection system and educating the public in the importance of good waste disposal habits will help ensure the sustainability of the system and ultimately reduce the use of water ways for the disposal of garbage by the public. However, there is still a need for a supervisory body to monitor the implementation of the contract and to investigate complaints and to ensure that users are not over-charged, such that they resort to their old disposal habits.

[22] Unfortunately, no information was made available by WAE to the Consultants, when they visited them in January 2019, that would enable them to measure their progress in resolving the solid waste issues, except for a posting on a WAE web site.

3.5.5 The Department of Budget[23]

The current system of budget preparation is based on requests from the MDAs and the forecast revenues of the State. However, the system requires improvement. The current practice is for revenue generating MDAs to receive back 5% of their self-generated revenue, regardless of their annual budget allocation based on their proposed budgets, to be allocated for their respective MDA as the MDA determines. However, the idea of allowing some departments to ring fence a greater portion of their self-generated revenues to cover all their expenses is not being considered. It is recognized that from the internally generated revenues, the priority must be to pay the salaries of Government employees. Hence, one reason for the move towards sub-contracting many of the responsibilities of the State to the private sector. If the department can demonstrate how they could increase revenues for the state while becoming financially more self-reliant, the Ministry might be willing to support such a move.

It was thought that the maximum portion of the revenues generated by the BPPDC that could be ring-fenced under such a system of self-financing would be just 20%, though this would depend largely on the arguments and data provided by the BPPDC. The BPPDC claimed24 that the fees currently collected represented approximately 30% of the potential revenue, due to staff shortages, lack of transport etc. They argued that were they provided a greater share of these, they could meet their staffing needs and so increase the revenues available to the IRG. The OSMF&B questioned this claiming that the work of the Bureau was subsidized from the general budget.

A more detailed examination of the estimate of the BPPDC's revenue and their budget request, with the actual amounts received, suggest some very glaring disparities as shown in Table 3.2 below.

Table 3.2: Budget Projection and Request against Actual BPPDC[25]

Year	Revenue	Recurrent Expenditure	Capital Expenditure	Total
Approved Budget 2017 (Nara)	1,245,750,000.00	47,500,000.99	160,000,000.00	207,500,000.00
Actual Performance 2017 (Nara)	653,279,012.20	2,972,900.00	Nil	2,972,900.00
Percentage Actual of Approved 2017	52.44	6.26	0	1.43
Percentage of Revenue Collected to Actual Budget Allocation				**0.46**
Approved Budget 2018 (Nara)	1,360,288,734.04	64,170,000.00	135,000,000.00	199,170,000.00
Actual Performance 2018 (Nara)	668,917,544.25	7,235,000.00	915,750.00	8,150,750.00
Percentage Actual of Approved 2018	49.17	11.27	0.68	4.09

[23] Source: Meeting with the PS of the OSMF&B and response to follow up questions 29 April 2019.
[24] Meeting of Consultant with staff of BPPDC 18 January 2019.
[25] Source: Written response to additional questions provided by BPPDC 26 April 2019

Year	Revenue	Recurrent Expenditure	Capital Expenditure	Total
Percentage of Revenue Collected to Actual Budget Allocation				**1.22**

From this table, it can be seen that the budget disbursed represents a very small fraction of the budget approved/requested for both FY 2017 and FY 2018. But even more critical is that the revenue collected in both years was much closer to that predicted, at around 50 percent of the potential. When the actual expenditure is set against the revenues collected, the picture is even worse, with the average over the same two financial years being less than one percent. Total expenditure in FY 2018, on flood control, including infrastructure, repairs and improvements as well as counterpart funding amounted to N.1,185,000,000.0026, while expenditure on the BPPDC represents 0.069 percent of this. With good planning and development control being so important to the effectiveness of the flood management system, it would appear that some serious rethinking on budget allocation is required to improve the effectiveness and efficiency of the Bureau. Furthermore, there is also room for improvement in the revenue collection performance of the Bureau, which could be facilitated by increased investment in the Bureau.

3.5.6 The Project Monitoring Department of the Office of the Executive Secretary

The PMD in the Office of the Executive Secretary works closely with the Department of Budget of OSMF&B. The PMD is a member of the Budget Monitoring Committee. All projects funded through the State Government must be monitored by the PMO and the tasks are broken down into stages of work and specific activities and set against a time line. The Budget Monitoring Committee has powers to reduce or increase budget depending on funds available and the performance of the project.

The PMD, however, does not have the capacity to evaluate the causes for any delays in depth and are not in a position to advice on corrective action. One option that could be considered, is for the PMD to be greatly strengthened so as to monitor the implementation of the Drainage Master Plan and the IUFMP

3.5.7 Oyo State Emergency Management Agency

OSEMA is the agency within the Office of the Governor, responsible for fulfilling the State's response to a natural or man-made disaster and is not an agency concerned with planning or developing infrastructure to prevent the disaster. Established by law in 2008 (assent given January 2009), its main functions spelled out in law are: preparedness, mitigation, response and recovery cycles. OSEMA claim that Section 8 clearly states that it is responsible for planning against the occurrence of floods and other natural disasters, which would mean it should be involved in the planning of the flood preventive measures. However, this would tend to conflict with the role of other MDAs with the same responsibilities, such as DEEB or at present the PIU. Given the capacity of the OSEMA, it is probably more than enough for it to plan for the eventuality of a natural disaster and for it to be fully involved in an oversight role on the plans and proposals to prevent flooding.

Given that, its main responsibilities include policy and coordination functions, monitoring of preparedness, emergency response to a disaster, organizing emergency relief, coordinating the use of funds and donations received from the international community to cover the cost of the help provided. It does, also, have responsibility for data collection, measurements of water levels and flows, which could be used by those planning drainage schemes or preventive land uses. However, to date the department responsible for this, Research and Forecasting, has limited achievements because like most of the Agency, it lacks equipment and funding to undertake the work. It works closely with NIMET and NIHSA in the preparation of forecasts and has proven to be quite accurate in this task.

The Agency while not consulted directly on development applications, it does routinely report to the BPPDC and the OSME&WR on inappropriate developments along waterways, or the indiscriminate dumping of waste. It is, also, currently a member of the Advisory Committee for the IUFMP. Further it works with NEMA in developing a better understanding of the task of disaster preparedness. It works with NGOs involved in providing assistance in situations where natural disasters strike. Through them and the local governments, it can help educate vulnerable communities on what protective measures they can take and how they can change those practices that increase the risk of disasters, such as deforestation, building on or near to drainage systems or dumping of waste.

The Agency is planning, once resources become available, to undertake a Vulnerability Capacity Assessment which would identify those areas vulnerable to flooding and other hazards. While the Agency does not have the expertise to undertake this work, it proposes to hire consultants to prepare it. However, as at the moment, funds have not yet been made available. This goes beyond the flood risk management project's assessment of flood risk as it looks at the preparedness of the State and its MDAs as well as the Federal Agencies in the State and other institutions such as the military and police to respond to a natural or man-made disaster in the State. This would include the capacity of local institutions to provide emergency shelter and access to clean water, basic food supplies and medical care, to name some of the most important. It will also need to evaluate the availability of equipment to aid in the rescue and recovery of people affected. It should therefore be seen as an integral part of a flood management master plan.

[26] Source: Written response to additional questions provided by the Director of Budget 29 April 2019. This figure is for the 2019 FY and includes N500,000,000 to cover the PIU's operational costs. The funding for the projects is part of the World Bank Loan.

Recent initiatives provided under the IUFMP, include the establishment of the Ibadan Flood Emergency Response Team, with equipment funded through the WB project. The IFERT is based on volunteers trained through the project. OSEMA has responsibility for coordinating other Agencies to establish ERTs and the IFERT is a tremendous move forward in realizing this. Further, OYEMA has established the Flood Forecast and Early Warning System with NIMET.

4. Flood risk Management and Drainage Master Plan Requirements.

Flood risk management aims at preventing losses and damages to the physical environment (building, infrastructure, natural resources, etc..) and to the people by managing the main sources of Risk:

1- Managing Flood Hazard

2- Managing Exposure

3- Managing Vulnerability

In this regard Section 8 of the FRMDMP report discusses the management requirements clearly. The important thing here is to note that managing flood risk will require the involvement of many agencies and contributors to manage and control flood risk.

4.1 Flood Risk Management Requirements

As can be seen from the Flood risk management framework and the measures required the institutional requirements are vast and should be covered through many agencies, authorities, departments and institutions. The measures required to be covered are:

- Protection measures which aims at controlling or reducing flood peak. The protection measures include:
  - water retention basins,
  - river training interventions and enhancement,
  - rehabilitation and restoration of the river corridor,
  - resizing of the undersized crossing structures and
  - applying sustainable protective measures
- Preventive measures which use knowledge, practice or regulations to reduce disaster risks and impacts. The preventive measures include:
  - producing flood risk maps,
  - preparing policies and laws,
  - raising public awareness and
  - activating monitoring and maintenance programs
- Post event measures which depends on:
  - Documenting the flooding and damages.
  - Remediation plan.
- Watershed Conservation measures which covers the catchment-wide interventions to decrease surface runoff and soil erosion aiming at reducing risk.

These measures and management requirements are far more than what the existing institutions cover and follow, span among many fields of work and activities, require holistic approach to follow, need a very close coordination between all the institutes and require one entity to follow up while coordinating with others.

4.2 Assessment of the Existing Arrangement

A major issue with the existing institutional arrangement is that we do not have an institute that look over reducing the flood risk. What we have is an ad-hoc system where different institutions are involved and most of them are following on one part of the problem and not looking at the full picture of the flood risk management problem.

This sub-section assesses the existing institutions with respect to accommodating the requirements of the FRMDMP. The assessment is performed though a simple gap analysis. Table 4.1 presents this simple gap analysis.

Table 4.1: Agencies Gap Analysis

Institution	Desired Future State	Current State	Identified Gap	Action Plan
OSMEWR	To be the main control agency managing flood risk management. Measured by: 80% in control of implementing the FRMDMP	Managing parts of the work and have no overall look at the FRMDMP Measured by: 20% in control	Gap 60%	- Establishment of FRMDMP technical steering committee.
DEEB	To be the main implementing Agency and the main maintenance agency Measured by: 80% in control of implementing drainage plan and maintaining the system	Managing parts of the work and have no overall look at the FRMDMP Measured by: 40% in control	Gap 40%	DEEB to ensure the responsibility of, review design and construction and follow-up on proper construction of drainage works. DEEB to continue maintaining the drainage system and ensuring proper maintenance activities. This may require special arrangements.
BPPDC	To control urban development and issue approvals and if development is not approved to remove or demolish. Measured by: 60% in control	Managing parts of the work and have no overall look at the urban development laws and enforcement of law Measured by: 10% in control	Gap 50%	- Implementing of the laws and enforcing it through active courts or some enforcing mechanism. - Activation of the role of PDCD and URMCD - Ensure the implementation of sustainable drainage systems within the new developments.
DH	Implementing the crossing structures to the appropriate sizes and based on specific design criteria and to follow the FRMDMP developed plan Measured by: At least 90% to follow the design criteria At least 80% to implement the FRMDMP requirements	Design and construction of all the highway crossings, implementing the available design criteria, no vision of a full FRMDMP Measured by: Only 60% to follow design criteria Only following 10% of drainage system	Gap 30% Gap 70%	OSPWD to continue its responsibility to design and construct the proper crossing structures following the vision of the FRMDMP

Institution	Desired Future State	Current State	Identified Gap	Action Plan
PIU	Complete the different in progress activities developed under the IFMPIU and transfer the knowledge and information to the other implementing agencies. Measured by: 80% transfer of knowledge 90% handing over of all the developed material under the project 100% completion of the construction works and development works under the project (complete all priority works, Eleyele dam construction, early warning system)	Partial completion of the construction works. Ongoing transfer of knowledge, however it is in limited way. Measured by: 30% transfer of knowledge 20% as PIU is handing the different stakeholders the material for review 15% very slow construction activities	60% 85%	Proper handing over of the works developed and prepared under the project to the implementing agencies. Successfully completing the works under development by the PIU Properly Transfer of knowledge and information gained during the PIU project period (capacity building, seconded staff to return to their original jobs to enrich the original agency with the knowledge gained.
OSEMA	Implement of the emergency plan Measured by: 90% improvement in applying the emergency plan	Ineffective operation Measured by: 20% implementation of NEMA framework	70%	Implementation of emergency Plan to be activated based on the early warning system
CBA/CBO	Take responsibility of improving: - Flood Risk public awareness - In understanding relation between solid and liquid waste and Flood Risk to control Solid and liquid waste dumping in rivers and natural streams. Measured by: 70% increase in people awareness of the Flood Risk 70% increase in solid and liquid waste control in natural streams	Very limited public awareness as people is building in the flood plains and encroaching on the rivers and natural streams and even at storage lake of Eleyele dam. Dumping solid and liquid wastes in the rivers and streams Measured by: 15% aware of the flood Risk 10% aware of solid and liquid waste impact on flood risk and water quality	55% 60%	Prepare a program to be implemented by the CBA and all other possible organizations such as churches/mosques schools, universities, communication agencies (television and radio)

Institution	Desired Future State	Current State	Identified Gap	Action Plan
OSSWMA	Development of solid waste management plan Implementation of the plan Measured by 100% development of a plan 70% implementation of the Plan	No proper solid waste management activities within the city Measured by: No proper plan is available 20% No proper implementation of the plan 20%	80% 50%	Implementation of an efficient solid waste collection system
Department of Budget	To raise the required fund for implementing the FRMDMP Measured by: 80% improvement in allocating funds to implement the FRMDMP	No adequate budget to run the system and to recruit staff Measured by: 10% allocating funds	70%	Help in raising the fund and securing the required money and funds to implement the required works under the FRMDMP

The gap analysis was used to define the alternative institutional arrangements.

The FRMDMP requires the cooperation and coordination of multiple MDAs. This is not made easier by the reluctance of some MDAs to share information and to accept the inputs with what is perceived as being competing Agencies. In some cases, the laws have not been adequately reconciled, so more than one agency may claim to have responsibility for specific activities, such as for the approval of EIAs. Some laws remain on the statute book but do not reflect the organizational reality of the current administration. Institutional changes take place before the legal support for them has been formulated or approved, such as was the case of the BPPC which had been in three different locations: Ministry of Environment, Ministry of Lands and as a stand-alone Bureau, over the past five years and so there are different laws affecting them, still on the statute book, especially the law of 2015.

5. Alternative Institutional Arrangements

The institutional arrangements should close the gaps identified while assessing the current institutional arrangements in regard to the implementation of the FRMDMP plan.

From the foregoing, in order to address this multiplicity of institutional arrangements, a number of options need to be considered and answers found to the following questions:

- Should the responsibility for the coordination of the FRMDMP be given to the OSMEWR, or
- should a new institution be established to coordinate the contribution of the different MDAs to the FRMDMP program; or
- should the PIU be institutionalized, or
- should the responsibilities and powers of existing MDAs be clarified and their capacity enhanced, so each contributes to the effective management of flood risk and their consequences. Coordination could then be handled by the ExCo with the assistance of the PMD of the Office of the Executive Secretary.

5.1 Strengthening the role of the OSMEWR

The OSMEWR has been the key institution in the development and implementation of the project but has, for the preparation and implementation of the project, had this responsibility largely delegated to the PIU. Given the diversity of the work required for a comprehensive flood management program, could it alone replace the PIU? It is difficult to see, without some overall direction from the Governor and the ExCo how the one Ministry could coordinate all the components and assume the powers to direct their individual programs. This can be covered by the establishment of a Flood management technical steering committee headed by the OSMEWR with DEEB providing the Secretariat. This is proposed as one of the alternatives in the next sub-section.

5.1.1 OSMEWR Tasks

The new arrangement can allow the OSMEWR to manage the FRMDMP implementation. This shall not be the only task to be handled by the OSMEWR other tasks should be handled by DEEB. The tasks to be considered are at the following:

- The design stages
- The construction stages
- The operations and monitoring stages, including clearance and repairs, the water levels, flows, flooding frequency and duration

- The post event measures which includes revisions and planning stage.

The first two stages are currently being undertaken by the PIU. Given that parts of the system are the responsibility of the DH of OSMWT, the Federal Roads Maintenance Agency and of local governments, there will need for a coordinated plan. The overall responsibility for the design of the system should lie with the OSMEWR through DEEB and DWRM, who would also be responsible for monitoring its realization. Does the Ministry have the capacity to undertake this work? It is proposed that the major part of this work should be done by external consultants. This would mean that the Ministry would have to have the ability to manage the work of the consultants, which includes preparation of the TOR, organizing the bids and making the assessments. The ministry should have the capability to take the designs and implement them through supervising the works of the Contractors and monitoring the contracts. This should be well within the capabilities of the Ministry. To facilitate this, it is also proposed that the two key departments (DEEB and DWRM) are made more flexible in sharing the engineering capabilities and responsibilities for design and site supervision.

The third element of the Ministry's responsibilities (operations and maintenance) requires good cooperation with various MDAs, as different parts of the system are the responsibility by law of different MDAs. The first part of the task is monitoring and reporting failures in the system, whether as a result of structural failures, blockages, under-design or planning issues (where inappropriate development is taking or has taken place, thereby impeding the drainage system or putting the users at the risk of flooding). Four groups or agencies may be involved in reporting the failures: citizens or residents in the area, local governments, the LGI, DEEB inspectors and officers from OSEMA. Primary action is required from four agencies: Local Governments, DEEB, DH and OSPWD. The actual clearance of the drainage system will depend on which parts of the system require cleaning or repair, including citizens, the local governments, the DH, the OSPWD and DEEB. Follow-up work may be required of the OSSWMA responsible to remove the materials cleared from the drains, rivers and canals and to take them to the final disposal sites or other arrangements for final disposal (waste separation, composting, bio-gas production or waste to energy plants). Minimizing dumping of waste in the drainage system will require adequate public enlightenment programs, especially for the citizens in Ibadan and other stakeholders such as industry and commerce, the formal and informal sectors.

Most drainage clearance and maintenance actions, not covered by the Local Governments or the OSMWT, must be prioritized by the PS of the OSMEWR and approved by the Hon Commissioner. As mentioned, lack of equipment and relevant staff means that most work of this nature is undertaken through contractors. However, hiring of contractors requires that regulations affecting sub-contracting be followed. As such, the work required cannot be undertaken rapidly on demand.

One way this might be overcome is for the Ministry to develop a framework contract, which is based on unit rates (covering type of work, quantities and expected time periods for that task to be complete) and to pay the winning contractor a retainer to be ready to undertake the work at short notice. When a problem is identified, the quantity of work will be agreed, and the unit rates applied. The terms of the framework contract guarantee that the work will start within a pre-determined time. Failure to start within that agreed time, or if completion is delayed for no justifiable reason, the contractor will forfeit the retainership payment. Where no equipment is required, the responsible agency can opt to hire directly day-laborers to do much of the work under the supervision of staff from the responsible institution. The use of contractors will limit the need of the DEEB to employ a large staff. A smaller staff of professionals will be responsible for identifying the work needed, preparing the contracts with the unit rates or bill of engineering measurement and evaluation, and supervising the contractors.

The fourth element follows the post event cases where it allows for the evaluation of the system and revisions to the system. These works are similar to the first two, but would be based on results of an evaluation of the effectiveness of the current system as a result of the conditions following an event (post event conditions). The responsibility in this case may have to be added to the Ministry, but being a task that is usually undertaken every few years after completion of the system, it should again be outsourced to proper institution, as example University or other relevant institution, which has the capacity to handle such responsibilities. This requires proper documentation and proper information on the functioning of the system. This will require equipment to measure water levels and flood flows. It will also require cooperation with OSEMA to measure the impact of any flooding event that takes place. This also will depend on implementation of proper rainfall and flood flow records within the system. This is under implementation under the Early warning project supervised by the PIU.

5.1.2 OSMEWR Capacity Improvement

Based on the required tasks to be handled by the OSMEWR and specifically DEEB, capacity improvements to DEEB is foreseen. As discussed, the DEEB shall not handle the performance of the tasks related to design, construction maintenance and post event activities by staff within the department, however these works shall be contracted to proper contractors to perform the. In this respect DEEB should have the staff capable of handling the preparation of the assignments and the management of all these tasks. This will result in limited capacity upgrade requirements which follow the vision of the Government to reduce the Government employees.

In this respect and based on Table 3.1 which lists the existing staff within the DEEB the below table 5.1 lists the additional staff required based on the arrangements that DEEB staff shall contract the works to contractors to perform the works.

Table 5.1: DEEB additional Staff requirements

Position	Existing No.	Proposed No.	Balance
Civil Engineers	4	10	(6)
Hydrologists	4	4	(0)
Technologists (Civil)	2	10	(8)
Surveyors	1	3	(2)
Geologists	1	2	(1)
Technicians	3	10	(7)
draftsmen	1	5	(4)
Community Officers	2	5	(3
Secretarial Assistants	2	5	(3)
Clerical Staff	2	5	(3)
Drivers	1	5	(4)
Forest/Agricultural Officers	1	6	(5)
Parks & Gardens Superintendents	1	5	(4)
Landscape Architects	1	2	(1)
Park Attendants	50	50	(0)
TOTAL	76	127	(51)

The funding requirements are discussed in section 6.7.

5.2 The development of new institutions to coordinate the flood management program.

The flood management program, as has been stated, involves a number of activities that fall outside the remit of the OSMEWR. These include land use and emergency response issues. Development control is the responsibility of BPPDC, as is the planning of additional solid waste sites, which is done after due consultation with OSMANRRD, the OSG and Lands Department of the OSMLHS, the, OSEMA, the local government and land holders.

With regards to illegal development, the primary task of the BPPDC through the PDCD or the Zonal offices is to issue stop orders and ultimately with the approval of the Director General of the Bureau, to require that any structure which have not been approved be removed or demolished. In the case of demolition, the main problem is the lack of willingness by politicians to support such action. It might be better if the BPPDC did not need to get political support for the decision which could rest with the DG alone. Objections to such actions could be made through the proposed Planning Tribunal on issues of the applicability of the plan and to the courts, on points of law, rather than on the opinion of a powerful political lobby. However, as prevention is better than cure, it is important that the capacity of the BPPDC be increased to ensure that all development, and especially those in areas sensitive to flooding or which might impede the flow of flood waters, be approved first then monitored and action taken quickly through the issuance of stop work orders.

Critical to the effectiveness of the drainage system is the understanding of the public to the different Flood Risks. The citizens and industries should understand that flood plains need to be protected and developers discouraged from filling swampy areas, reducing the natural flood plain and in effect probably moving the flood further downstream. Furthermore, the citizens and industries understand that rivers, streams, drainage canals, roadside drains and culverts are not blocked. This is not just a question of waste disposal, but also of construction and use. All these require education and public awareness campaigns for all groups and effective enforcement of the law. This in turn requires the full cooperation of all agencies, the local governments, the Chambers of Commerce Industries, and other stakeholders representing the persons or organizations likely to be affected. To achieve these goals, a budget needs to be set aside to publicize these requirements on Television or the newspapers or through leaflets and billboards. Regular surveys need to be carried out to assess how successful the various campaigns are in raising public awareness. OSEMA should monitor this and provide the results as input to the key agencies to further improve such campaigns.

The components identified for the implementation of a working flood risk management system include:

1- design and construction of protection measures

2- Implementing preventive measures including maintenance, development of flood risk maps to help warning the people, development of development regulations, early warning system, spreading awareness, good land use planning and control and proper monitoring of meteorological and hydrological records.

3- Implementing of post event measures to improve the system and development a more sustainable and reliable Flood risk management system.

4- development of proper watershed conservation measures.

To achieve this, it is proposed that a new institution that would be a standing committee to coordinate the different actors involved in the system but, unlike the current PIU, would not act as a separate agency with direct involvement in the actions, but work with existing MDAs to achieve its ends be set up.

The key agencies shall be as follows:

OSMEWR as the key implementing agency which will be heading the Flood risk Management Technical Steering Committee. The Flood Risk Management Coordination Committee is the most important institution for the coordination of the flood risk management program. It is proposed that the Head of this unit be a civil engineer contracted by the OSMEWR and/or the Office of the

Executive Secretary of EXCo. Membership of the Committee would include representatives' from the following MDAs:

- OSMEWR with DEEB as Secretariat
- MLGCM
- BPPDC
- PMU
- OSMFB
- OSMWT
- OSDPW
- OSSWMA
- OSMLHS
- OSEMA

- OSMEWR through DEEB and DWRM with the help of DH and OSPWD to handle the design and Construction tasks of the protection measures.
- DEEB to handle the cleaning and maintenance. All problems would be reported to them as a one-stop shop, and DEEB would, with the authority of the Maintenance Coordination Committee, direct the responsible agencies to take necessary action.
- DEEB to develop a Drainage and Maintenance unit to handle the different drainage works and maintenance of these drainage works. It is proposed that staff positions in the Unit are recruited through competition. The performance of each employee should be evaluated annually and those not considered to be performing be returned to their old duties at the payment level they were on before joining the unit.
- Development regulation laws and rules to be arranged by the BPPDC through PDCD and URMCD.
- The Planning Tribunal which is incorporated in the current legislation establishing the BPPDC but has not even been instituted, although identified in all previous legislations on the State's physical planning institutions.
- CBA/CBO handling with the help of drainage and maintenance Committee the public awareness programs to be prepared.

5.3 Institutionalizing the PIU

It could be asked, why not keep the PIU as it is and allow it to handle the whole flood management program? The answer must be that this would replace most of the work of the DEEB, and so would require a revised Ministerial structure. Secondly, the PIU is not staffed as the existing line agencies but has employed consultants and OSMEWR to undertake some of the roles, and uses an incentive system for paying its staff: a performance based bonus system. Could these be applied once the project is completed? This is both a financial question and one which impinges on the operational regulations of the State Government. These special arrangements were possible because the PIU was a special donor funded and supported project, and the incentive payments were factored into the project costs. But with the World Bank ending its direct involvement, it is unlikely that this could be continued, especially as the funding of N500 million for the Unit's running costs is much higher than other line agencies get for the equivalent staff. However, there are some lessons to be learnt. Consultants can replace regular staff. Staff could be allowed to take unpaid leave and move onto special performance-based contracts. But were this to happen, what would be the reaction of other MDAs? It is unlikely to be politically acceptable for any extended period.

It is considered preferable to return those that have benefited from the experience of working in the PIU to the MDAs from where they were recruited and ensure that the experience improves the performance of their respective mother MDAs. It may however, be worth the while for the State Government to consider the introduction of performance bonuses to sections or departments that meet the targets agreed within the time specified. Such bonuses could be included in the budget, but only paid out if the program is completed on schedule. Such a system could be applied in all departments but would need careful monitoring to avoid abuses. It is a question that goes beyond the remit of this project but may be considered by the State as part of its reforms.

The PIU should perform proper handing over of all the developed works under the PIU to the DEEB and the DWRM. And all other appropriate agencies and institutions.

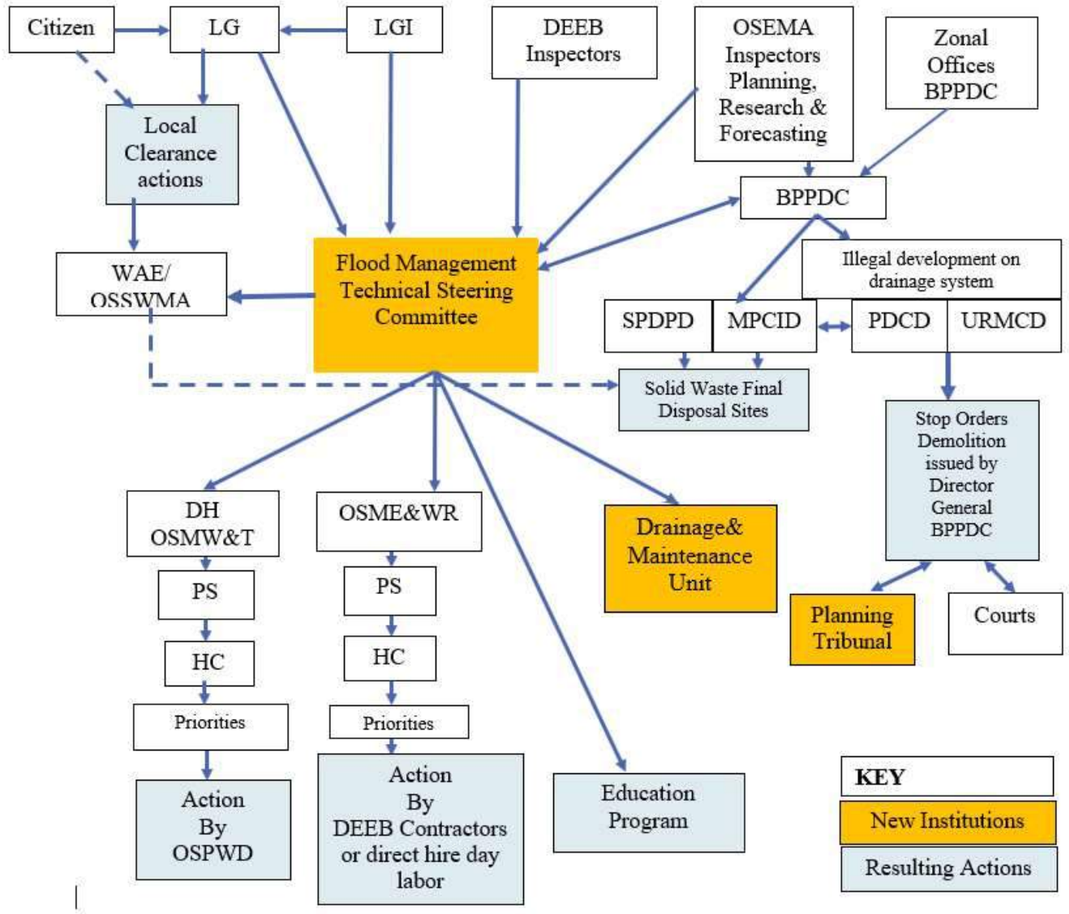

Figure 5.1: Proposed Flood Management Committee

5.4 Increasing the role of the PMD

The fourth alternative is to increase the capacity of the PMD within the office of the Executive Secretary of the ExCo to supervise the performance of the various components of the flood management program. This is to ensure that the programs and budgets of the agencies involved are in line with the overall plan for the system's implementation and needs. The PMD would then be able to recommend, through the Budget Monitoring Committee, redistribution of resources to higher priority work and where for any reason it is clear the responsible MDA is not going to be able to complete the work scheduled in that FY.

The weakness of this proposal is that the PMD does not have adequate technical understanding of the issues and would need to recruit staff who do to help assess the issues that has to do with delays and budget reallocation. It is not recommended that this be the solution. However, it is recommended that the PMD be strengthened, after the PIU has concluded it assignment, to ensure that budget allocations are adequate and properly used. The PMD will need to work closely with the MDAs and other new institutions proposed.

6. Recommended Institutional Arrangement

6.1 OSMEWR

As discussed in the previous sections the OSMEWR shall be the key institute that manages the Flood risk management. However, this shall be handled by the steering committee that overlook the full spectrum of the Flood risk management which is far beyond the vision of the OSMEWR. In this respect the updated institutional arrangements within the OSMEWR are as follows:

- Establish permanent Technical Steering Committee for Flood Risk Management System in Ibadan, with DEEB providing the Secretariat.
- Establish the Drainage Maintenance Coordination Unit DMCU within DEEB. The Unit is to coordinate all identified needs and requests for clearance, maintenance or repair of parts of the drainage system; a form of one stop shop. This unit would also liaise with OSSWMA to ensure all cleared wastes are properly disposed of in approved final disposal sites and could be the key agency that will be providing inputs on the importance of good waste management.
- Ring fencing a proportion of all revenues collected by OSMEWR for to meet the costs of the DMCU and the Steering Committee.
- The DEEB should be restructured such that the design, construction, operation and maintenance functions of the flood management system would be organized in a similar way as the Department of Highways, with greater flexibility on the use of personnel.
- Restructure OSMEWR to act as the client and regulator for contractors engaged to provide these services, rather than directly providing the services themselves. Contractors to be engaged to undertake majority of cleaning and repair work, whilst OSMEWR will make use of day-laborers where simpler jobs not requiring machinery are required.
- DEEB to develop new forms of service contracts for sub-contractors to repair, clean or maintain the various parts of the drainage system for which they have responsibility, so as to properly manage and speed up the operations of contractors so hired.

6.2 BPPDC

The BPPDC has a major role in managing the flood risk as this institution covers the tasks related to the watershed conservation and tasks related to preventive measures including building regulations and protection of the flood plains. The BPPDC has one of the major roles in improving the funding arrangements of the FRMDMP requirements. In this respect the BPPDC improved institutional arrangements involves the following:

- Preparing development guidelines related to the flood risk management and flood plain regulations. This should be coordinated with OSMEWR and DEEB to ensure minimizing the flood risks. This is to be controlled by the PDCD and the URMCED.
- Establishment of the Planning Tribunal
- 'Ring fencing' of a proportion of revenues raised through the activities of BPPDC to be used exclusively for their operations, including the Planning Tribunal, and for the establishment of digital mapping and planning capabilities, and capital equipment costs. The BPPDC must prepare a proposal for this and demonstrate, using existing verifiable data, how making such funds available could improve the effectiveness of the department in undertaking its functions and how this would help increase Government revenue. Such an approach should be executed for a trial period, during which its effectiveness would be monitored and evaluated.
- The 2015 Laws and their associated regulations of 2013 dealing with the functions of the OSMEWR and the proposed BPPDC law should be harmonized to draw a clear distinction between their functions, especially with regards to environmental impact analysis and assessment and the enforcement of the same. The changes in the earlier laws and regulations should be specified in the law establishing the BPPDC.
- While planning approval and development control function should be decentralized, the staffing levels and arrangements for Zonal offices needs to be reviewed to improve their capacities to take on the additional works. Study needs to be undertaken by the Bureau to rationalize the capacity of the local offices, including staff and equipment. This would include transport, especially motor cycles. Priority needs to be given to rapid urbanizing areas and areas of special environmental importance. Local Government and LCDAs within Ibadan Metropolis, with its rapid rate of growth and its approved Master Plan should be given highest priority.
- The BPPDC devise means to increase rate of fee collection for planning approval by stricter enforcement, facilitated by the increased capacity of the local offices. The success of this approach will need to be monitored and the impact evaluated.
- New sites and means for final waste disposal need to be identified, prepared and implemented. Identification of the sites should be done with involvement of all stakeholders and in cooperation with OSMWT who will need to provide proper access roads.

6.3 Management of land and land-based data information systems

This task is to be handled by the survey general where it is required to develop and approve the architecture and operational rules for a common digitized geographic information system that can be used for

- Flood risk maps
- Land based development, ownership disputes and tax purposes,
- Setbacks and preventive resettlements.
- Flood plains and attenuation ponds demarcation requirements
- Storage reservoirs protected lands.
- Post event documentations

Over and above, the institute should ensure securing the equipment required, including equipment for protecting the computers and the back-up servers, and to train staff in the use of the same.

6.4 OSMFB

OSMFB should be capable to improve the funding conditions for the FRMDMP, this is because FRM shall reduce the damage losses within the city, shall reduce the economic loses and disruption to the economic activities such halting of the industrial activities as a result of flooding, and the huge disruption to the markets and different people activities. This could be achieved through:

- Considerations given by OSMFB to provide incentives for improved revenue collection by such agencies as the BPPDC to 'ring fence' a proportion of their total earnings for uses directly related to that agency's expenditures, This will include payment of salaries, hiring of sub-contractors, equipment, repairs and their running costs. The Agency would need to make the case for consideration by the Department of Budget and would need to keep detailed accounts which would be audited by the Auditor General of the State. Sub-contracts over a specified threshold would require approval by the Executive Committee.
- Undertake study on how to establish incentive payments for workers involved in delivering approved outputs of plans within time and available budget.
- Introduce an incentive payment scheme and monitor its impact on performance of the MDAs

6.5 Law affecting fines and penalties for fly-dumping

As solid and liquid waste are major flood risk components and a source of funds to the FRMDMP it is expected that penalties and fines should be imposed for breaching the law concerning illegal development or fly dumping. This will require reviewing these penalties so as to keep up with or ahead of inflation and to make them an effective disincentive. Where the law stipulates the maximum penalties, changes need to be made so that these can be set by the MDAs concerned, without the need for additional legislation.

6.6 OSEMA

The statutory responsibility of OSEMA is not only on emergency but also on preparedness, mitigation and recovery. OSEMA shall be the responsible agency to handle the activities of the Early warning System under development by the PIU. In this respect, the PIU project for the early warning systems is studying the institutional arrangements to allow OSEMA to handle this task.

In this respect, it is required to increase the capacity of OSEMA, and the Planning, Research and Forecasting Department in particular, through making available adequate staff and equipment. This could be funded through providing a share of Ecological Fund as specified in law establishing OSEMA[27].

For more details regarding this institute strengthening referral to the Early Warning System project is essential.

6.7 Improving the financial capacity of the key institutions

This task is one of the major tasks to be achieved and which will require further studies and assessments to improve the funding conditions of the FRMDMP. Some of these improvements can be summarized as follows:

- Budget provision must be made for the works required under the FRMDMP including the development of the different committees and units and the capacity building of the different institutions (as example DEEB). Furthermore, adequate budget provision must also be made for developing the geographic information base for the flood risk management of the city of Ibadan. Responsibility for this may lie with the Surveyor General's Office but would involve DEEB and BPPDC and later, when more data is stored in digitized format, other MDAs, including the proposed DMCU. This system would require greater use of private contractors and increasing the capability of the responsible institutions to manage them. Furthermore, funding of a digitized land registry, including software, accommodation and hardware is an essential part of an improved development-control system. The DEEB will also need to establish a computerized system for
    - Handling the design and construction documents
    - Documenting the post events records
    - Handling of the Flood risk maps
    - recording of blockages and maintenance issues
    - improving efficiency of the prioritization program for repair and clearance work.
    - aid the monitoring of critical areas,

- The use of contractors will mean the role of the existing MDAs concerned will change to focusing on establishing strategies and standards, preparing TOR and selecting suitable and capable contractors, including monitoring implementation of the work. This is likely to change the form and size of the budget required, with more money being needed to cover payment for work done by the contractors. While less staff are required in the responsible MDA for design work, additional staff will be required for monitoring and measurement of water levels in the canals, behind the dams, and for identifying blockages and structural failures in the system. The establishment of DMCU in the DEEB will require staffing and equipment. In all probability, the overall budget in all the MDAs concerned, including the OYSMA, as mentioned earlier, will need to be increased. The question however is where such money will come from
- One source such money would be from revenue generated through the issuance of licenses by BPPDC. It is proposed that about 20 percent of this be ring-fenced for increasing the capacity of the BPPDC, establishment of the Planning Tribunal, implementation of the GIS Data Base, establishment and equipping of the MCU and the provision of necessary and essential equipment for the OSEMA. The current estimated level of collections of revenue from this source is achieving approximately 50 percent of its potential. Improving the capacity of the BPPDC, including equipping the District Offices and the introduction of the GIS and the data base, will facilitate achievement of a higher level of collection. Currently, as shown in Table 3.2 above, BPPDC receives less than 1.5% of the revenue collected. Quadrupling the size of the departmental budget, including providing them with adequate and suitably equipped offices, would require the Bureau to achieve a ten or twenty percent increase in the revenue collected from this source. This would further increase the revenue available for other budget requirements of the State, including the proposed additional investment in the IUFMP as outlined in this report.
- A further proposal made in this report includes incentive payments for departmental staff when program targets are achieved. The success of the PIU is to a certain extent due to the special incentive payments made to the staff as well as the fact that the office is better than most government offices and is better equipped and has adequate access to transport. It raises the question of whether such incentives and employment conditions can be replicated for other departments (such as the BPPDC) and for those working in the MDAs responsible for the design, implementation and maintenance of the flood management program after the World Bank funding and for the 20% counterpart funding by the Oyo State Government for the costs has ended. Apart from the revenues raised through the licensing of contractors by BPPC, OSME&WR also has powers to generate income through Environmental Development Charges on industrial and commercial premises. They also collect fees for approving the EIAs undertaken and various powers to impose fines on individuals and companies that dispose garbage in drains etc. While more probably needs to be done to enforce these powers, they exist and the OSME&WR receives back from the OSMF&B five percent of all the revenue they generate, which can be used in any way the Ministry sees fit to improve their services, be it the purchase of equipment, contracting of work or the payment of incentives. It is proposed that the Ministry of Finance and Budget increases the proportion of the amount that can be kept by OSMEWR and this be ring-fenced for the activities of a proposed DMCU in the DEEB.

[27] A Law for the Establishment of Oyo State Emergency Management Agency (No 2 2009). Reference establishment of Department of Planning Research Article 10 (5 – iii) and funding using Ecological Fund Article 12 (2 – b).

6.8 Activity Timeline

Based on the required upgraded institutional arrangement presented in section 5 and 6, the activity timeline is proposed and is presented in table 6.1.

Table 6.1: Activity Timeline

	Activity	Key Agencies	Short Term	Medium Term	Long Term
1	Establishment of Flood management Committee (i,e, permanent Technical Steering Committee)	• OSMEWR • MLGCM • BPPDC • PMU • OSMFB • OSMWT • OSDPW • OSSWMA • OSMLHS • OSEMA	Xxx		
2	Establishment of DMCU	DEEB	xxx		
3	Restructuring of OSMEWR	OSMEWR (ExCo)	xx	xxx	
4	DEEB to act as Client and contract out design and supervision of contracts	OSMEWR DEEB (OSMFB)	x	xxx	xxx
5	Contract out clearing of drainage system through retainership and performance-based contracts	OSMEWR DEEB DH (OSMWT) (OSMFB)	x	xxx	xxx
6	Signing of Law establishing BPDC by Governor	Governor	xxx		
7.	Ratification of IMP	ExCo and State Legislature Governor	xxx		
8	Establishment of Planning Tribunal	Exco OSMFB	xx	xxx	
9	Clarification in law of role of OSME&WR and BPPDC on responsibility for EIA approval	OSMEWR BPPC Office of Attorney General	xxx		
10	Decentralization of Planning and Development Control functions and capacity development	OSMLGCM BPPDC Head of Service		xxx	xxx
11	Stricter enforcement of fee collections to increase revenues	BPPDC (OSMFB)	xx	xxx	xxx
12	Identification and Planning of new sites and other means for Final Waste Disposal	BPPDC OSMLGCM (LG & LCDA) WAE	xxx	xx	xxx
		OSMEWR PPP			
13	Reform of law on compensation for loss of land for state use	Dept. of Lands Office of the Attorney General ExCo Legislature Governor		xxx	xxx
14.	Development and approval of architecture for GIS, Data Base, including access and right of use	Office of Surveyor General BPPDC Dept. of Lands ExCo	xxx	xx	
15	Introduction of Ring Fencing Portion of fees and Charges collected by an MDA for exclusive use	OSMFB ExCo Auditor General BPPDC (OSMEWR)	X	xxx	
16	Introduction of Performance based stipends for employees in key Ministries	OSMFB Head of Service Other MDAs concerned	X	xxx	
17	Monitor impact of incentive payments	OSMFB Concerned MDAs		xx	xxx
18	Introduce increased penalties for unapproved developments and fly dumping	OSMEWR ExCo (Legislature and Governor)	X	xxx	xxx
19	Improving Capacity of OSEMA: increasing staff and providing needed equipment	OSEMA Head of Services OSMFB	X	xxx	
20	Providing adequate budget through ring fencing for exclusive use part of Ecological Fund	OSMFB		xx	xxx

ANNEX A – Methodology

The data presented in this report has been very reliant to the information provided by the responsible MDA. The consultant administered a series of questionnaires on each of the institutions, including questions on their structure, staffing levels, responsibilities, procedures and legal status, as well as reviewing the legislation under which these powers and responsibilities were allocated to the respective MDA.

The original questionnaires were sent out in November 2017. The responses were incomplete and not all the MDAs replied. Follow-up questionnaires were also sent in March 2018, which repeated the questions which were not answered in the first set of questionnaires that were sent out. Responses to these second questionnaires were not received until January 2019. Meanwhile an oversight paper prepared to provide the institutional background, based on work done for the Ibadan City Master Plan had been presented, mistakenly, as the institutional proposals for the IUFMP. In the meantime, certain decisions had been made by the Governor and the ExCo, which effectively negated the recommendations included in that IMP, in particular regarding proposal for the establishment of the BPPDC with its own Directorate for Master Plan Coordination and Implementation. This effectively focused on the spatial development and land use aspects of the IMP and not on the broader coordination of the work.

The Consultant made a field trip to Ibadan to gather more data and to prepare the current report. Comments from the World Bank received in April 2019 stimulated a third round of questions. The responses received to date, have been used to further revise this report. However, the follow up questions have not been completed and some responses needed clarification. The information depended heavily on the detail of responses received and data gathered from the responsible MDA by the Consultant in face-to-face interviews. The questionnaires are attached below. Some of the same questions were asked from different MDAs as it was not clear at the time the limit of responsibility of each.

A. Questionnaire of November 2017

Preliminary Questions from Institutional Specialist for Ibadan Flood Management Master Plan Project

This section a list of questions on solid waste collection and capacity because blocking of drains by garbage is a major cause of flooding. Any long-term flood management system must also include solid waste management. The questions do not go into issues such as implementing a strategy that reduces waste (such as the 4 Rs) but limits itself to cleaning, collection and final disposal.

Glossary of Terms:

IFMMP	Ibadan Flood Management Master Plan
IMP	Ibadan Master Plan (Land Use Structure Plan)
OSMEWR (MEWR)	Oyo State Ministry of Environment and Water Resources
OSMW&T (MW&T)	Oyo State Ministry of Works and Transport
OSMLG&CA	Oyo State Ministry of Local Government and Chieftaincy Affairs
CBA	Community Based Associations
CBO	Community Based Organizations
OSSWMA	Oyo State Solid Waste Management Authority
OSEMA	Oyo State Emergency Management Authority
BPPDC	Bureau of Physical planning and Development Control
MADs	Ministries, Agencies and Departments (includes Bureaus where relevant)

OYO STATE MINISTRY OF ENVIRONMENT AND WATER RESOURCES (OSMEWR)

Oyo State Ministry of Environment and Water Resources (OSMEWR)
Structure and Responsibilities
Which department or agency in which Ministry is responsible for design of drainage master plan?
Which department or agency in which Ministry is responsible for the detailed design of collector drains and overflow holding areas (? Terminology, but referring to enclosed areas where excess water from drainage system can be held until water levels in drains recede), culverts and crossings.
Who or what institution provides hydrological information required for drainage design?
Who is responsible for any design of structures or improvement to existing river system used as part of the drainage system proposed in the Flood Management Master Plan, especially those rivers used as the final drainage outlet for the system?
Who is responsible (name department of which Ministry or Agency) for cleaning and maintaining any structural improvements on these rivers?
What form of monitoring is carried out post construction and by whom?
The OSMEWR has said it would take responsibility for the IFMMP, is there a single department in the Ministry responsible for this?
What capacity has OSMEWR to design and construct flood control infrastructure?
How does OSMEWR coordinate its activities with OSMW&T, and with Federal Government responsible for federal roads and drainage, and the local governments? For design? For construction? For Maintenance?
Does OSMEWR have any education program developed to teach local residents on the importance of keeping drainage systems clean and clear of obstructions? Is there any program organized by the OSMLG&CA? Is there coordination between the OSMEWR and the OSMLG&CA?
What powers and sanctions do the MADs have to impose sanctions or require reparation where drainage system blocked or impeded?
Identification of Staffing and Skills
Structure and staffing levels (including capabilities/qualifications) of OSMEWR
Inspection of Drainage System
Who inspects road side drainage (MW&T or MEWR or Local Government?)
What staff are available to do this?
How often are the drains inspected?
To whom are reports sent?

Is budget adequate to cover this work? If not, what proportion of task covered and what is system for prioritizing use of limited finds?
Monitoring of flood frequency and severity
Do Local Governments collect data on flood frequency and severity?
Does OYSEMA collect and compile data on flood frequency and severity?
Is this data shared with BPPDC and with OSMEWR?
How is this data used in preparing land use plans and in preparing drainage schemes?
Are local drainage schemes responsibility of Local Government?
Who designs local drainage schemes and are these developed in coordination with agency responsible for flood management?
What source of budget required for construction?
Who is responsible for maintenance of local drainage system?
What powers have the Local Government to ensure land and property owners clean the drains on or around their property?
In times of flood, is a special budget available for local government, OSEMA or OSMEWR? What is source of budget?
System for reporting and action
What is procedure if problem of drains, culverts, etc being blocked to be reported
What happens then?
Is there a difference between the main drains and the roadside drainage system? Who is responsible for taking action?
Who organizes the action?
Do both MW&T and MEWR both have budgets for these activities
Do Local governments have budget for this?
How big is the department responsible in the two Ministries and the Local Governments?
Do they have equipment for dredging main drains?
What happens if the drainage canal is damaged? Is there a budget for repairs?
Opportunity for public to report problems and issues and mechanism for response
Where do people report blockages or damage to drains- main drains and roadside drains?
How easy is it for someone to report a problem? This question relates to location of offices, telephone systems, internet systems, publicity of the opportunity to make reports.
What staff are available to receive such complaints?
What happens to the record of the complaint?
What oversight is there of this process?
Is there any data on the time between a problem being reported and action being taken?
What are the constraints to rapid response? Lack of manpower, lack of equipment? Lack of funds? Other reasons?
Performance standards?
Are there performance standards for repair work on drains? If so what?
Are there performance standards on drain clearance work? If so what?
Do the MW&T and MEWR both have common performance standards for the drains
Are design standards reviewed in the light of climate change?
What proportion of flooding is due to poor maintenance, poor clearance or under-design?

OYO STATE MINISTRY OF WORKS AND TRANSPORT (OSMW&T)

Oyo State Ministry of Works and Transport (OSMW&T)
Structure and Responsibilities
Which department or agency in which Ministry is responsible for the detailed design of collector drains and overflow holding areas (? Terminology, but referring to enclosed areas where excess water from drainage system can be held until water levels in drains recede), culverts and crossings.
Who or what institution provides hydrological information required for drainage design?
Who is responsible for any design of structures or improvement to existing river system used as part of the drainage system proposed in the Flood Management Master Plan, especially those rivers used as the final drainage outlet for the system?
Who is responsible (name department of which Ministry or Agency) for cleaning and maintaining any structural improvements on these rivers?
What form of monitoring is carried out post construction and by whom?
How does OSMEWR coordinate its activities with OSMW&T, and with Federal Government responsible for federal roads and drainage, and the local governments? For design? For construction? For Maintenance?
What powers and sanctions do the MADs have to impose sanctions or require reparation where drainage system blocked or impeded?
Identification of Staffing and Skills
Structure and staffing levels (including capabilities/qualifications) of OSMW&T
Inspection of Drainage System
Who inspects road side drainage (MW&T or MEWR or Local Government?)
What staff are available to do this?
How often are the drains inspected?
To whom are reports sent?
Is budget adequate to cover this work? If not, what proportion of task covered and what is system for prioritizing use of limited finds?
Monitoring of flood frequency and severity
Who designs local drainage schemes and are these developed in coordination with agency responsible for flood management?
What source of budget required for construction?
Who is responsible for maintenance of local drainage system?
System for reporting and action
What is procedure if problem of drains, culverts, etc being blocked to be reported
What happens then?

Is there a difference between the main drains and the roadside drainage system? Who is responsible for taking action
Who organizes the action?
Do both MW&T and MEWR both have budgets for these activities
How big is the department responsible
Are there equipment for dredging main drains?
What happens if the drainage canal is damaged? Is there a budget for repairs?
Opportunity for public to report problems and issues and mechanism for response
Where do people report blockages or damage to drains- main drains and roadside drains?
How easy is it for someone to report a problem? This question relates to location of offices, telephone systems, internet systems, publicity of the opportunity to make reports.
What staff are available to receive such complaints?
What happens to the record of the complaint?
What oversight is there of this process?
Is there any data on the time between a problem being reported and action being taken?
What are the constraints to rapid response? Lack of manpower, lack of equipment? Lack of funds? Other reasons?
Performance standards?
Are there performance standards for repair work on drains? If so what?
Are there performance standards on drain clearance work? If so what?
Do the MW&T and MEWR both have common performance standards for the drains
Are design standards reviewed in the light of climate change?
What proportion of flooding is due to poor maintenance, poor clearance or under-design?

IBADAN URBAN FLOOD MANAGEMENT PROJECT (IUFMP)

Ibadan Urban Flood Management Project (IUFMP)
Structure and Responsibilities
Which department or agency in which Ministry is responsible for design of drainage master plan?
Which department or agency in which Ministry is responsible for the detailed design of collector drains and overflow holding areas (? Terminology, but referring to enclosed areas where excess water from drainage system can be held until water levels in drains recede), culverts and crossings.
Organograms of key institutions
Who or what institution provides hydrological information required for drainage design?
Who is responsible for any design of structures or improvement to existing river system used as part of the drainage system proposed in the Flood Management Master Plan, especially those rivers used as the final drainage outlet for the system?
Who is responsible (name department of which Ministry or Agency) for cleaning and maintaining any structural improvements on these rivers?
The OSMEWR has said it would take responsibility for the IFMMP, is there a single department in the Ministry responsible for this?
Opportunity for public to report problems and issues and mechanism for response
Where do people report blockages or damage to drains- main drains and roadside drains?
How easy is it for someone to report a problem? This question relates to location of offices, telephone systems, internet systems, publicity of the opportunity to make reports.
What staff are available to receive such complaints?
What happens to the record of the complaint?
What oversight is there of this process?
Is there any data on the time between a problem being reported and action being taken?
What are the constraints to rapid response? Lack of manpower, lack of equipment? Lack of funds? Other reasons?

OYO STATE MINISTRY OF LOCAL GOVERNMENTS AND CHIEFTANCY AFFAIRS (OSMLG&CA)

Structure and Responsibilities
Organograms of key institutions
What capacity has the OSMLG&CA got to organize information/education campaigns for the general public and how do they ensure involvement of CBAs, Township Associations and CBOs?
What powers and sanctions do the MADs have to impose sanctions or require reparation where drainage system blocked or impeded?
Inspection of Drainage System
Who inspects road side drainage (MW&T or MEWR or Local Government?)
What staff are available to do this?
How often are the drains inspected?
To whom are reports sent?
Is budget adequate to cover this work? If not, what proportion of task covered and what is system for prioritizing use of limited finds?
Monitoring of flood frequency and severity
Do Local Governments collect data on flood frequency and severity?
Does OSEMA collect and compile data on flood frequency and severity?
Is this data shared with BPPDC and with OSMEWR?
Are local drainage schemes responsibility of Local Government?
Who designs local drainage schemes and are these developed in coordination with agency responsible for flood management?
What source of budget required for construction?
Who is responsible for maintenance of local drainage system?
What powers have the Local Government to ensure land and property owners clean the drains on or around their property?

System for reporting and action
What is procedure if problem of drains, culverts, etc being blocked to be reported
What happens then?
Is there a difference between the main drains and the roadside drainage system? Who is responsible for taking action
Who organizes the action?
Do both MW&T and MEWR both have budgets for these activities
Do Local governments have budget for this?
How big is the department responsible in the two Ministries and the Local Governments?
Do they have equipment for dredging main drains?
What happens if the drainage canal is damaged? Is there a budget for repairs?
Opportunity for public to report problems and issues and mechanism for response
Where do people report blockages or damage to drains- main drains and roadside drains?
How easy is it for someone to report a problem? This question relates to location of offices, telephone systems, internet systems, publicity of the opportunity to make reports.
What staff are available to receive such complaints?
What happens to the record of the complaint?
What oversight is there of this process?
Is there any data on the time between a problem being reported and action being taken?
What are the constraints to rapid response? Lack of manpower, lack of equipment? Lack of funds? Other reasons?

BUREAU OF PHYSICAL PLANNING AND DEVELOPMENT CONTROL (BPPDC)

Organograms of key institutions
Which department or agency in which Ministry is responsible for design of drainage master plan?
Who or what institution provides hydrological information required for drainage design?
Who is responsible for any design of structures or improvement to existing river system used as part of the drainage system proposed in the Flood Management Master Plan, especially those rivers used as the final drainage outlet for the system?
Monitoring of flood frequency and severity
Do Local Governments collect data on flood frequency and severity?
Does OYSEMA collect and compile data on flood frequency and severity?
Is this data shared with BPPDC and with OSMEWR?
How is this data used in preparing land use plans and in preparing drainage schemes?
Protection of Natural Flood Plains
Are natural flood plains identified in MP?
Activities of BPPDC in identifying natural flood plains and preparing plans that will protect them?
Does BPPDC propose plans that would include clearance of existing structures on natural flood plains?
What mechanisms are used to control informal or illegal development on flood plains?
What powers does the BPPDC or the Governor have to demolish illegal development?

OYO STATE SOLID WASTE MANAGEMENT AUTHORITY (OSSWMA)

Solid Waste Tariffs and collection
Tariff collection structure (ie private household, industrial, commercial, pubic agency etc. rates charged)
System of collection of payment
Proportion of population covered
Proportion of city covered
Costs of collection versus revenues
System of paying collectors of tariff
System of collecting garbage
Is recycling practiced and if so what proportion of garbage sorted and collected
Who does the collection
What public and private sector firms/organizations are involved
What proportion of garbage collected by informal garbage collectors and who do they sell the collected materials to?
What controls are in place to prevent fly dumping?
What is the system for collecting and depositing waste to final disposal sites?
What criteria are considered in selection of final waste disposal site? Is the risk of pollution of river systems taken into account and are these final disposal sites designed to minimize this risk?
Are there waste sorters at these locations: formal and informal?
Do they have machinery to sort waste and prepare bio-degradable waste for composting or power generation? (bio-gas)
System of cleaning common areas: include street cleaners and sweepers
Collection schedules
Mapping collection schedules in place in different parts of town. Correlate schedules with land use (housing, industrial, commercial), land values
Is all garbage collected formally through OSSWMA, and if not who does it?
Are the formal private sector involved?
If so, on what basis?
Capacity
Structure and staffing levels (including capabilities/qualifications) of OSSWMA
Performance Monitoring

Are there performance standards for garbage collection (quantity versus estimated generation, information on recycling as proportion of population and proportion of garbage generated)
Are these data available for different types of area (land use/income bracket of population)

OYO STATE EMERGENCY MANAGEMENT AUTHORITY (OYSEMA)

Structure and Responsibilities
Organogram of OSEMA
Monitoring of flood frequency and severity
Does OYSEMA collect and compile data on flood frequency and severity?

B. Questionnaire of March 2018

Follow-Up Questions from Institutional Specialist for Ibadan Urban Flood Management Master Plan Project

Glossary of Terms:

IUFMP	Ibadan Urban Flood Management Project
IMP	Ibadan Master Plan (Land Use Structure Plan)
LG	Local Government
OSMEWR (MEWR)	Oyo State Ministry of Environment and Water Resources
OSMW&T (MW&T)	Oyo State Ministry of Works and Transport
OSMLG&CA	Oyo State Ministry of Local Government and Chieftaincy Affairs
CBA	Community Based Associations
CBO	Community Based Organizations
OSSWMA	Oyo State Solid Waste Management Authority
OSEMA	Oyo State Emergency Management Authority
BPPDC	Bureau of Physical planning and Development Control
MDAs	Ministries, Departments and Agencies (includes Bureaus where relevant)
WAE	West Africa ENERG

OYO STATE MINISTRY OF ENVIRONMENT AND WATER RESOURCES (OSMEWR)

Oyo State Ministry of Environment and Water Resources (OSMEWR)
Structure and Responsibilities
• Who carries out any monitoring of discharge and blockages caused by solid waste? • What department and at what level?
Please give greater detail and careful clarification how OSMEWR coordinates its design, construction and maintenance activities with the following authorities: • OSMW&T ➢ For design? ➢ For construction? ➢ For Maintenance? • Federal Government responsible for federal roads and drainage, ➢ For design? ➢ For construction? ➢ For Maintenance? • Local governments ➢ For design? ➢ For construction? ➢ For Maintenance?
• Do Community Officers from SMLG & CA have power to impose fines or other sanctions? • What can they impose?
Identification of Staffing and Skills
There is an available list of many approved positions in OSMEWR. However, very few positions have been filled (as of 2016). This raises serious doubts whether the department is able to do half of what it says it does do • Please provide structure and staffing levels (including capabilities/qualifications) of OSMEWR. • Please clarify why few positions have been filled
Inspection of Drainage System
If Technical staff inspect drains, but there are limited staff available, • How effective can they be? • How regularly are they able to oversee the drains in their area? • How much are they re-active rather than pro-active?
Given the number of drains involved in the whole City. • We presume that not all reports on the state of drains needs to pass through the PS to the HC. Is this correct? • Presumably only reports which are critical are sent this way. May you please confirm?
Monitoring of flood frequency and severity
• What is the Ministry Budget proportion held for emergencies such as floods?
System for reporting and action
• What way do LGs and the MEWR cooperate on the need to maintain main drains? • Does the roadside drainage remain the responsibility of the authority responsible for the particular road, so it could be Federal, Regional or Local?
Opportunity for public to report problems and issues and mechanism for response
People report blockages or damage to drains- main drains and roadside drains to Hon Commissioner MW&T, and then onto MEWR. • Why does it not direct their reports to MEWR?
Concerning location of offices, telephone systems, internet systems, publicity of the opportunity to make reports. • How easy is it for someone to report a problem to the DEEB and other relevant departments? • What happens if there are no local offices available to respond? • Are there other ways of contacting them directly or indirectly (such as through LG offices?) • Do LGs have representatives of the DEE&B?
• What oversight is there of this process? • Are records of time taken for a complaint to be responded to. • Could the PS or his office say how long does it take for the following:

a) the officials to inspect the problem, b) to prepare the plan of action, c) for the action to be approved –including financed, d) for action to begin.
Performance standards?
• Are there time performance standards for repair work on drains? • If so, what are these? Please elaborate.

IBADAN URBAN FLOOD MANAGEMENT PROJECT (IUFMP)

Ibadan Urban Flood Management Project (IUFMP)
Structure and Responsibilities
• Why is BPPDC not represented on IUFMP PIU?
• Please provide Organograms of PIU?
As part of the drainage system proposed in the Flood Management Master Plan • Who is responsible for any design of improvement to existing river system used? • Who is responsible for rivers used as the final drainage outlet for the system? • Is this the responsibility of the Consultants?
• Who is responsible for cleaning and maintaining any structural improvements on these rivers? Please provide the name of the responsible authority. ➢ Department ➢ Ministry or Agency
• The OSMEWR has said it would take responsibility for the IUFMP. Please confirm. • Is the DEE&B ultimately responsible?
Opportunity for public to report problems and issues and mechanism for response It would appear that the PIU of the IUFMP is not responsible for the maintenance of the system after it has been constructed, except in the period after construction during which the contractor is responsible. • Is this correct • Please clarify who is responsible for the maintaining the PIU works after implementation?
• Where do people report blockages or damage to drains- main drains and roadside drains?
Concerning location of offices, telephone systems, internet systems, publicity of the opportunity to make reports. • How easy is it for someone to report a problem? • What staff are available to receive such complaints? • What happens to the record of the complaint? • What oversight is there of this process? • Is there any data on the time between a problem being reported and action being taken?
What are the constraints to the following: • Rapid response? • Lack of manpower • Lack of equipment? • Lack of funds? • Other reasons?

OYO STATE MINISTRY OF LOCAL GOVERNMENTS AND CHIEFTANCY AFFAIRS (OSMLG&CA)

Structure and Responsibilities
• Please provide Organograms of OSMLG&CA
• What capacity has the OSMLG&CA got to organise information/education campaigns for the general public • How do they ensure involvement of CBAs, Township Associations and CBOs?
• What powers and sanctions do the MADs have to impose sanctions or require reparation where drainage system blocked or impeded?
Inspection of Drainage System
• Do LGs inspect road side drainage after construction and during use? • If not who does?
• What staff are available to do this?
• How often are the drains inspected?
• To whom are reports sent?
• Is budget adequate to cover this work? • If not, what proportion of task covered and • What is system for prioritizing use of limited finds?
Monitoring of flood frequency and severity
• Do Local Governments collect data on flood frequency and severity?
• Does OSEMA collect and compile data on flood frequency and severity?
• Is this data shared with BPPDC and with OSMEWR?
• Are local drainage schemes responsibility of Local Government?
• Who designs local drainage schemes? • Are these developed in coordination with agency responsible for flood management?
• What source of budget is required for construction?
• Who is responsible for maintenance of local drainage system?
• What powers have the Local Government to ensure that land and property owners clean the drains on or around their property?
System for reporting and action
• What is procedure if problem of drains, culverts…etc. are being blocked? • Are they reported? • What happens then?
• Is there a difference between the main drains and the roadside drainage system? • Who is responsible for taking action? • Who organizes the action?
• Do both MW&T and MEWR both have budgets for these activities
• Do Local governments have budget for this?

• How big is the department responsible in the two Ministries and the Local Governments? • Do they have equipment for dredging main drains?
• What happens if the drainage canal is damaged? • Is there a budget for repairs?
Opportunity for public to report problems and issues and mechanism for response
• Where do people report blockages or damage to drains- main drains and roadside drains?
Concerning location of offices, telephone systems, internet systems, publicity of the opportunity to make reports. • How easy is it for someone to report a problem? • What staff are available to receive such complaints? • What happens to the record of the complaint? • What oversight is there of this process? • Is there any data on the time between a problem being reported and action being taken?
What are the constraints to the following: • Rapid response? • Lack of manpower • Lack of equipment? • Lack of funds? • Other reasons?

BUREAU OF PHYSICAL PLANNING AND DEVELOPMENT CONTROL (BPPDC)

• Please provide Organograms of BPPDC
• What responsibility does the BPPDC have for design of drainage master plan? • How is the IUFMP and the IMP coordinated?
As part of the drainage system proposed in the Flood Management Master Plan • What is the role of the BPPDC in the process of developing the design of structures or improvement to existing river system • What is the role of the BPPDC for rivers used as the final drainage outlet for the system?
Monitoring of flood frequency and severity
• Does the BPPDC collect data on flood frequency and severity?
• How is this data used in preparing land use plans and in preparing drainage schemes?
Protection of Natural Flood Plains

• What mechanisms are used to control informal or illegal development on flood plains?
• Is the Development Control department adequately staffed to do this job?
• How regularly do members of the BPPDC get to inspect all potential areas?
• Do they welcome or encourage the public to report violations?
• Is there an office or identified location where such complaints can be lodged?
  ➢ Are there any telephone number for complaints?
  ➢ Are there any e-mail address for complaints?

Referring to clause 48, 49, 50 and 59 of State Physical planning and Urban Development Law. • Does the BPPDC or the Governor have provided Powers to demolish illegal developments?
• How often do they use this power?
Planning Responsibilities
• Is the BPPC responsible for deciding the suitable locations of the Final Disposal Sites for solid waste management?

OYO STATE SOLID WASTE MANAGEMENT AUTHORITY (OSSWMA) and West Africa ENERG (WAE)

Solid Waste Tariffs and collection
• What is the status of the WAE? • Is it a contracted company or organization used to manage the garbage? • Can it take over the responsibilities of the OSSWMA?
• What are the terms of their engagement? • Are they meant to be self-financing using licenses and fees?
• Does the OSSWMA still have staff? • Does the OSSWMA act as the Client to the WAE? • If so, what capacity has it to monitor the implementation of the contract? • What powers to sanction WAE if it fails to fulfil its obligations?
• What is the Proportion of urban population in Ibadan city covered by WAE? • Is the whole metropolitan Ibadan area, covered?
• Are revenues collected by WAE? • What authority does WAE have to determine the level fees to be charged and the collection of fees?
• Will WAE implement different system of collecting garbage from the way OSWMA did?
• What was the function of the LGs in the collection of garbage (as required in the roles of LGs in the 1999 Constitution)?
• Is the WAE going to sub contract the collection to other private entities?
• Is there a system of informal collection of recyclable materials? • Is there a recycling industry? • What is the market for recyclable materials?

• What controls are in place to prevent fly dumping?
• Is the prevention fly dumping enforced?
• Are controls and preventions applicable to all Oyo State
  ➢ Are they applicable for all urban areas?
  ➢ Or, are they applicable for some parts (localities)?
  ➢ If so, which ones?

• What criteria are considered in selection of final waste disposal site? • Is the risk of pollution of river systems taken into account? • Are these final disposal sites designed to minimize this risk? • Will WAE determine where the Final Disposal Sites are?
• Are there waste sorters at these locations?

• Are they formal and informal?
• Do they have machinery to sort waste and prepare bio-degradable waste for composting or power generation (bio-gas)? • If NOT, will WAE develop such facilities?
System of cleaning common areas: include street cleaners and sweepers • Are these under the LGs?
Collection schedules
Mapping collection schedules in place in different parts of town. • Does the schedules vary with land use (housing, industrial, commercial), land values?
• Will all garbage from both residential, commercial and industrial areas be collected formally by WAE or sub-contractors of WAE? • If not, by whom?
Performance Monitoring
• Are there performance standards for garbage collection (quantity versus estimated generation, information on recycling as proportion of population and proportion of garbage generated)?
• Are these data available for different types of area (land use/income bracket of population) • Are these data available for different administrative areas?

OYO STATE EMERGENCY MANAGEMENT AUTHORITY (OYSEMA)

Structure and Responsibilities
• Please provide the Organogram of OSEMA
Monitoring of flood frequency and severity
• Does OYSEMA collect and compile data on flood frequency and severity?
• Is this data shared with BPPDC and with OSMEWR?
• Does OSEMA inspect regularly the infrastructure, including the drainage that could impact on the risks faced in certain areas from natural disasters?
• Does OSEMA review planning proposals to assess impact of development in a selected area? • Does OSEMA review risk of flooding in other areas upstream or downstream of development? • Do OSEMA have this sort of expertise?

C. Follow up list of questions from Dar

OYO STATE MINISTRY OF ENVIRONMENT AND WATER RESOURCES (OSMEWR)

Oyo State Ministry of Environment and Water Resources (OSMEWR)
Structure and Responsibilities
• Who carries out ~~any~~ monitoring of discharge and blockages caused by solid waste? • What department and at what level?
Please give greater detail and careful clarification (on) how OSMEWR coordinates its design, construction and maintenance activities with the following authorities: • OSMW&T ➢ For design? ➢ For construction? ➢ For Maintenance? • Federal Government responsible for federal roads and drainage, ➢ For design? ➢ For construction? ➢ For Maintenance? • Local governments ➢ For design? ➢ For construction? ➢ For Maintenance?
Do Community Officers from SMLG & CA have power to impose fines or other sanctions?
Identification of Staffing and Skills
There is an available list of many approved positions in OSMEWR. However, very few positions have been filled (as of 2016). This raises serious doubts whether the department is able to do half of what it says it does do • Please provide structure and staffing levels (including capabilities/qualifications) of OSMEWR. • Please clarify why few positions have been filled
Inspection of Drainage System
If Technical staff inspect drains, but there are limited staff available, • How effective can they be? • How regularly are they able to oversee the drains in their area? How much are they re-active rather than pro-active?
Given the number of drains involved in the whole City. • We presume that not all reports on the state of drains needs to pass through the PS to the HC. Is this correct? ANS

• Presumably only reports which are critical are sent this way. May you please confirm?
Monitoring of flood frequency and severity
• What is the Ministry Budget proportion held for emergencies such as floods? ANS:
System for reporting and action
• What way do LGs and the MEWR cooperate on the need to maintain main drains? • Does the roadside drainage remain the responsibility of the authority responsible for the particular road, so it could be Federal, Regional or Local
Opportunity for public to report problems and issues and mechanism for response
People report blockages or damage to drains- main drains and roadside drains to Hon Commissioner MW&T, and then onto MEWR. • Why does it not direct their reports to MEWR?
Concerning location of offices, telephone systems, internet systems, publicity of the opportunity to make reports. • How easy is it for someone to report a problem to the DEEB and other relevant departments? • What happens if there are no local offices available to respond? • Are there other ways of contacting them directly or indirectly (such as through LG offices?) • Do LGs have representatives of the DEE&B?
• What oversight is there of this process? • Are records of time taken for a complaint to be responded to. • Could the PS or his office say how long does it take for the following: e) the officials to inspect the problem, to prepare the plan of action, f) for the action to be approved –including financed, for action to begin.
Performance standards?
• Are there time performance standards for repair work on drains? • If so, what are these? Please elaborate.

Questionnaire of March 2019 following comments by the WB to draft

No	Section of Report	Information Required	Details
1	3.e. Table 2	More detailed justification for required staffing levels identified here.	Focus of interest: staff required for implementing Drainage and flood management system. It should specify • how many and what level of skill, seniority, each position must have to fulfill roles: ▪ analysis and design of rivers, canals, roadside drainage; ▪ costing of work required; ▪ environmental impact assessments; ▪ contract preparation and selection and awarding of contracts; ▪ supervision and Q.C. of contractors; ▪ Inspection of infrastructure which forms part of flood control and drainage system; ▪ maintenance of these infrastructures (analysis and design, contracting of work required and supervision); ▪ clearing and cleaning of drainage (all types from rivers to roadside drains).
2		Skills deficit in DEEB	• What additional training (skills are lacking or weak) is required for any of the positions identified above (in Q 1)? • What proposals does the DEEB have for improving the skills? • Does Department think it should be working more closely with PIU of IUFMP? If so, how?
3	3e. & 3d.iv	Capacity of WAE and Final Disposal site development and use	• Does WAE have the capacity to remove all waste from drainage, river, stream etc, clearance operations? • What arrangements do they have for the collection, on regular basis (every week, month etc.), or when requested, or they don't collect? • Who pays for the collection of this clearance waste? • Is the waste being disposed of in final disposal sites? • What form do the final disposal sites take (eg. Sanitary land fill, incineration, waste to energy, waste sorting for recycling etc.)? • Are new final disposal sites being prepared? • Who is responsible for preparing these sites? • Are there any issues concerning equipment for these operations (e.g. does WAE have sufficient Lorries that are roadworthy and running to meet the demand? Likewise, do they have fork-lift trucks and bulldozers required? • If not, what additional investment is required to enable WAE to do this work adequately?
4	3e. and 3h v	Budget lines and adequacy of budget	Question to Min of Finance and Budget • What budget lines are used for (a) construction of drainage and flood management infrastructure (b) maintenance of flood management infrastructure (c) clearance and cleaning of drains, canals and rivers etc which form part of IUFMP infrastructure

			(d) collection and disposal of material cleaned from the drainage system? • How adequate are each for the job to be done effectively? • What budget constraints are there on hiring adequate numbers and skilled staff? [Note: as budget lines for MADs are possibly not broken down for each location and may be for all similar work within Oyo State, rather than the IUFMP area only, the question needs to be asked whether what is received is enough for the whole of the Oyo State or would it be insufficient to cover Ibadan metropolitan area only, or not adequate even if all devoted to Ibadan alone. If there is a shortage, how much is required. • Are there ways, in the opinion of WAE, whereby dumping in the drainage system might be minimized. Some way the "polluter pays" principle can be used?
5	Section 4 a	DEEB's functions	• Could any of the functions of DEEB be more effectively (ie at less cost, or more complete using same budget) provided by the private sector? For example: ▪ could they contract out all design work? ▪ Contract out clearance and maintenance work? • If the work was contracted out, what core staff would be required to prepare the TOR and supervise the contractors? • Alternatively, could the OSME&WR use its professional staff more 'flexibly'? For example, the staff of the DEEB and the DPM&ES and even the DES might share staff, depending on the work load and priorities of the Ministry?
6	Fig 1, Section 2	Update PIU structure	Comments from the Bank: • The current PIU structure is not as given. The Technical Committee does not oversee the PIU. • What is meant by the 'Technical Assistance Team? • There is no Technical Steering Committee, is this the Project Steering Committee? • The Project Management Consultancy Technical Assistance was never put in place • Is the project Technical Committee the Independent Advisory Group? (this has an advisory function and not a supervisory one)
			• Identify the consultants that work with the specialists in the PIU. • Identify from which agency, each civil servant seconded to the PIU, was seconded from. • Would it be possible in the opinion of the head of the PIU for staff from the agencies to be rotated so as the increase the capacity of the existing MADs?
7	Table 1, section 3a.	Channelization and other issues	• Is this dredging of canals, rivers, streams etc,. Or something else? Question aimed at DEEB who gave us this term. • Are maintenance and dredging of silt from behind dams part of responsibility of DEEB? If not who? (if no MDA then clarify this) • Are there currently contracts (or were there, in which case are they planning to contract out this work) to the private sector to maintain dams and clear silt? • Are DEEB responsible for dredging of river beds? If not, who? (If no MDA state clearly). Do they do it themselves or do they contract the work out?
8	Section section 4 d (i)	Oyo GIS contract	Please provide details of work covered, geographical scope of contract (all/part of Ibadan and if so which parts) and its current status. Copy of TOR for contract and details of how far they have got Question for BPPDC and or Lands or Surveyor General's Office
9	Section 4. d(iii)	OSWC	Tractabel have apparently prepared a draft O&M plan for Eleyele Dam. Need to know • What do they recommend for the maintenance of the Dams? • What do they recommend for increasing the capacity of the OSWC or DEEB to maintain the dams? ▪ Do they recommend how this can be paid for? If so, how? If Tractabel has prepared a report on these issues for OS, please can you get a soft copy and send to me?
10		OSWC funding	While the OSWC is financially dependent on the State budget, • how much revenue is collected for the 30% of the coverage supplied. • Have the rates been considered in terms of adequacy? When was the last revision in the charges made? What proportion of the costs are covered? ▪ total running costs ▪ operational costs
11	Section 4 c & Section 4 h (v)	BPPCD and Department of Budget OSMF&B	• It is stated trained planners from other departments "cannot be re-located because in their new positions their salaries would need to be increased and

			the positions they vacated would in many cases need to be filled". Can this be confirmed by the DG of BPPCD and Department of Budget, OSMF&B? • Ask Budget to verify the revenues generated by BPPDC and compare this with total Budget allocation to BPPDC in FY 2017/18
12	Section 3 h (vii)	OSEMA	• What is the contents of the Vulnerability Capacity Assessment proposed? (If possible request a soft copy of the TOR for this so it can be compared with the risk assessment undertaken by DAH for IUFMP) • Does this differ from flood risk assessment in undertaken in IUFMP? • Seek additional information on the Emergency Response Team of OSEMA. What staff are there, positions and skills, equipment, location(s). • Do they duplicate some of the emergency services, or are they additional? This is important because one of the main functions of OSEMA is rescue and recovery post disaster. • Do they need more equipment and if so why?
13.	Section 5	PIU	• Seconded staff are on performance-based contracts to achieve stipends. Can this be explained, how it works? • It is reported that PIU have undertaken dredging. ▪ How did they organize this? Through contracts? ▪ How were contractors chosen? ▪ How did they manage final disposal of material cleared? ▪ What are the relevant lessons learned that might be applied to framework contracts after the project is completed?
14.		PIU – education and communications campaigns	• Please get a list of those used • What proportion of population targeted? • Degree of success? Problems? Lessons learned?

Annex

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Sustainable Drainage Measures

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1. Introduction

1.1. Overview

Constructing the conventional surface water drainage systems (protection measures) has always been the primary response to urban drainage problems. These measures capture and transfer the water to defined receiving areas. When properly designed, constructed and maintained these systems have dealt well with flooding issues.

More recently, drainage planning has required to address these issues in an integrated fashion, using designs and technologies that reduce the scale of the problem at source and restrict flows in a fashion that closely mimics the natural environment. Depending on the location, systems may be selected in isolation, or more commonly in conjunction, from a raft of measures or Best Management Practices (BMPs). Such systems are often termed Sustainable Drainage Systems (SUDS).

The Ibadan drainage master plan focused on development of the surface water drainage systems (protection measures) in line with the ideals of the Sustainable Drainage Systems (SUDS). The concept of SUDS is to either divert surface water runoff from paved areas to groundwater via permeable paving, soakaways or filter drains or to attenuate on-site the stormwater. Attenuation slows down storm events through storage.

Appropriately designed, constructed and maintained, SUDS are more sustainable than conventional drainage methods because they can mitigate many of the adverse effects of urban stormwater runoff to the environment. This can be achieved through:

- Reducing runoff rates, thus reducing the risk of downstream flooding
- Reducing the additional runoff volumes and runoff frequencies that tend to be increased as a result of urbanization, and which can exacerbate flood risk and damage receiving water quality
- Encouraging natural groundwater recharge (where appropriate) to minimize the impacts on aquifers
- Reducing pollutant concentrations in stormwater, thus protecting the quality of the receiving body
- Acting as a buffer for accidental spills by preventing direct discharge of high concentrations of contaminants to the receiving water body
- Contributing to the enhanced amenity and aesthetic value of developed areas

In addition, the SUDS system considers the following:

1- Development of IDF curves that considers up-to-date rainfall records to accommodate all expected increase in rainfall intensities.
2- Reserve the water bodies' right of way and boundaries as much as possible.
3- Limit the drainage system by the natural slopes and lowlands, and the low infiltration rates in the project area
4- All floods generated from outside the project area should be contained within the natural streams and discharged directly to the water bodies (ocean or lakes).

However, SUDS systems do not eliminate runoff volume. It only reduces the peak runoff rate. So, drainage systems are designed to convey a pre-controlled storm runoff. In this case, built-up areas should be limited according to certain polices. Such laws can be set by institutional regulations or governmental decrees to ensure non-encroachment on green areas.

1.2. SUDS Design Context

Given the factors influencing drainage within Ibadan, the Design Context objectives for SUDS are:

- Primarily surface water flow management
- Secondarily water quality management

Appropriately designed, constructed and maintained SUDS are an important tool for mitigating many of the adverse effects on the environment of stormwater runoff.

Choosing the appropriate systems (green storm water schemes) can, however, be difficult. Geological, hydrological, environmental, cost, man-made and location factors must be considered, to ensure the most appropriate technologies are employed.

1.3. Green Storm Water Systems Selection

In selecting and assessing the green systems that may be used within a SUDS scheme a number of factors should be considered:

- Characteristics (land uses) of the catchment to be served
- Available land and land prices
- Design management objective
- Soil type and cover (horizon depth)
- Slope
- Hydrogeological conditions (water table depth and water quality)

- Maintenance capacity of local authority / management companies etc
- Materials availability and cost
- Health and safety issues (e.g. mosquito breeding grounds, odour, water safety hazards)
- Socio- cultural factors
- Visual impacts

1.4. Green Storm water Systems Classification

The systems are classified into one of three broad types:

1.4.1. Runoff Capture at Source

These technologies are intended to reduce the peak rate of flow/volume of runoff generated during rainfall events. They work by capturing and retaining a percentage of the rainfall that may fall in a catchment at the point of fall. Such measures include permeable pavements, green roofs, localised harvesting (rain barrels and cisterns) and dry wells.

1.4.2. Detention and Retention of Peak Flow

Detention systems temporarily store runoff, and then allow discharge through a pipe or other outlet structure into a receiving channel. A variety of forms of detention systems exist but they are all variants of a depression that collects water.

Retention systems store runoff indefinitely allowing discharge only during periods of excess water (beyond storage capacity), and usually via a spillway or other overflow facility. Water stored in the pond may be re-used or allowed to evaporate off or discharged through pumping to the downstream depending on the design objective. In all such cases the system would be designed with that objective in mind.

A fundamental consideration in all detention and retention systems is the area required to effectively contain and attenuate peak flows.

Water channel/transfer systems that transfer water to the detention and retention systems may also be used to restrict water flow and temporarily store water.

1.4.3. Treatment of Captured Flow

Capture and treat technologies are among the more difficult to categorise. They range from "natural" filtration technologies such as constructed wetlands, basins, sand filters and grassed strips, to engineered flotation technologies such as water quality inlets, continuous deflection separation, and prefabricated structures, such as oil separators or Stormceptors[1].

[1] A stormceptor is a manhole device that can intercept storm flow before the main trunk, removing sediment and oil at the secondary network stage.

A well-designed SUDS system will comprise a mixture of the three types and may be applied across variable scales, i.e. individual buildings, small residential developments, Master plans etc.

1.5. Green Storm Water Systems

The systems that are most applicable on the Master Plan level are the retention and detention ponds. Actually, all the greens systems should be considered while introducing the new developments in the area.

The following sections address the application of SUDS Best Management Practices in Ibadan.

1.5.1. Ponds

Stormwater detentions are temporary storage of runoff in underground containers, ponds, basins, or depressions. Stormwater detention is typically necessary in new developments where higher runoff rates occur because of the increased impervious areas (streets, driveways, roofs, sidewalks etc.).

Two common classifications of ponds are either "wet" or "dry." Wet ponds, known as retention ponds, continually have a pool of water in them called dead storage. Dry ponds, detention ponds, do not have dead storage and dry out between storms

- Both types of ponds provide both stormwater attenuation and treatment.
- These ponds are designed to detain the water for a certain amount of time and keep the runoff to a desired rate. When the rain ends, the water in the detention pond will empty shortly afterwards.
- This method is mainly used for flood control, when large amounts of rain could cause flash flooding if not dealt with properly.
- It highly reduces runoff volume and can accommodate a storm with a 100-year return period.
- The attenuation can be achieved by proposing of a set of detention ponds adjacent to the proposed channels.
- These ponding areas are selected in undeveloped land locations where expropriation for land is at the low side.
- These ponds can be made use of as business opportunity projects if developed into recreational areas for visitors and tourists.

Unfortunately, they invite mosquitoes and require a high land take. In addition, they have a high risk for health and safety and may result in fencing and isolation of the ponds.

Impounding reservoirs upstream proposed dikes are proposed in the Master Plan to reduce and control storm run-off water as close as possible to its origin, and before it enters a watercourse.

1.5.2. Wetlands

These wetlands are shallow ponds and marshy areas, covered entirely in vegetation. They provide both stormwater attenuation and treatment.

Unfortunately, it invites mosquitoes and requires a high land take. In addition, they have a high risk for health and safety and may result in fencing and isolation of the wetland.

This method has a little reduction in the runoff volume and peak flow could be applied on the Local Level

1.5.3. Rainwater Harvesting

Rainwater Harvesting captures and stores water during rainfall events.

- Equipment can include barrels and tanks.
- Systems can be designed to maximize capture from roofs and hard surfaces during extreme events, which significantly contribute to runoff reduction.

Unfortunately, it has potential risks to public health, water quality / maintenance can be an issue if it is reused for domestic purposes. In addition, regular inspection and cleaning of collection systems is required.

This method reduces runoff volume and peak flow, it could be applied but it is not practical.

1.5.4. Bio-Retention Areas

These are vegetated areas for collecting & treating water from small drainage areas

- They contain a gravel layer that filters and treats runoff
- They are referred to as rain gardens or bio filters.
- They can be planned as landscaping features
- They are very effective in removing urban pollutants

Unfortunately, it is susceptible to clogging if the surrounding landscape is poorly managed

In addition, it is not suitable for areas with steep slopes and requires a high land take which is not suitable in highly dense urbanized areas

This method reduces runoff volume and peak flow, it could be applied in the Master Plan but with care as it needs regular inspection.

1.5.5. Site Layout Management

The concept of this system is a good design for site roads and buildings to help in minimizing impervious surfaces. Roads and buildings onsite should follow natural landforms wherever possible.

- Natural drainage paths should be preserved by appropriate design of road layouts and buildings
- Filling or grading of natural depressions and ponding areas should be avoided
- Clearing and grading of site should be kept to a minimum
- Open space should be maximized.

This method reduces runoff volume and peak flow, but it can be only applicable on a local level as there is no space in highly dense urbanized areas.

1.5.6. Green Roofs

Green roofs comprise vegetation cover over a geotextile drainage layer. They cover roof surface space and are designed to intercept and retain precipitation, reducing the volume of runoff.

- Multiple (hydraulic) outlets are needed to reduce risks from blockages
- Lightweight soil and appropriate vegetation are needed
- It provides cooling in the summer and insulation in the winter
- It is not appropriate for steep roofs
- In addition, maintenance of roof vegetation is important

This method reduces runoff volume and peak flow, but it can be only applicable on a local level for its cost when compared to conventional runoff systems

1.5.7. Networks (Ditches & Pipes)

These networks provide conveyance and drainage connectivity

- Pipe sizes should be not be less than 150mm in diameter
- Pipes can be perforated, to allow infiltration

Unfortunately, they have a high risk of clogging and require detailed modelling of the drainage system.

This method reduces runoff volume and peak flow and could be applied in the Master Plan and on the Local Level.

1.5.8. Swales

Swales are long, shallow channels used to store and convey surface run-off. They can be vegetated or filled with gravel. Depending on the design of the system, they allow infiltration and reduction in flow rates.

Unfortunately, they have high clogging potential and are not suitable in sites with fine clays/silts or dense urban areas.

Swales are not applicable generally in Ibadan for the following reasons:

- Soil has low permeability
- No space in highly dense urban areas

1.5.9. Filter Drains

Filter drains are trenches that are filled with permeable material.

- They collect surface water from paved areas into trenches
- A slotted or perforated pipe may be built into the base of the trench to collect and convey the water.

Unfortunately, they have high clogging potential and are not suitable in sites with fine clays/silts.

In addition, regular inspection and cleaning of collection systems is required

This method reduces runoff volume and peak flow but could not be applied due to poor soil infiltration.

1.5.10. Soakaways

These are square or circular excavation areas for draining runoff.

- They are porous underground wells that stores runoff & allows water to slowly soak into the ground
- A minimum distance of 1m from its base is required from the high groundwater table

This method reduces runoff volume and peak flow but could not be applied due to poor soil infiltration (low permeability).

1.5.11. Permeable Surfaces

Permeable surfaces are generally pavements, suitable for people and traffic.

- They allow water infiltration through the surface and into the subsoil.
- The water is temporarily stored before infiltration to the ground.

Unfortunately, it has a risk of clogging and weed growth if poorly maintained.

This method reduces runoff volume and peak flow but could not be applied due to poor soil infiltration (low permeability) and high ground water table.

1.5.12. Infiltration Trench

Infiltration trenches are shallow excavations filled with rubble or rocks that create temporary subsurface storage for storm water. They allow runoff to transfer into the surrounding soils from the bottom and sides of the trench.

Unfortunately, they have a high risk of clogging potential and cannot be applied for sites with fine particle soils (clays/silts)

Infiltration trenches are not applicable generally in Ibadan for the following reasons:

- Soil has low permeability
- No space in highly dense urban areas
- High clogging potential
- Cannot be used for sites with fine particle soils (clays/silts)

1.5.13. Infiltration Basins

Infiltration Basins are shallow basins that stores runoff and infiltrate it gradually into the ground, they can be vegetated or filled with gravel.

Unfortunately, they have a high risk of clogging potential and weed growth. In addition, regular inspection and cleaning of collection systems is required

This method reduces runoff volume and peak flow, but could not be applied due to poor soil infiltration (low permeability) and high ground water table

1.5.14. Geocellular/Modular Systems

Geocellular Systems are constructed with a high void ratio that allows high capacity storage of water and infiltration. They are cost-effective and easy to install

Unfortunately, they have a high risk of clogging potential and materials can be expensive. In addition, regular inspection and cleaning of collection systems is required

Table 1.1 lists a summary of the green storm water system and whether it is applicable to be applied in Ibadan or not.

Table 1.1: Applicability of green storm water system in Ibadan

Green system	Description	Applicability (level)
Pond	Retention or detention ponds to attenuate the flow (it could help in treating water)	Applicable (master plan level, and local level)
Wetland	Ponds with aquatic vegetation	Applicable (master plan level and local level)
Rainwater harvesting (on-plot)	Capture water for reuse from hard surfaces	Could be applied but again not practical (local level)
Bio-retention areas	Vegetated areas for collecting, treating water before discharge	Applicable (local level, it could also be applied on master plan level but with care)
Site layout Management	Conservation of natural drainage paths Minimise use of impervious surfaces Filling of natural depressions avoided	Applicable (Local level)
Green Roofs	Vegetated roofs that reduce runoff volume and rate	Could be applied however it has limitations and requires lots of preparation. (local level)
Networks (ditches, pipes, etc.)	Interconnected ditches for transferring rainfall runoff from collection areas	Applicable (Local and master plan level)
Swale (lined and unlined)	Shallow channels that conduct/ retain water	Not applicable could also be applied on the local level
Filter Drain	Linear drain/ trench filled with a permeable material	Not applicable
Soakaway	Subsurface structure to store and dispose water	Not applicable
Permeable surfaces	Allow inflow of rainwater into underlying soil	Not applicable
Infiltration Trench	Drain/trench that allows infiltration through base and sides	Not applicable
Infiltration Basin	Small depressions that store and dispose of water via infiltration	Not applicable
Geocellular System	Water infiltrates void areas and is stored	Not applicable
Silt removal devices	Device to remove silt, suspended solids and hydrocarbons	Applicable (local level)
Detention Basin	Dry depression designed to store water for a specified time	Applied with care (master plan level and local level)
Filter Strip	Sloping, vegetated strips designed to drain water	Not Applicable
Sand Filter	Treatment device using sand beds	Applicable (local level)

1.6. Final considerations

Like all other drainage systems, the SUDS system has its advantages and disadvantages where the advantages are much more beneficial than the disadvantages. Among the different systems presented in this chapter, diverse positive points become evident, and among them are:

- Have positive aquatic ecosystems and positive environmental impacts
- Creation of leisure areas and a better landscaping aspect for cities.
- Reduces surface runoff and flooding risks
- Retaining of rainwater for later use in less refined activities (watering gardens, flushing toilets in bathrooms, washing sidewalks, etc.);

Nevertheless, the challenges that must be overcome for improvement in performance and incentive for application of these systems must be kept in mind. Among the main problems are:

- Need for frequent maintenance;
- In general, these systems have a high risk of clogging potential.
- Increased health safety risk as a result of ponds and wetlands

In spite of being relatively new compared to the traditional system of urban drainage, SUDS already present diverse implemented systems in operation as an alternative for improving urban drainage, effectively reducing peak flows of human creation. Although still little applied in Africa, SUDS is being studied and applied in diverse developed countries.

Therefore, it may be concluded that the application of SUDS systems means evolution in drainage systems, and results in improvement of quality of life for the population involved. It renews the search for sustainable environments in urban areas.

1.7. SUDS Systems Applicable to Ibadan

Appropriately designed, constructed and maintained SUDS are an important tool for mitigating many of the adverse effects on the environment of stormwater runoff. Choosing the appropriate SUDS systems can, however, be difficult. Geological, hydrological, environmental, cost, man-made and location factors must be considered, to ensure the most appropriate technologies are employed.

The following sections address the application of SUDS Best Management Practices in Ibadan, with an overview of the key characteristics associated with each technique so that the benefits and risks of each technique can be better understood.

Each technique is presented as a data sheet, containing:

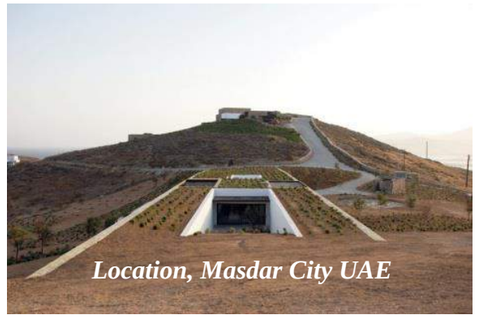
1) **Description of the technique** - to identify its purpose
2) **Picture** - showing an example of the application in use
3) **Key design criteria** - denotes specific considerations at the siting, design and construction stages
4) **Advantages** - highlights the benefits of the technique
5) **Disadvantages** - notes design and performance related issues, such as land take or irrigation requirements
6) **Performance** - indicates the techniques potential for flow attenuation and treatment
7) **Treatment Train Suitability** - notes suitability as a primary or secondary treatment technique
8) **Site Suitability** - confirms the techniques suitability in different land uses, such as residential and commercial/industrial
9) **Cost Implications** - indicates if land take, capital and maintenance costs are expected to be high
10) **Pollutant Removal** - notes the techniques' treatment, or not, of total suspended solids, nutrients and heavy metals
11) **Key Maintenance Requirements** - lists any maintenance considerations, such as debris removal

2 SITE LAYOUT

2.1 DESCRIPTION

Site layout includes two concepts:

- Good design for site roads and buildings to help minimise impervious surfaces, as they prevent infiltration and increase runoff and pollutant loadings e.g. ensuring bunding of above ground oil or chemical storage tanks.
- Good site management techniques to manage the quantity and/or quality of the runoff at source. For example; frequent weeping of impervious surfaces to reduce pollution build up, minimising the application of chemicals on landscaped areas, and ensuring adequate procedures are in place to deal quickly with spillage of materials using dry rather than wet techniques.


Location, Masdar City UAE

2.2 KEY DESIGN CRITERIA

- Review development Masterplan and implement pollution prevention and optimum site layout and design, wherever possible
- Roads and buildings onsite should follow natural landforms wherever possible
- Natural drainage paths should be preserved by appropriate design of road layouts and buildings
- Clearing and grading of site should be kept to a minimum
- Filling or grading of natural depressions and ponding areas should be avoided
- Open space should be maximised, and integrated with drainage design wherever possible

ADVANTAGES • Manage stormwater (quantity and quality) as close to source as possible • Prevent potential damaging impacts rather than mitigating them • Offers simple, non-structural methods for runoff management (that are often lower cost and lower maintenance than structural controls) • Reduced construction costs • Increased property values • More open space • More pedestrian/user-friendly environments • More aesthetically pleasing and naturally attractive landscapes • Integration of biodiversity and habitat provision	**PERFORMANCE** • Peak flow reduction • Volume reduction • Water quality treatment • Amenity potential • Ecology potential **TREATMENT TRAIN SUITABILITY** • Source control • Conveyance • Site system • Regional system **SITE SUITABILITY** • Residential • Commercial/industrial • High density • Retrofit • Contaminated sites/sites above vulnerable groundwater **COST IMPLICATIONS** • Land take • Capital cost • Maintenance **POLLUTANT REMOVAL** • Total suspended solids • Nutrients • Heavy metals	Excellent Excellent Excellent Excellent Excellent Yes Yes Yes Yes Yes Yes Yes Yes Yes Low-High (depends on site design & procedures) Medium-High (depends on site design & procedures)
DISADVANTAGES • Risk of silt blockage • Disposal areas required • Silt can be toxic, safe waste management required • Non-manual methods can be expensive • Effectiveness during high flow conditions varies		
KEY MAINTENANCE REQUIREMENTS • Varies depending on site design		

3 GREEN ROOFS

3.1 DESCRIPTION

Green roofs comprise vegetation cover over a geotextile drainage layer. They cover roof surface space and are designed to intercept and retain precipitation, reducing the volume of runoff.

3.2 KEY DESIGN CRITERIA

Design for interception storage

- Minimum roof pitch of 1 in 80, maximum 1 in 3 (unless specific design features are included)
- Structural roof strength must provided for the full additional load of saturated green roof elements
- Multiple (hydraulic) outlets to reduce risks from blockages
- Lightweight soil medium and appropriate vegetation

ADVANTAGES	
• Can generate aesthetic qualities	
• Typical soil type has a high retention capacity	
• Additional advantages can include energy efficiency (from cooling in the summer and added insulation in the winter), reduction of the 'Urban Heat Island Effect", sound insulation and amenity value.	
DISADVANTAGES	
• As with water harvesting limited effect unless wide scale implementation	
• Not popular solutions for developers	
• Cost (when compared to conventional runoff systems)	
• Not appropriate for steep roofs	
• Maintenance of roof vegetation important, especially to avoid damage to roof lining/ structure	
PERFORMANCE	
• Peak flow reduction	Medium
• Volume reduction	Medium
• Water quality treatment	Good
• Amenity potential	Good
• Ecology potential	Good
TREATMENT TRAIN SUITABILITY	
• Source control	Yes
• Conveyance	No
• Site system	No
• Regional system	No
SITE SUITABILITY	
• Residential	Yes
• Commercial/industrial	Yes
• High density	Yes
• Retrofit	No
• Contaminated sites/sites above vulnerable groundwater	Yes
COST IMPLICATIONS	
• Land take	None
• Capital cost	Low-High (depending on roof type and capacity)
• Maintenance	Medium
POLLUTANT REMOVAL	
• Total suspended solids	Medium
• Nutrients	High
• Heavy metals	Medium
KEY MAINTENANCE REQUIREMENTS	
• Irrigation during establishment of vegetation	
• Litter removal	
• Inspection for bare patches and replacement of plants	

4 RAINWATER HARVESTING (ON-PLOT)

4.1 DESCRIPTION

Structures are created to capture and store water during rainfall events for non-potable water supply.
Equipment can include cisterns, barrels and tanks. Systems can be designed to maximise capture from roofs and hard surfaces during extreme events, and can significantly contribute to runoff reduction.

4.2 KEY DESIGN CRITERIA

- Design dependent on demand requirements, contributing surface area, stormwater management requirements, and seasonal rainfall characteristics
- First flush often diverted away from tank

ADVANTAGES	
• With careful design, can provide source control of stormwater runoff	
• Reduces demand on mains water	
• Structures can be at surface or subsurface	
• Simple to install and low cost	
• Potential reuse of water	
DISADVANTAGES	
• Negligible impact unless incorporated into a system wide suite of measures and adopted by all households	
• Water quality / maintenance can be an issue if reuse is for domestic purposes	
• Potential risks to public health	
• May lack aesthetic appeal and require additional costs to mitigate impacts (e.g. Camouflage structures)	
• Larger scale systems can be complex and costly to install	
PERFORMANCE	
• Peak flow reduction	High
• Volume reduction	High
• Water quality treatment	Poor
• Amenity potential	Poor
• Ecology potential	Poor
TREATMENT TRAIN SUITABILITY	
• Source control	Yes
• Conveyance	No
• Site system	No
• Regional system	No
SITE SUITABILITY	
• Residential	Yes
• Commercial/industrial	Yes
• High density	Yes
• Retrofit	Yes
• Contaminated sites/sites above vulnerable groundwater	Yes
COST IMPLICATIONS	
• Land take	None
• Capital cost	High
• Maintenance	Medium
POLLUTANT REMOVAL	
• Total suspended solids	High
• Nutrients	Low
• Heavy metals	Low
KEY MAINTENANCE REQUIREMENTS	
• Regular inspection and cleaning of collection systems, filters, valves and pumps	

5 PERMEABLE SURFACES

5.1 DESCRIPTION

Pervious surfaces are generally pavements, suitable for pedestrian and/or vehicular traffic, that allow water infiltration through the surface and into the subsoil. The water is temporarily stored before infiltration to the ground, reuse, or discharge to a watercourse or other drainage system.
Different concrete, asphalt, synthetic plastic and grass surface/paving types are available, offering different levels of infiltration (e.g. total infiltration, partial infiltration).

Location: North Carolina,

5.2 DESIGN CRITERIA

- Pervious surfaces and sub-base to be structurally designed for site purpose and design vehicular loading
- Surface infiltration rate should normally be an order of magnitude greater than the design rainfall intensity
- Temporary subsurface storage volume to meet requirements for infiltration and /or controlled discharge
- Geotextile may be specified as a filtration treatment component near the top of the structure
- Soil and other material must be prevented from contaminating the pavement surface and substructure

ADVANTAGES

- Effective in removing urban runoff pollutants
- Lined systems can be used where infiltration is not desirable, or where soil integrity would be compromised (allows for capture and treatment)
- No additional land take, allows dual use of space
- Easily available materials
- Visually acceptable
- Can be built/integrated into other storm water management systems
- Estidama compliant
- Good community acceptability
- Surfaces are generally proven to be effective, and have a wide application of uses in car parking/hardscape areas

DISADVANTAGES

- Cannot be used where large sediment loads may be washed/carried onto the surface
- Risk of long term clogging and weed growth if poorly maintained
- Surfaces can be easily damaged
- The performance of porous pavements is not proven (suffer from blockages of pores), especially if used on heavily trafficked urban roads.
- Economies of scale are not present (can be 2-3 times the cost of conventional asphalt paving)

PERFORMANCE

Peak flow reduction	Good
Volume reduction	Good
Water quality treatment	Good
Amenity potential	Poor
Ecology potential	Poor

TREATMENT TRAIN SUITABILITY

Source control	Yes
Conveyance	No
Site system	Yes
Regional system	No

SITE SUITABILITY

Residential	Yes
Commercial/industrial	Yes
High density	Yes
Retrofit	Yes
Contaminated sites/sites above vulnerable groundwater (with liner)	Yes

COST IMPLICATIONS

Land take	Low
Capital cost	Mediun
Maintenance	Low

POLLUTANT REMOVAL

Total suspended solids	High
Nutrients	High
Heavy metals	High

KEY MAINTENANCE REQUIREMENTS

- Sweeping
- Regular brushing and vacuuming

6 SILT REMOVAL DEVICES

6.1 DESCRIPTION

A manhole or similar prefabricated structure used to remove silt from runoff. Normally, the devices have an integrated lower storage/separation chamber (where the oils and liquids separate and suspended solids settle to the bottom) and an upper by-pass chamber to allow normal flow to continue.

Location: San Diego, USA

6.2 KEY DESIGN CRITERIA

- Establish appropriate silt removal frequencies
- Maintenance and monitoring plan should be developed during the design phase.

ADVANTAGES

- Useful in areas where silt accumulation risks are significant
- Filters a wide range of pollutants e.g. oils, grime, silts
- Can be used as standalone device or part of a SUDS treatment plan e.g. with an urban wetland to remove development pollutants
- Allows for pollutant storage
- Located underground
- Suited to urban catchments up to 5 ha
- Minimises need for excavation de-silting e.g. from ponds

DISADVANTAGES

- Risk of silt blockage
- Disposal areas required
- Silt can be toxic, controlled waste disposal required
- Variable effectiveness during high flow conditions

PERFORMANCE

Peak flow reduction	Poor
Volume reduction	Poor
Water quality treatment	Good
Amenity potential	n/a
Ecology potential	n/a

TREATMENT TRAIN SUITABILITY

Source control	Yes
Conveyance	No
Site system	No
Regional system	No

SITE SUITABILITY

Residential	Yes
Commercial/industrial	Yes
High density	Yes
Retrofit	Yes
Contaminated sites/sites above vulnerable groundwater	Yes

COST IMPLICATIONS

Land take	Low
Capital cost	High
Maintenance	High

POLLUTANT REMOVAL

Total suspended solids	High
Nutrients	Low
Heavy metals	Low

KEY MAINTENANCE REQUIREMENTS
Inspection for silt blockages and removal where necessary

7 FILTER DRAINS

7.1 DESCRIPTION

Filter drains are trenches that are filled with permeable material. Surface water from the edge of paved areas flows into the trenches, is filtered and conveyed to other parts of the site. A slotted or perforated pipe may be built into the base of the trench to collect and convey the water.

7.2 KEY DESIGN CRITERIA

- Excavated trench 1-2m depth filled with stone aggregate
- Effective upstream pre-treatment to remove sediment and file silts
- Observation/access points for maintenance of perforated pipe components

ADVANTAGES	**PERFORMANCE**	
• Used to filter and covey stormwater	• Peak flow reduction	Medium
• Reduces pollutant load discharged to receiving areas	• Volume reduction	Low
• Can be easily incorporated into site landscaping and fit well beside roads	• Water quality treatment	High
	• Amenity potential	Low
	• Ecology potential	Low
DISADVANTAGES	**TREATMENT TRAIN SUITABILITY**	
• High clogging potential without effective pre-treatment	• Source control	No
• Not suitable in sites with fine clays/silts in upstream catchments	• Conveyance	Yes
• Build-up of pollution/blockages difficult to see	• Site system	No
• High historic failure rate due to poor maintenance, wrong siting or high debris input	• Regional system	No
	SITE SUITABILITY	
• Limited to relatively small catchments	• Residential	
• High cost of replacing filter material should blockage occur	• Commercial/industrial	Yes
	• High density	Yes
	• Retrofit	Yes
	• Contaminated sites/sites above vulnerable groundwater	Yes
	COST IMPLICATIONS	
	• Land take	Low
	• Capital cost	Medium (if liner required)
	• Maintenance	Medium
	POLLUTANT REMOVAL	
	• Total suspended solids	High
	• Nutrients	Low
	• Heavy metals	Low
KEY MAINTENANCE REQUIREMENTS		
• Regular inspection for signs of clogging		
• Removal of sediment from pre-treatment system		
• Removal and cleaning or replacement of stone		

8 SWALES

8.1 DESCRIPTION

Swales are long, shallow channels used to store and convey surface run-off. Depending on the design of the system, they can also allow or prohibit infiltration and reduction in flow rates.
Swale channels can be vegetated, comprising grass or other ground covering plant, or non-vegetated, comprising stabilised sand, rock and gravel (see image)

8.2 KEY DESIGN CRITERIA

- Limit velocities during extreme events to 1-2 m/s, depending on soil type, to prevent erosion
- Maintain flow height of water during frequent events below the top of the vegetation (typically 100mm)
- Maximum side slopes of 1 in 3 (where soil conditions allow)
- Minimum base width normally 0.5m

ADVANTAGES	**PERFORMANCE**	
Unvegetated	• Peak flow reduction	Medium
• No planting and therefore no supplementary irrigation requirements	• Volume reduction	Medium
• Erosion control	• Water quality treatment	Medium-Low
• Generally very low maintenance	• Amenity potential	Medium
• Easily integrated as a landscape feature	• Ecology potential	Medium-Low
Vegetated	**TREATMENT TRAIN SUITABILITY**	
• Easily integrated into irrigated landscape feature. If integrated into detention/retention basins, runoff is stored and reused or slowly discharged into stormwater collection system	• Source control	Yes
	• Conveyance	Yes
	• Site system	Yes
• Pollution/blockages are visible, easily trapped,	• Regional system	No
• Maintenance can be incorporated into general landscape management	**SITE SUITABILITY**	
	• Residential	Yes
	• Commercial/industrial	Yes
DISADVANTAGES	• High density	No
Unvegetated	• Retrofit	No
• Not suited to dense urban areas	• Contaminated sites/sites above vulnerable groundwater (with liner)	Yes
• Litter trap	**COST IMPLICATIONS**	
Vegetated	• Land take	High
• Intensive maintenance	• Capital cost	Low (Medium if vegetated)
• Not well suited to arid climates	• Maintenance	Medium
• Aesthetics – litter trap	**POLLUTANT REMOVAL**	
• Not suited to steep areas	• Total suspended solids	High
• Limited opportunities to use trees for landscaping	• Nutrients	Low
• Risk of blockages in connecting pipework	• Heavy metals	Medium
KEY MAINTENANCE REQUIREMENTS		
• Litter removal, repair of eroded or damaged areas		
• Grass cutting and removal of cuttings, if vegetated		
• Clearing of inlets, culvers and outlets from debris and sediment		

9 PIPE NETWORKS

9.1 DESCRIPTION

Pipes are commonly used to provide conveyance and drainage connectivity for a site.

Location: Birmingham,

9.2 KEY DESIGN CRITERIA

- Pipe size and depth to be appropriate for stormwater network, using runoff rates calculated for the development and checked against hydrograph methods (drainage methods)
- Size should be at least 150mm in diameter
- Not laid flatter than 1 in 150
- Should be designed on the premise that all hard surfaces contribute runoff at the normal rate, even it if is attenuated or reduced in volume by other SUDS components

ADVANTAGES	
• Can absorb rainfall in the region of 30-50mm/hr (residential uses)	
• Flexible in design, suitable for range of land uses e.g. agriculture, residential, commercial	
• Complement other SUDS techniques, e.g. runoff from swales	
• Located above or below ground	
• Pipes can be perforated, to allow infiltration	
DISADVANTAGES	
• Risk of long term failure/flooding due to pipe capacities being overloaded by high rainfall events	
• Network can require modifications, may require authority approval	
• Detailed modelling of the drainage system can be required for larger/complex systems	
PERFORMANCE	
• Peak flow reduction	Good
• Volume reduction	Poor
• Water quality treatment	n/a
• Amenity potential	n/a
• Ecology potential	n/a
TREATMENT TRAIN SUITABILITY	
• Source control	No
• Conveyance	Yes
• Site system	Yes
• Regional system	Yes
SITE SUITABILITY	
• Residential	Yes
• Commercial/industrial	Yes
• High density	Yes
• Retrofit	Yes
• Contaminated sites/sites above vulnerable groundwater	Yes
COST IMPLICATIONS	
• Land take	Low
• Capital cost	High
• Maintenance	Low/Medium
POLLUTANT REMOVAL	
• Total suspended solids	n/a
• Nutrients	n/a
• Heavy metals	n/a
KEY MAINTENANCE REQUIREMENTS	
• Inspection for blockages	
• Debris removal from inlet/outlet	

10 FILTER STRIPS

10.1 DESCRIPTION

Filter strips are vegetated strips of land designed to accept runoff as overland flow from upstream developments. They lie between a hard-surfaced area and a receiving stream, surface water collection, treatment or disposal system. They treat runoff by vegetative filtering, and promote settlement of particulate pollutants and infiltration.

Location: North Carolina, USA

10.2 KEY DESIGN CRITERIA

- Recommended minimum width of 6m
- Runoff from an adjacent impervious area must be evenly distributed across the filter strip, with a water depth <50mm for the water quality treatment event
- Slopes not exceeding 1in 20, minimum 1in 50

ADVANTAGES	
• Well suited to implementation adjacent to large impervious areas	
• Encourages evaporation and can promote infiltration	
• Easy to construct and low construction cost	
• Effective pre-treatment option	
• Easily integrated into landscaping and can be designated to provide aesthetic benefits	
DISADVANTAGES	
• Large land requirement	
• Not suitable for steep sites	
• Not suitable for draining hotspot runoff or for locations where risk of groundwater contamination, unless infiltration is prevented	
• No significant attenuation or reduction of extreme event flows	
• Require irrigation	
PERFORMANCE	
• Peak flow reduction	Poor
• Volume reduction	Poor
• Water quality treatment	Medium
• Amenity potential	Low
• Ecology potential	Medium
TREATMENT TRAIN SUITABILITY	
• Source control	Yes
• Conveyance	No
• Site system	Yes
• Regional system	No
SITE SUITABILITY	
• Residential	Yes
• Commercial/industrial	Yes
• High density	Yes
• Retrofit	No
• Contaminated sites/sites above vulnerable groundwater (unless infiltration prevented)	No
COST IMPLICATIONS	
• Land take	High
• Capital cost	Low
• Maintenance	Low
POLLUTANT REMOVAL	
• Total suspended solids	Medium
• Nutrients	Medium
• Heavy metals	Medium
KEY MAINTENANCE REQUIREMENTS	
• Require irrigation	
• Mowing	
• Repair of eroded or damaged areas	

11 SAND FILTER

11.1 DESCRIPTION

Sand filters are composed of single or multi-chambered structures designed to treat surface water runoff. Run-off initially flow into a temporary ponding area above the filter, before flowing through a sedimentation chamber. The water then percolates through the sand bed, either into the underlying soil or into a collection system. They can be designed with an impervious lining or to allow infiltration, depending on the soil type. They are best suited to industrial or semi-industrial sites where storm water is likely to mix with surface pollutants before draining away.

11.2 KEY DESIGN CRITERIA

- Filter depths of 0.45 - 0.6m
- Sand sizes of 0.5 - 1.0mm
- Combined volume of sedimentation and filter chamber should provide >75% of treatment volume in temporary storage before filtration
- Minimum sedimentation chamber length: width ratio 2:1

ADVANTAGES • Offers flexibility of design • Very effective for removing TSS from run-off and can retain other contaminants • Suitable for retrofits and in tightly constrained urban locations • Possible use to achieve - Section PW-2 ‘ Storm Water Management’ of Estidama’s Pearl Community Rating System recommends the removal of 80% of TSS, 95% removal of litter, and 90% removal of hydrocarbons from rain water before entering any surface water removal network. **DISADVANTAGES** • Not recommended for areas with high sediment content in runoff • Long detention times can support algae growth and lead to filter clogging • Negative aesthetic appeal, possible odour problems • Not suitable for large catchment areas • High capital cost • The requirement for continuous maintenance, and the infrequency of rainfall would limit their yearlong effectiveness. • Generation of contaminated solid waste requiring appropriate disposal.	**PERFORMANCE** • Peak flow reduction — Poor • Volume reduction — Poor • Water quality treatment — Good • Amenity potential — Poor • Ecology potential — Poor **TREATEMENT TRAIN SUITABILITY** • Source control — No • Conveyance — No • Site system — Yes • Regional system — No **SITE SUITABILITY** • Residential — No • Commercial/industrial — Yes • High density — Yes • Retrofit — Yes • Contaminated sites/sites above vulnerable groundwater (with liner) — Yes **COST IMPLICATIONS** • Land take — Low • Capital cost — High • Maintenance — High **POLLUTANT REMOVAL** • Total suspended solids • Nutrients — High • Heavy metals — Low — High
KEY MAINTENANCE REQUIREMENTS • Regular performance inspection • Litter/debris removal	• Inlet/sedimentation basin cleaning • Replacement or rehabilitation of top filter layer • Vegetation management around filter	

12 RAINWATER HARVESTING (OFF-PLOT)

12.1 DESCRIPTION

The use of natural depression or creation of artificial terraces, swales and other features to reduce run-off speed and provide a landscaping feature.

12.2 KEY DESIGN CRITERIA

- Design dependent on demand requirements, contributing surface area, stormwater management requirements, and seasonal rainfall characteristics

ADVANTAGES • Simple to install and relatively low cost • Can make use of local materials • Can be used to promote traditional construction approaches/skills • Potentially very attractive landscape feature • Additional water attenuation by infiltration • **DISADVANTAGES** • Negligible impact unless incorporated into a system wide suite of measures • May require supplementary watering if landscaped	**PERFORMANCE** • Peak flow reduction — Medium • Volume reduction — Medium • Water quality treatment — Medium • Amenity potential — High • Ecology potential — High **TREATMENT TRAIN SUITABILITY** • Source control — Yes • Conveyance — Yes • Site system — Yes • Regional system — No **SITE SUITABILITY** • Residential — Yes • Commercial/industrial — Yes • High density — No • Retrofit — No • Contaminated sites/sites above vulnerable groundwater — No **COST IMPLICATIONS** • Land take — High • Capital cost — Low • Maintenance — Low **POLLUTANT REMOVAL** • Total suspended solids — Low • Nutrients — Low • Heavy metals — Low	
KEY MAINTENANCE REQUIREMENTS • Inspection and removal of debris from terraced areas • After heavy flood events, some maintenance of terraced/bank walls may be required		

13 INFILTRATION TRENCH

13.1 DESCRIPTION

Infiltration trenches are shallow excavations filled with rubble or rocks that create temporary subsurface storage for storm water. They allow runoff to transfer into the surrounding soils from the bottom and sides of the trench. They are smaller than infiltration basins, and generally do not have an outlet pipe.

Location: Rhode Island, USA

13.2 DESIGN CRITERIA

- Excavated trench 1-2m depth, filled with stone aggregate
- Effective upstream pre-treatment to remove sediment and fine silts
- Infiltration should not be used where groundwater is vulnerable or to drain pollution hotspots
- Observation wells/and or access points for maintenance of perforated pipe components

ADVANTAGES

- Infiltration can significantly reduce both runoff rates and volumes.
- Infiltration provides a significant reduction in the pollutant load discharged to receiving body
- Trenches can be incorporated easily into site landscaping and fit well beside roads

DISADVANTAGES

- High clogging potential without effective pre-treatment - not for sites with fine particled soils (clays/silts) in upstream catchment
- Build-up of pollution/blockages difficult to see
- High historic failure rate due to poor maintenance, wrong siting or high debris input
- Limited to relatively small catchments

PERFORMANCE

Peak flow reduction	Medium
Volume reduction	High
Water quality treatment	High
Amenity potential	Low
Ecology potential	Low

TREATMENT TRAIN SUITABILITY

Source control	Yes
Conveyance	Yes
Site system	No
Regional system	No

SITE SUITABILITY

Residential	Yes
Commercial/industrial	Yes
High density	Yes
Retrofit	Yes
Contaminated sites/sites above vulnerable groundwater (with liner)	No

COST IMPLICATIONS

Land take	Medium
Capital cost	Low (Medium if liner required)
Maintenance	Medium

POLLUTANT REMOVAL

Total suspended solids	High
Nutrients	Low/Medium
Heavy metals	High

KEY MAINTENANCE REQUIREMENTS

- Regular inspection for signs of clogging
- Removal of sediment from pre-treatment system
- Removal and cleaning or replacement of stone

14 SOAKAWAYS

14.1 DESCRIPTION

Soakaways are square or circular excavation areas for draining runoff. The supporting structure is filled with rubble/backfill, or lined with brickwork, pre-cast concrete, polyethylene rings or some other geocellular structure. They can be grouped together to drain large areas, such as highways

Location: Surrey, UK

14.2 KEY DESIGN CRITERIA

- Design to meet site drainage standards - generally 1 in 10 or 1 in 30 year flood event
- Site infiltration rate assumed for design should be based on appropriate site investigations and should include an appropriate factor of safety
- Appropriate pre-treatment is required
- If (back) fill is used, the material should provide >30% void space
- Minimum distance of 1m from the base to the seasonally high groundwater table
- Minimum distance of 5m from foundations

ADVANTAGES

- Minimal net land take
- Provides groundwater recharge
- Good volume reduction and peak flow attenuation
- Good community acceptability
- Easy to construct and operate
- Can be retrofitted

DISADVANTAGES

- Not suitable for poor draining soils
- Field investigations required to confirm infiltration rates
- Not suitable for locations where infiltrating water may put structural foundations at risk, or where infiltrating water may adversely affect existing drainage patterns
- Not appropriate for draining polluted runoff
- Increased risk of groundwater pollution
- Some uncertainty over long term performance

PERFORMANCE

Peak flow reduction	Good
Volume reduction	Good
Water quality treatment	Good
Amenity potential	Poor
Ecology potential	Poor

TREATMENT TRAIN SUITABILITY

Source control	Yes
Conveyance	No
Site system	Yes
Regional system	No

SITE SUITABILITY

Residential	Yes
Commercial/industrial	Yes
High density	Yes
Retrofit	Yes
Contaminated sites/sites above vulnerable groundwater	No

COST IMPLICATIONS

Land take	Low
Capital cost	Low
Maintenance	Low

POLLUTANT REMOVAL

Total suspended solids	Medium
Nutrients	Low
Heavy metals	Medium

KEY MAINTENANCE REQUIREMENTS

- Removal of sediments/debris from pre-treatment device
- Monitoring performance (using observation well)

15 BIORETENTION

15.1 DESCRIPTION

Bioretention areas are excavation cells with shallow surface depressions that can be used to capture, treat and infiltrate roof, road and parking lot runoff from small drainage areas. They contain a gravel layer along the bottom and a prepared soil bed above, that filters and treats runoff and provides a growing medium for specially selected vegetation planted on the surface. They are aimed at managing and treating runoff from frequent rainfall events, and can also be referred to as rain gardens, biofilters and bioswales.

Location: York, United Kingdom

15.2 KEY DESIGN CRITERIA

- Sufficient area to temporarily store the Water Quality Treatment Volume at a depth <0.15m on the surface
- The water quality treatment event should half drain within 24hrs to provide adequate capacity for multi-event scenarios
- Minimum depth to groundwater of 1m, if unlined
- Overflow/bypass facilities for extreme events

ADVANTAGES	**PERFORMANCE**	
• Can be planned as landscaping features	• Peak flow reduction	Medium
• Very effective in removing urban pollutants	• Volume reduction	Medium/High
• Can reduce volume and rate of runoff	• Water quality treatment	Good
• Flexile design, can fit into landscape	• Amenity potential	Good
	• Ecology potential	Medium
DISADVANTAGES	**TREATMENT TRAIN SUITABILITY**	
• Requires landscaping and management	• Source control	Yes
• Require regular rain fall events or irrigation	• Conveyance	No
• Susceptible to clogging if surrounding landscape is poorly managed	• Site system	Yes
• Not suitable for areas with steep slopes	• Regional system	No
	SITE SUITABILITY	
	• Residential	Yes
	• Commercial/industrial	Yes
	• High density	No
	• Retrofit	Yes
	• Contaminated sites/sites above vulnerable groundwater (with liner)	Yes
	COST IMPLICATIONS	
	• Land take	High
	• Capital cost	Low
	• Maintenance	Medium
	POLLUTANT REMOVAL	
	• Total suspended solids	High
	• Nutrients	Low
	• Heavy metals	High
KEY MAINTENANCE REQUIREMENTS		
• Regular inspection	• Replacement of mulch layer/vegetation management	
• Litter, debris removal	• Soil spiking and scarifying	

16 PONDS

16.1 DESCRIPTION

Ponds can provide both stormwater attenuation and treatment. They are designed to support emergent and submerged aquatic vegetation along their shoreline. Runoff from each rain event is detained and treated in the pool.
The retention time promotes pollutant removal through sedimentation and the opportunity for biological processes to reduce nutrient concentrations.

Location: Auckland, New Zealand

16.2 KEY DESIGN CRITERIA

- Permanent pool volume for water quality treatment
- Temporary storage volume for flow attenuation
- Upstream sediment pre-treatment
- Length: width ratio between 3:1 and 5:1Minimum depth for open water areas of 1.2m
- Maximum depth of permanent pool of 2m
- Side slopes <3:1 for slopes

ADVANTAGES	**PERFORMANCE**	
• Can cater for all storms e.g. 1 in 100 yr flood	• Peak flow reduction	Good
• Good removal capability of urban pollutants	• Volume reduction	Poor
• Can be used where groundwater is vulnerable, if lined	• Water quality treatment	Good
• Good community acceptability	• Amenity potential	Good
• High potential ecological aesthetic and amenity benefits	• Ecology potential	Good
• May add to local property values	**TREATMENT TRAIN SUITABILITY**	
	• Source control	No
DISADVANTAGES	• Conveyance	No
• No reduction in runoff volume	• Site system	Yes
• Anaerobic conditions can occur without regular inflow	• Regional system	Yes
• Land take may limit use in high density sites	**SITE SUITABILITY**	
• May not be suitable for steep sites, due to requirements for high embankments	• Residential	Yes
• Susceptible to colonisation by invasive species, leading to increased maintenance	• Commercial/industrial	Yes
• Perceived with health and safety risks, may lead to fencing and isolation of the pond	• High density	No
• Mosquitoes can be an issue	• Retrofit	No
	• Contaminated sites/sites above vulnerable groundwater (with liner)	Yes
	COST IMPLICATIONS	
	• Land take	High
	• Capital cost	Medium (High with liner)
	• Maintenance	Medium
	POLLUTANT REMOVAL	
	• Total suspended solids	High
	• Nutrients	Medium
	• Heavy metals	High
KEY MAINTENANCE REQUIREMENTS		
• Litter, debris removal	• Management of vegetation coverage	
• Inlet/outlet cleaning	• Sediment monitoring and removal when required	

17 WETLANDS

17.1 DESCRIPTION

Wetlands provide both stormwater attenuation and treatment. They comprise shallow ponds and marshy areas, covered almost entirely in aquatic vegetation.
Wetlands detain flows for an extended period to allow sediments to settle and promote the removal of contaminants by vegetation and aerobic decomposition.

Location: Port Fraser, Australia

17.2 KEY DESIGN CRITERIA

- Water quality treatment volume, detained within or above the permanent water body
- Shallow, temporary storage volume for attenuation
- Upstream sediment pre-treatment or equivalent
- Continuous baseflow
- Combination of deep and shallow areas (maximum depth <2m)
- Length: width ratio of greater than 3:1
- Shallow side slopes

ADVANTAGES	
• Significant ecological, aesthetic, amenity benefits	
• Good removal capability of urban pollutants	
• if lined, can be used where groundwater is vulnerable	
• Good community acceptability	
• Can add value to local property	
DISADVANTAGES	
• Land take is high	
• Requires baseflow	
• Limited depth range for flow attenuation	
• May release nutrients during non-growing season	
• Little reduction in runoff volume	
• Not suitable for steep sites	
• Susceptible to colonisation by invasive species, that can increase maintenance	
• Performance vulnerable to high sediment flows	
• Perceived health and safety risks may result in fencing and isolation of wetland	
• Mosquitoes can be an issue	
PERFORMANCE	
• Peak flow reduction	Good
• Volume reduction	Poor
• Water quality treatment	Good
• Amenity potential	Good
• Ecology potential	Good
TREATMENT TRAIN SUITABILITY	
• Source control	No
• Conveyance	Yes
• Site system	Yes
• Regional system	Yes
SITE SUITABILITY	
• Residential	Yes
• Commercial/industrial	Yes
• High density	Unlikely
• Retrofit	Unlikely
• Contaminated sites/sites above vulnerable groundwater (with liner)	Yes
COST IMPLICATIONS	
• Land take	High
• Capital cost	High
• Maintenance	Low/Medium
POLLUTANT REMOVAL	
• Total suspended solids	High
• Nutrients	Medium
• Heavy metals	High
KEY MAINTENANCE REQUIREMENTS	
• Litter, debris removal	
• Inlet/outlet cleaning	
• Management of vegetation coverage	
• Sediment monitoring and removal when required	

18 DETENTION BASINS

18.1 DESCRIPTION

Detention basins are surface storage basins that provide flow control through attenuation of stormwater runoff. They are designed to hold a specific amount of flow for a minimum duration period (e.g. 24 hours). Rainwater is directed to the basins, which flows through the system, allowing sediment particles and associated pollutants to settle out. They do not have a permanent water supply.

Location: Nevada, USA

18.2 KEY DESIGN CRITERIA

- Detention volume to manage design storms via constrained outflow
- Minimum length: width ratio of 2:1
- Maximum side slopes of 1:4 for maintenance and safety reasons, unless the situation allows steeper slopes to be used
- Bioretention and/or wetland or micropools at outlets is desirable for enhanced pollution control

ADVANTAGES	
• Can cater for a wide range of rainfall events	
• Can be used where groundwater is vulnerable, if lined (increases evaporative loss)	
• Simple to design and construct	
• Potential for dual/multipurpose land use e.g. football pitch, landscaped/habitat area	
• Easy to maintain	
DISADVANTAGES	
• Detention depths may be constrained by system inlet and outlet levels	
• Potential safety risk is not used throughout year	
• In certain areas, sand and litter can accumulate resulting in the need for maintenance	
PERFORMANCE	
• Peak flow reduction	Good
• Volume reduction	Poor
• Water quality treatment	Medium
• Amenity potential	Good
• Ecology potential	Medium
TREATMENT TRAIN SUITABILITY	
• Source control	No
• Conveyance	No
• Site system	Yes
• Regional system	Yes
SITE SUITABILITY	
• Residential	Yes
• Commercial/industrial	Yes
• High density	Yes
• Retrofit	Yes
• Contaminated sites/sites above vulnerable groundwater (with liner)	No
	Yes
COST IMPLICATIONS	
• Land take	Medium
• Capital cost	Low
• Maintenance	Low
POLLUTANT REMOVAL	
• Total suspended solids	Medium
• Nutrients	Low
• Heavy metals	Low
KEY MAINTENANCE REQUIREMENTS	
• Litter/trash removal	
• Inlet/outlet cleaning	
• Vegetation management	
• Sediment monitoring and removal when required	

19 INFILTRATION BASINS

19.1 DESCRIPTION

Infiltration basins are shallow vegetated depressions designed to receive and store runoff, and infiltrate it gradually into the ground.

19.2 DESIGN CRITERIA

- Effective pre-treatment required to remove sediments and fine silts prior to infiltration
- Designed to infiltrate the water quality treatment volume, as a minimum
- Infiltration should not be used where groundwater is vulnerable or to drain pollution hotspots
-

ADVANTAGES	
• Reduces the volume of runoff from a drainage area	
• Can be very effective at pollutant removal via filtering through the soils	
• Contributes to groundwater recharge and baseflow augmentation	
• Simple and cost-effective to construct	
• Changes in performance are easy to observe	
DISADVANTAGES	
• Potentially high failure rates due to improper siting, poor design and lack of maintenance, especially if appropriate pre-treatment is not incorporated	
• Require irrigation to maintain vegetation	
• Comprehensive geotechnical investigations required to confirm suitability for infiltration	
• Not appropriate for draining pollution hotspots where high pollution concentrations are possible	
• Requires a large, flat area	
• Can be unsightly, especially when they clog	
PERFORMANCE	
• Peak flow reduction	Average
• Volume reduction	Good
• Water quality treatment	Good
• Amenity potential	Good
• Ecology potential	Good
TREATMENT TRAIN SUITABILITY	
• Source control	No
• Conveyance	No
• Site system	Yes
• Regional system	No
SITE SUITABILITY	
• Residential	Yes
• Commercial/industrial	Yes
• High density	No
• Retrofit	No
• Contaminated sites/sites above vulnerable groundwater (with liner)	No
COST IMPLICATIONS	
• Land take	High
• Capital cost	Low
• Maintenance	Low
POLLUTANT REMOVAL	
• Total suspended solids	High
• Nutrients	Medium
• Heavy metals	High

KEY MAINTENANCE REQUIREMENTS

- Regular inspections for signs of deterioration in performance, clogging and other blockages
- Litter removal
- Inlet cleaning
- Vegetation management and irrigation
- Regular removal of sediment from pre-treatment

20 GEOCELLULAR/MODULAR SYSTEMS

20.1 DESCRIPTION

Systems constructed with a network of high void ratio areas that can allow water to infiltrate and be stored.
Typically, geocellular systems are honeycomb shaped structures, with perforated distribution pipe work running under or through the structure. Modular systems are box shaped, with inlet/outlet pipe work connected to the sides of the structure.

20.2 DESIGN CRITERIA

- Standard storage design uses restricted discharge which determines max storage volumes
- Structural design to relevant standards for appropriate surface loadings
- Appropriate geotextile/geomembrane for wrapping

ADVANTAGES	
• Modular and flexible	
• Dual usage, infiltration and/or storage	
• Can be installed beneath public open spaces or heavily trafficked areas	
• Tend to be more cost-effective than traditional alternatives	
• High void ratio (up to ~90%) and therefore high storage capacity, compared to traditional systems like stone filled Soakaways	
• Lightweight, easy to install and robust	
DISADVANTAGES	
• Material can be expensive	
• Requires regular maintenance inspections	
• Does not provide water quality treatment	
PERFORMANCE	
• Peak flow reduction	Good
• Volume reduction	Good (with infiltration)
• Water quality treatment	Poor
• Amenity potential	Poor
• Ecology potential	Poor
TREATMENT TRAIN SUITABILITY	
• Source control	Yes
• Conveyance	Possible
• Site system	Yes
• Regional system	Yes
SITE SUITABILITY	
• Residential	Yes
• Commercial/industrial	Yes
• High density	Yes
• Retrofit	Yes
• Contaminated sites/sites above vulnerable groundwater (with liner)	Yes
COST IMPLICATIONS	
• Land take	Medium
• Capital cost	High
• Maintenance	Low
POLLUTANT REMOVAL	
• Total suspended solids	Low
• Nutrients	Low
• Heavy metals	Low

KEY MAINTENANCE REQUIREMENTS

- Regular inspection of silt traps, manholes, pipework and pre-treatment devices, with removal of sediment and debris as required

Annex

20

Capacity Building

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3 Capacity Building Progress 4

1 Introduction

This report outlines the Capacity Building Program conducted during the period of the project. The aim of the Program is to transfer the Consultants' capacity and experience to the PIU representing the Client's future representatives.

The capacity building programme are broken down into three key layers of knowledge transfer, which are described as follows:

1. On-site training for counterpart staff during Project development on-site and in the Consultants' offices in Nigeria. In this task the nominated participants join the consultant's staff during their different site missions in Ibadan in order to transfer technology to the participants. The Consulting Engineer's team members, each in his field, trains the Client's assigned personnel.
2. One- week training for 5 senior staff members in the Consultants' Office in Beirut, to make them familiar with the Design Tools, Hydrological and Hydraulic Modelling
3. One- week training for the 10 senior staff members (including the same 5 senior of the previous week) in the Consultants' Office in Beirut, to make them familiar with flood risk assessment and drainage options.

The first part of the program was initiated from the Project's onset following the kick-off meeting starting from the 4th May 2017. On-site training was conducted in intermittent periods during the course of the project. The last two parts of the program took place in the period between 1st April and 12th April 2019.

This report presents the Consultants training program for design tools and flood risk analysis.

1.1 Approach

Capacity and institutional development are intended to meet data and technical gaps. The intention is to ensure that those who ultimately hold responsibility for delivering the masterplan have the necessary knowledge and ability. In order to meet this need, the project development is supported by targeted training designed and conducted for key staff.

The end product will ultimately be the ownership by Oyo State Government. As such, it is essential that the Government is fully versed and confident in the project outcome. Not only must the Client be fully supportive of the contents of the project, it must also be in a position to implement it.

The purpose of this training is to enable the Client's engineers to understand the specific requirements and problems associated with the drainage analysis performed for Ibadan and the detailed design and construction phases of the project. The training program assists the participants to be familiar with the different design aspects of the project for different site conditions and applications.

The Consultant bears the cost of materials and presentations at the trainings and workshops. However, the setup, venues, travels, tickets, accommodations, allowances etc..., are arranged directly by the Client/project. The Consultants facilitated all required and necessary logistics to conduct the off-job training in their Office in Beirut. The Consultants are not be responsible for the purchase of any software and licenses that the Client received during training.

1.2 Contents of this Report

The contents of this report include the following sections:

- Section 1 is the present Introduction;
- Section 2 presents an elaboration on the program
- Section 3 presents the capacity building progress
- Appendix 1 shows the training program agenda (as conducted)

2 Training Program

The training program is divided into two parts:

- Part A: Design Tools
- Part B: Flood Risk Analysis

The below sub-sections present an elaboration of the training program

2.1 Training on Design Tools

The training covers the different tools the Consultant uses to implement the project. These tools cover the following main topics: GIS technology, hydrologic modeling and hydraulic modeling, refer to Table 1 in Appendix 1. Below is a brief description on the training plan.

2.1.1 GIS technologies

The objective of this training component is to introduce the GIS concepts and how GIS was used in the project during the preparation of the project database and in the hydrological modelling.

This session focused on the following sub-topics:

- Basics of the GIS technology;
- Basics of the ArcGIS Software;

- Presentation of the project Geodatabase: layers, source of data, data preparation procedures; and
- Hand-on exercises on data representation and editing.

In addition to the above the Consultant provided a special presentation regarding the following:

- Watershed delineation using ArcGIS and ArcHydro tools.
- LiDAR Technology

The following subsections elaborates few details on each sub-topic

2.1.1.1 Basics of the GIS technology

In this subtopic, the trainee gets to know an introduction of the GIS components, capabilities, data representation, data sources, remote sensing, integration of satellite images and aerial photos, links with models and other databases, GIS Data formats vector and raster layers.

2.1.1.2 Basics of the ArcGIS Software

In this subtopic, the trainee gets to know types of coordinate systems used in ArcGIS (Geographic and Projected), shapefiles, rasters, geodatabases and how to create/modify different types of feature classes (points, polylines and polygons), import/export data from CAD. In addition, the trainee gets to know some ArcGIS tools such as the conversion of a DEM into a contour with a specified interval, export a feature such as a stream, pond or culvert to a kml/kmz file and visualise this feature in Google Earth.

2.1.1.3 Geodatabase Layers, Source of Data and Data Preparation Procedures

In this subtopic, the trainee gets to know information on geodatabase layers with special concern on the layers collected for the drainage master plan such as administrative, building survey, hydrology, landuse, study area, terrestrial, topography, transportation and flood inundation layers. In addition, the trainee gets information on the data sources of these layers, their metadata and the procedures adopted to prepare this data.

2.1.1.4 Exercises on Data Representation and Editing

The trainee practiced on personal computers under this subtopic on how to represent data in layout and construct maps. In addition, the trainee practiced how to edit and modify shapefiles.

2.1.1.5 Watershed Delineation using ArcGIS and ArcHydro tools

In this subtopic, the trainee gets to know the ArcHydro tool that is embedded in the ArcGIS and how to use this tool in delineating watersheds and defining streams according to a certain threshold catchment area. In addition to the knowledge of other features of ArcHydro such as sink removal, drainage direction, catchments development and burning the streams in the Digital Elevation Model.

2.1.1.6 LiDAR Technology

In this subtopic, the trainee gets to know an introduction to LiDAR Remote Sensing including platform for data collection, airborne LiDAR components, laser types, principles, advantages, applications and data products.

2.1.2 Hydrological Modelling

The objective of this training component is to introduce the hydrological concepts and the basis of hydrological modelling.

This session focused on the following sub-topics:

- Introduction to Engineering Watershed Hydrology
- Rainfall
- Watershed Characteristics
- Watershed Delineation Practice
- Stream Flow Hydrology Basics and Peak Discharge Estimation Methods
- Introduction to HEC-HMS Model
- HEC-HMS Model Practice

The following subsections elaborates few details on each sub-topic

2.1.2.1 Introduction to Engineering Watershed Hydrology

In this subtopic, the trainee gets to know an introduction on the hydrological cycle, approaches in flow estimation such as flow-based methods and precipitation-based methods. In addition to data used in hydrological design such as stream flow data, rainfall data, Physiographic Data (Contour maps, Digital Elevation Models, Aerial Photos, satellite images, …) and Soil / Land Use Data

2.1.2.2 Rainfall

In this subtopic, the trainee gets to know information on rainfall types, measurement methods and records, areal distribution, mean areal precipitation, average rainfall, extreme rainfall, Intensity-Duration-Frequency Curves (IDF) and Synthetic Hyetographs.

2.1.2.3 Watershed Characteristics

In this subtopic, the trainee gets to know information on watershed characteristics, delineation, slope, topography, size, shape, stream order and stream patterns.

2.1.2.4 *Stream Flow Hydrology Basics and Peak Discharge Estimation Methods*

In this subtopic, the trainee gets to know information on hydrology basics, precipitation losses such as evaporation, interception and infiltration. In addition to peak discharge estimation methods such as the rational method and SCS method and a comparison between these two methods. Moreover, the trainee gets to know information on the time of lag, time of concentration, rational coefficient and the Curve Number (CN).

2.1.2.5 *Watershed Delineation Practice*

Following the knowledge of the Watershed Delineation using ArcGIS and ArcHydro tools in section 2.1.1.5, the trainee practices on personal computers under this subtopic on how to delineate a watershed, define its streams according to a specified threshold area, delineate sub-catchments according to a desired outlet point and analyse its hydrological characteristics.

2.1.2.6 *Introduction to HEC-HMS Model*

In this subtopic, the trainee gets to know how to analyse hydrological information using the Hydrologic Modelling System (HEC-HMS) including peak flow estimation, runoff hydrographs and other hydrological characteristics of subcatchments.

2.1.3 Hydraulic Modelling

The objective of this training component is to introduce the hydraulic concepts and the basis of hydraulic modelling for natural and engineered channels.

This session focused on the following sub-topics:

- Introduction to Open Channel Hydraulics
- Introduction to Storm and Sanitary Analysis Model
- Storm and Sanitary Analysis Model Practice
- Introduction to HEC-RAS Model

The following subsections elaborates few details on each sub-topic

2.1.3.1 *Introduction to Open Channel Hydraulics*

In this subtopic, the trainee gets to know information on types of open channels flow cross-sections, types of flow, and how to estimate the channel's flow rate using manning's equation, make use of available data in analysis such as type of soil, longitudinal slope and side slopes, and how to make certain assumptions such as selecting an appropriate manning's roughness coefficient. In addition, the trainee gets to know how to use a commercial package such as FlowMaster by Bentley to design a channel's cross-section (bed width, depth and side-slopes) and estimate its corresponding normal depth and velocity.

2.1.3.2 *Introduction to Storm and Sanitary Analysis Model*

In this subtopic, the trainee gets to know information on a 1D hydrologic and hydrodynamic model used for simulating rainfall and runoff. The trainee gets to know how to input rainfall data, catchments, conduits, storage facilities and outfalls. In addition, the trainee gets to know how to simulate and analyse a river network using the models tools such as, profiles, sections, reports and animation videos. Moreover, the trainee gets to know information on different types of simulations such as steady and unsteady state analysis.

It is to note that the **S**torm and **S**anitary **A**nalysis Model (SSA Model) is an Autodesk commercial software that uses the same engine of the free license software named "EPA-SWMM".

2.1.3.3 *Introduction to HEC-RAS 2D Model*

In this subtopic, the trainee gets to know information on a 2D model developed by the **H**ydrologic **E**ngineering **C**entre for **R**iver **A**nalysis **S**ystem (HEC-RAS) used in developing inundation maps. The trainee gets to know how to build the model, input topographic data, mesh creation, input precipitation data, flow hydrographs, introducing 1D elements such as culverts, then the trainee gets to know how assign the computational parameters and run the model. In addition, the trainee gets to know information on how to analyse different types of results such as depth, inundation velocity, water surface elevations, duration inundation, river profiles, cross-sections and outflow hydrographs. It is to note that the HEC-RAS 1D model is a free license software that is available on the internet.

2.2 Training on Flood Risk Analysis

This training covers the flood risk assessment procedure including hazard assessment, damage functions and drainage options, refer to Table 2 in Appendix 1. Below is a brief description on the training plan.

2.2.1 Risk Assessment

The objective of this training component is to introduce flood risk analysis.

This session focused on the following sub-topics:

- Flood Mapping
  - Flood Inundation Mapping
  - Flood Hazard Mapping
  - Flood Vulnerability Mapping
  - Flood Risk Mapping
- Asset Valuation
- Damage Functions

- Flood Risk Analysis

The following subsections elaborates few details on each sub-topic

2.2.1.1 Flood Mapping

In this subtopic, the trainee gets to know information on how to extract flood maps from the 2D Model (HEC-RAS) then present the output data for different storm return periods using ArcGIS. The flood mapping session includes a presentation for the development of flood inundation, flood hazard, vulnerability and flood risk mapping.

2.2.1.2 Asset Valuation

In this subtopic, the trainee gets to know information on how to estimate values of different types of assets including buildings and infra-structure using the collected information gathered from landuse site surveys. The session includes a presentation on the shapefiles in the ArcGIS environment and the inventory of the collected data. Moreover, the trainee gets to know the equations and assumptions used in the Microsoft Excel Sheet and GIS database on how to estimate the values of different types of assets.

2.2.1.3 Damage Functions

In this subtopic, the trainee gets to know how to use damage functions to evaluate asset losses corresponding to different storm return periods. The session includes how to select appropriate damage functions taking into consideration different types of assets, water depths, velocities and other parameters. Moreover, the trainee gets to know how to evaluate asset losses using the asset data inventory and damage functions in the ArcGIS environment and Microsoft Excel Sheets.

2.2.1.4 Flood Risk Analysis

In this subtopic, the trainee gets to know how to analyse flood risk based on hazard exposure and vulnerability analysis. The analysis presents how to evaluate probable losses for different risk scenarios.

2.2.2 Integrated Flood Risk Management in Development Planning

The objective of this training component is to introduce the drainage options to minimize flooding, in addition to an introduction to Flood Risk Management.

This session focuses on the following sub-topics:

- Drainage Options to minimize flooding
- Flood Risk Management in Development Planning

The following subsections elaborates few details on each sub-topic

2.2.2.1 Drainage Options to minimize flooding

In this subtopic, the trainee gets to know different drainage options to minimize flooding such as channelization, non-structural proposals, attenuation, river training, natural river restoration…etc. In addition, the trainee gets to know the differences of each option and their impact on flood inundation.

2.2.2.2 Flood Risk Management in Development Planning

In this subtopic, the trainee gets to know more about flood risk management including managing structural and non-structural measures, manging exposure to flood hazards and managing vulnerability to flood risks.

3 Capacity Building Progress

The consultants have initiated capacity building with the client ever since the onset of the project. Capacity building was performed through various workshops and site visits, this includes the following:

1- A 1-day site visit in May 4th, 2017 with representatives of the Project Implementation Unit (PIU) to vulnerable areas in Olorungunwa, main channels such as Ogunpa, Kudeti, Ona Rivers and recommended bridges proposed by the PIU.
2- A 4-day site visit in July 3 to 6th, 2017 with the WB and the PIU and conducted a complete workshop and site visits addressing the 1st pool of priority works
3- Field data collection starting from August 8th, 2017 to investigate the existing drainage systems and structures for the remaining geographical batches, namely Ibadan's south east and south west areas.
4- One- week training from April 1st to 5th, 2019 for 5 senior staff members in the Consultants' Office in Beirut, to make them familiar with the Design Tools, Hydrological and Hydraulic Modelling.
5- One- week training from April 6th to 12th, 2019 for the 10 senior staff members (including the same 5 senior of the previous week) in the Consultants' Office in Beirut, to make them familiar with flood risk assessment and drainage options.

The above training is considered as the capacity building programme of counterpart staffs.

Appendix 1

Table 1: First Week Training - Design Tools, Hydrological and Hydraulic Modelling

Day Order	Day	Proposed Date	Time	Main Topic	Sub-Topic	Conductor
Day 1	Mon.	01-Apr-19	9:00 to 10:30	Introduction	Drainage and Flood Risk Framework	Hesham Badry
			10:30 to 13:00 14:00 to 16:30	GIS technologies	* Basics of the GIS technology * Basics of the ArcGIS software (Add data, layers and Identification) * Geodatabase: layers, source of data, data preparation procedures	Moh Mahran
Day 2	Tue.	02-Apr-19	9:00 to 13:00 14:00 to 16:30	GIS technologies	* Data Representation and Editing * Label Management and Map Production * LiDAR Technology	Moh Mahran
Day 3	Wed.	03-Apr-19	9:00 to 11:00	GIS technologies	* Watershed Delineation using ArcGIS and ArcHydro tools	Moh Mahran
			11:00 to 13:00	Hydrological Modelling	* Hydrology Overview in Relation to the Masterplan	Hesham Nazmy
			14:00 to 16:30		* Introduction to Engineering Watershed Hydrology * Watershed Characteristics * Stream Flow Hydrology Basics and Peak Discharge Estimation Methods	Mah. Farhat
Day 4	Thu.	04-Apr-19	9:00 to 13:00	Hydrological Modelling	* Rainfall * Introduction to Hyfran Modelling	Mah. Farhat
			14:00 to 16:30	Hydraulic Modelling	* Design using Steady Flow Analysis * Introduction to Open Channel Hydraulics * Introduction to FlowMaster	Hesham Nazmy
Day 5	Fri.	05-Apr-19	9:00 to 11:00	Hydrological Modelling	* Watershed Delineation Practice * Introduction to HEC-HMS Model * HEC-HMS Model Practice	Mah. Farhat
			11:00 to 13:00	Hydraulic Modelling	Design using Unsteady Flow Analysis * Introduction to Storm Analysis by Autodesk (SAA) * Storm Analysis Model Practice	Mah. Farhat
			14:00 to 15:15	Hydraulic Modelling	Introduction to Civil 3D * Alignment of River Channels (Corridors) using Civil 3D * Introduction to Profiles and Sections using Civil 3D	Mah. Farhat
			15:15 to 16:30	Hydrodynamic 2D Modelling	* Introduction to HEC-RAS 2D Model * HEC-RAS 2D Model Practice	Mah. Farhat

Table 2: Second Week Training - Flood Risk Assessment and Drainage Options

Day Order	Day	Proposed Date	Time	Main Topic	Sub-Topic	Consultant
Day 6	Sat.	06-Apr-19	9:00 to 10:30 10:30 to 13:00 14:30 to 16:30	Introduction to Flood Risk Management	* Introduction to Flood Risk Management * Data Collection (Landuse and Crossing Structures) * Managing Flood Risk (Preventive and Protection Measures)	Hesham Badry Hesham Nazmy
Week End						
Day 7	Mon.	08-Apr-19	9:00 to 11:30	Project Management and Contracts	* Post-Contract and Site Supervision	Nadim Salama
			11:30 to 13:00 14:00 to 16:30	Drainage Masterplan	* Masterplan Geodatabase * Asset Valuation	Hesham Nazmy
Day 8	Tue.	09-Apr-19	9:00 to 11:30	Project Management and Contracts	* Pre-Contract Phases and Tender Documents	Ziad Dakkash
			11:30 to 13:00 14:00 to 16:30	Drainage Masterplan	* Masterplan Geodatabase *(Continued)* * Geodatabase in relation with the Drainage MasterPlan * Comparison between the City Master Plan and the Drainage Masterplan * Geosetter (Inserting Images on Google Earth) * Managing Flood Risk (Preventive and Protection Measures)	Hesham Nazmy Hesham Badry
Day 9	Wed.	10-Apr-19	8:30 to 13:00	Flood Mapping	* Flood Inundation Mapping * Flood Hazard Mapping	Ehab Zidan
			14:00 to 16:30	Flood Risk Analysis	* Damage Functions * Evaluation of Losses	
Day 10	Thu	11-Apr-19	8:30 to 11:00	Sedimentation and Solid Waste	* Erosivity and Solid Wastes	Ehab Zidan
Day 11	Fri	12-Apr-19	8:30 to 11:00	Master Planning	* Prioritization, Phasing and Selection of Priority Works	Hesham Nazmy
			11:00 to 13:00	Dredging Works	* Previous Dredging Works in 2017 and 2018	Open Discussion
			13:00 to 14:30	Sedimentation and Solid Waste	* Soil Loss Calculations	Ehab Zidan
			14:30 to 16:00	General	* Wrap up the program	Ivan Bruce

List of Participants at Dar's Training on Drainage Master Plan

The below table lists the participants at the Capacity Building on Integrated Flood Risk Management Development Planning held in Dar's Office, Beirut, Lebanon from April 1st – 12th, 2019 for the two Groups that participated in the Training for 1 and 2 Weeks respectively.

	NAMES OF PARTICIPANTS	DESIGNATION OF PARTICIPANTS	ORGANIZATION	REMARK	DURATION
1.	Engr. Adeola Moshood Ajani	Director (Environmental Engineering & Beautification)	Ministry of Environment & Water Resources	MSc, HND (Civil/Environmental Engineer)	2 Weeks
2.	Engr. Adeyemo Johnson	Snr. Hydrologist	Ministry of Environment & Water Resources	BSc, (Hydrologist)	1 Week
3.	Engr Aremu O K	Principal Engineer	Ministry of Works & Transport	BSc (Civil Engineer)	2 Weeks
4.	Engr. Adeniji Stephen A	Hydraulic Engineer	PIU (IUFMP)	MSc, PGD (Civil/Water Engineer)	2 Weeks
5.	Engr. Akanbi Tajudeen O	Infrastructure Engineer	PIU (IUFMP)	MSc, BSc (Civil /Structural Engineer)	2 Weeks
6.	Engr. Segun Akanmu	Principal Civil Engineer	Water Corporation of Oyo State	B. Tech (Civil Engineer)	2 Weeks
7.	Ajadi Ajibade	Surveyor 1	Surveyor General's Office	BSc, PGD (Surveyor/GIS Inclined)	1 Week
8.	Tpl Akinwale ,Olufemi Akindele	Dep. Director (Town Planning)	Bureau of Physical Planning & Dev. Control	MSc, PGD (Urban & Regional Planner)	1 Week
9.	Tpl Ayorinde Adedayo A	Project Coordinator	PIU (IUFMP)	MSc, Full Professional Dip. (Urban and Regional Planner)	1 Week
10.	Engr James Adeyemi Adeniji	Contract Management Consultant	PIU (IUFMP)	MSc, BSc (Civil Engineer)	2 Weeks

Registry of Capacity Building Participants

The below table are 2 scanned copies of the attendance sheet registered on the 10th of April 2019.

Capacity Building Program
From 1st April to 12th of April 2019

Project Name: Flood Risk Management and Drainage Master Plan in Ibadan
Venue: Dar Beirut Office
Date: 10th April

Attendence Sheet

	Name	Office	Email
1	AJADI AJIBADE YEMI	OFFICE OF THE SURVEYOR-GENERAL	ajadiajibade@yahoo.com // ajiyaglobal@gmail.com
2	Yemi ADENIJI	IUFMP	yadenijioz@gmail.com
3	AREMU OLUSEGUN KOLAWOLE	MINISTRY OF WORKS & TRANSPORT	segunpaperoc@yahoo.com
4	Tadeyi Abiola Felix	Dar	felix.tadeyi@dar.com
5	AKinwale Olufemi AKindele	Bureau of Phy. Planning & Dev. Control	alabamato@gmail.com
6	Akanmu Sunday Olusegun	Water Corporation of Oyo State	akanmuso~~@yahoo.com~~ akanmuso@gmail.com
7	AYORINDE, Adedayo Ayodele	Ibadan Urban Flood Management Project (IUFMP)	dayolayminde@yahoo.com
8	IVAN BRCIC	World Bank	
9	Hesham Nazmy	Dar Cairo	
10	Hesham Badry	Dar Cairo	

Please write your name and your email in clear Capital Letters

Capacity Building Program
From 1st April to 12th of April 2019

Project Name: Flood Risk Management and Drainage Master Plan in Ibadan
Venue: Dar Beirut Office
Date: 10th April

Attendence Sheet

	Name	Office	Email
11	SHITTU JAMIU ADEWALE	DAR	Shittu.Adewale@dar.com
12	AKANBI, Tajudeen Oluwatoyin	IUFMP	akanbi.tajudeen@yahoo.com
13	ADEYEMO, JOHNSON ADEYINKA	MINISTRY OF ENVIRONMENT AND WATER RESOURCES	hydroislife4nature@gmail.com
14	ADEOLA, MOSHOOD AJANI	OYSMENR	engradeola2005@yahoo.com
15	ADENIJI STEPHEN A	IUFMP	sadenijia@yahoo.com.
16	Ehab Zidan	Dar Cairo	
17	Nicolas Wakim	Dar Lagos	
18	Mohamed Itani	Resident Manager Dar Lagos	
19			
20			

Please write your name and your email in clear Capital Letters

Capacity Building Program Sample Photos

The first group of the Client Participants

Mohamed Mahran conducting the GIS Session

Hesham Nazmy conducting the Hydraulics Session

Mahmoud Farhat conducting the Hydrology Session

The first and second group of the Client Participants

Hesham Badry conducting the Flood Risk Management

Nadim Salama conducting Post-Contract Session

Ziad Daccache conducting Pre-Contract Session

The first and second group of the Client Participants in the presence of Ivan Bruce (World Bank Representative)

Ehab Zidan conducting the Damage Functions Session

Fouad Khoury (Consultant Project Director) and Dayo Ayorinde (Client Project Coordinator)

The whole group of participants

Annex

21

Inspection And Maintenance Plans

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1. Introduction

Drainage elements such as channels, culverts, bridges and dikes are designed to drain surface water away, before the water levels increase to an extent that puts property, roads, land and infrastructure at risk of flooding. If these elements are maintained to a good standard, any flooding is likely to only affect areas in the floodplain.

The cost of maintaining a watercourse is minor compared to the costs that can arise from flood damage, not to mention the distress and inconvenience caused if the property is flooded.

2. Inspection Plan

Ibadan's main drainage elements are the Culverts, Bridges, Channels & Dikes. An inspection plan should be prepared for these drainage elements within the Ibadan City to check their conditions and to ensure it is functioning properly. In this respect, the consultant prepared inspection sheets (presented at the end of this annex) for each drainage element to be filled by the inspection team.

3. Maintenance Plan

As previously mentioned, all Ibadan's drainage elements require regular maintenance. The next sections present an overview of typical maintenance tasks for each drainage element, with the required actions and the frequency with which they need to be undertaken.

3.1. Maintenance Plan for Open Channels

Actions	Frequency
For Vegetation Growth	
It is recommended to cut below the water level of the watercourse, leaving the fringe of the bank uncut, thereby maintaining some habitat as well as enabling a free flow of water in the channel.	Annually
Clearance Works	
Cuttings from any clearance work should be removed from the channel to avoid it causing blockages downstream. Putting removed material too close to the top of the bank can lead to it falling back in during times of flooding.	Annually
For Clogging due to Debris (e.g. litter, grass cuttings, and fallen trees and branches)	
Remove any physical obstructions such as large rocks, rubble, fallen trees and branches and other waste materials (litter, grass cuttings etc) so that water can flow freely.	Monthly
All non-organic waste should be completely removed off site and disposed of in an appropriate manner.	Monthly
Any green waste resulting from the maintenance of channel can be left a safe distance from the bank for a few days to allow any organisms to move back into the watercourse, after which the green waste should be removed so it doesn't wash back into the watercourse.	Monthly
Ensure that any disturbed debris does not end up flowing downstream and causing problems for other landowners.	Monthly
Do not store anything alongside the watercourse which may interfere with maintenance, affect the stability of the bank or get washed into the channel.	Monthly
For Siltation	
Where possible, maintaining the original slope and cross section of the channel when de-silting is a must.	Annually
As long as the silt is nonhazardous it can be put on the bank of the channel. Depositing silt on top of the banks of the watercourse allows for any silt to move back into the channel. However; - It is essential that this material does not then block any other channels or nearby roads, or stop water draining into the channel if it would normally do so (e.g. from higher ground into the channel). - The silt must be deposited as close as possible to where it was dredged from either: on the bank of the waters from where it was taken or on land directly next to the watercourse.	Annually

3.2. Maintenance Plan for Culverts and Bridges

Actions	Frequency
For Erosion, Cracks and Physical Deterioration (For Wingwalls, Headwalls and Barrels)	
Concrete repair or replacement	When needed
Void filling or seam/joint repairs	When needed
For Clogging due to Debris (e.g. litter, grass cuttings, and fallen trees and branches)	
Remove any physical obstructions such as large rocks, rubble, fallen trees and branches and other waste materials (litter, grass cuttings etc) so that water can flow freely.	Monthly
For Siltation	
Remove silt to the same level or below the bottom of the pipe(s).	Annually

3.3. Maintenance Plan for Dikes

Actions	Frequency
For Erosion, Cracks and Physical Deterioration (For Spillway and Bottom Outlet Culvert)	
Concrete repair or replacement	When needed
Void filling or seam/joint repairs	When needed
For Clogging due to Debris (e.g. litter, grass cuttings, and fallen trees and branches)	
Remove any physical obstructions such as large rocks, rubble, fallen trees and branches and other waste materials (litter, grass cuttings etc) so that water can flow freely.	Monthly
For Reservoir Siltation	
Remove silt to the same level or below the bottom of the culverts	As per table 1 below
For Human Activates	
Investigate and prohibit the existence of any human activities or resettlement of inhabitants within the right of way of the dike and its impounding reservoir.	Every three months

Table 1. Sediment Removal Frequency for Dikes

Dike Name	Sediment Removal Every (Years)
D24	6
D25	2
D37	66
D38	61
D39	53
D41	15
D42	27
D43	33
D44	1
D45	17
D46	15
D49	3
D50	24
D54	7
D55	19
D56	10
D61	2

3.4. Maintenance Cost Estimate

Maintenance cost could vary depending on each drainage element. The next table shows the annual estimated cost of maintenance for each drainage element.

Drainage Element	Annual Maintenance Cost Estimate
Structures (Culverts, Bridges & Dikes)	3-5% of Construction Cost
Channels	2% of Channelization Cost

4. Recommendations

For all drainage elements, it is a good practice to develop a program that sets out how often you will carry out maintenance works. Most drainage elements require annual maintenance to some degree and the best time to undertake works to be before the wet season (summer) which is normally from April to October.

- Maintenance works should be done when the water level is at its lowest i.e. when there has been little rainfall.
- Trash / weed screens and grilles should regularly be checked all year round, but, especially at times of anticipated high flow.
- Debris in channels should be removed as soon as it starts to build up.
- Culverts should be inspected for blockages or signs of collapse. If such problems are identified before a total obstruction to the watercourse occurs, it reduces the likelihood of flooding incidents.

Ibadan Drainage Master Plan - Inspection Sheet

Surveyor	LGA	Date	Sheet Ref

	Survey Sheet:																				
	Channel ID																				
FOR CHANNELS	SCOUR																				
	EMBANKMENT EROSION																				
	SIDE SLOPE DETERIORATION																				
	DRIFT																				
	SILTATION																				
	CLOGGIING																				
	VEGETATION																				
	GENERAL RATING																				

RATING CODES	
MILD	1
MODERATE	2
SEVERE	3

Surveyor	LGA	Date	Sheet Ref

	Survey Sheet:																				
	Culvert ID																				
FOR CULVERTS	NUMBER OF BARRELS																				
	SIZE (TENTITIVE)																				
	BARRELS CONDITION																				
	WINGWALL CONDITION																				
	HEADWALL CONDITION																				
	SETTLEMENT																				
	CLOGGIING																				
	EROSION																				
	WATERWAY ADEQUACY																				
	ROADWAY SHOULDER																				
	ROADWAY EMBANKMENT																				
	ROADWAY PAVEMENT																				
	GENERAL RATING																				

RATING CODES	
MILD	1
MODERATE	2
SEVERE	3

Surveyor	LGA	Date	Sheet Ref

	Survey Sheet:																				
	Bridge ID																				
FOR BRIDGES	NUMBER OF BARRELS																				
	SIZE (TENTITIVE)																				
	BARRELS CONDITION																				
	WINGWALL CONDITION																				
	HEADWALL CONDITION																				
	SETTLEMENT																				
	CLOGGIING																				
	EROSION																				
	WATERWAY ADEQUACY																				
	ROADWAY SHOULDER																				
	ROADWAY EMBANKMENT																				
	ROADWAY PAVEMENT																				
	GENERAL RATING																				

RATING CODES	
MILD	1
MODERATE	2
SEVERE	3

Ibadan Drainage Master Plan – Dikes Inspection Sheet

Surveyor Name		**LGA**	
DIKE ID		**DATE**	

UPSTREAM EMBANKMENT SLOPE				
	CONDITION RATING			**REMARKS**
	MILD	MODERATE	SEVERE	
CRACKS				
EROSION				
SETTLEMENTS AND SLIDES				
VEGITATION				
HUMAN ACTIVITIES				
ANIMAL BURROWS				

DOWNSTREAM EMBANKMENT SLOPE				
	CONDITION RATING			**REMARKS**
	MILD	MODERATE	SEVERE	
CRACKS				
EROSION				
LEAKAGE				
SETTLEMENTS AND SLIDES				
VEGITATION				
HUMAN ACTIVITIES				
ANIMAL BURROWS				

DIKE CREST				
	CONDITION RATING			**REMARKS**
	MILD	MODERATE	SEVERE	
CRACKS				
EROSION				
SETTLEMENTS AND SLIDES				

SPILLWAY				
	CONDITION RATING			**REMARKS**
	MILD	MODERATE	SEVERE	
CRACKS				
EROSION				
SETTLEMENTS AND SLIDES				
DEBRIS				

BOTTOM OUTLET CULVERT				
	CONDITION RATING			**REMARKS**
	MILD	MODERATE	SEVERE	
CLOGGING				
EROSION				
WINGWALL CONDITION				
ROUGH SCREEN CONDITION				
ROUGH SCREEN CLOGGING				

UPSTREAM IMPOUNDING RESERVOIR				
	CONDITION RATING			**REMARKS**
	MILD	MODERATE	SEVERE	
SEDIMENT				
HUMAN ACTIVITIES				

OVERALL RATING	