TECHNICAL REPORT ON

SHARE CATCHMENT MANAGEMENT PLAN

DEVELOPED UNDER

AGRO-CLIMATIC RESILIENCE IN SEMI-ARID LANDSCAPES

(ACRESAL) PROJECT

(WORLD BANK ASSISTED)

BY

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- **Executive summary**

The Share Catchment Management Plan (SCMP) is a Catchment Management Plan that is funded by the World Bank and developed under the Agro-Climatic Resilience in Semi-Arid Landscapes (ACReSAL) Project. The Management plan aims at improving sustainable landscape management practices in the Share catchment which is the capital of Ifelodun Local Government area of Kwara State, Nigeria. The improvement was targeted towards addressing key environmental and socio-economic challenges by providing a comprehensive framework for integrated catchment management to ensure long-term sustainability and resilience against climate change impacts.

- **Background**

The spotlight of ACReSAL Project is to develop micro-catchment management plans which will address agro-climatic challenges in Kwara state. The plans proffer possible solutions on how to get potable water from surface and underground sources for domestic and agricultural purposes, enhance soil health, and getting the people of the state to be socio-economic buoyant. Rivers Soose and Bakaji which originated as springs are the prominent rivers within Share Township serving as significant means of water supply for the people in the area and also play a significant role in irrigation of the neighboring farm lands.

- **Environmental Assessment**

i. Location, Extent and Accessibility of the Catchment

The Share catchment is located within Ifelodun Local Government of Kwara State, Nigeria. The catchment is bounded by latitudes $8^0$40' to $8^0$55' and longitudes $4^0$55' to $5^0$10' covering an approximate area of 770 km^2 (Fig. 1). Among the notable settlements in the catchment include Share Township, Tsaraji, Zonga and Gbugbu. The catchment is accessible by motorable roads and footpaths linking villages in the area.

ii. Land Use and Land Cover Dynamics

The primary land use of Share catchment is agriculture with about 60% of the land occupied by farm lands mainly for crop production, 30% occupied by livestock rearing, and the remaining 10% is occupied by vegetation cover (Fig. 1).

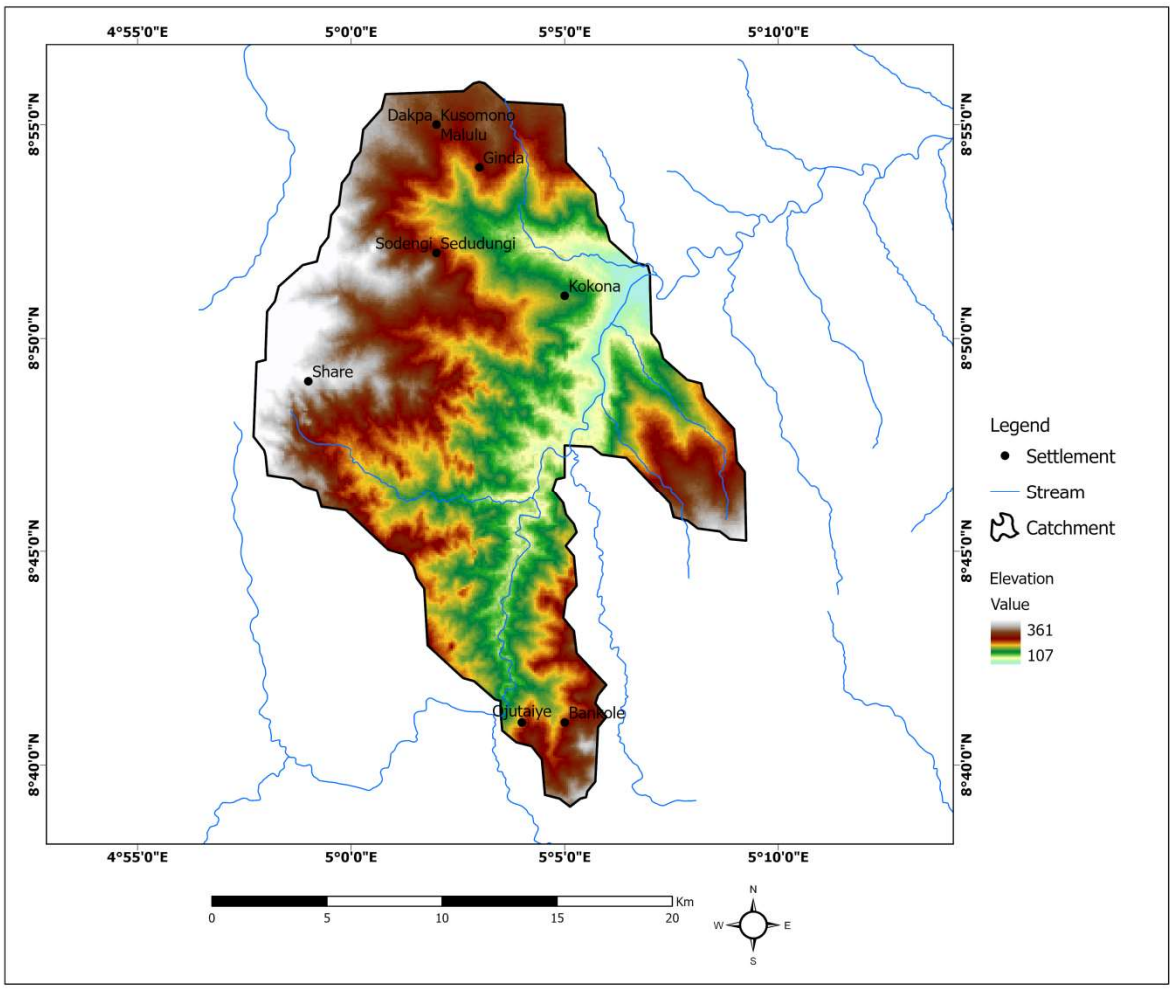


Figure 1: Location map of Share Catchment

iii. Geology, Hydrology and Hydrogeology of the Catchment

Geology

The Share Catchment falls in the Northern Bida Basin which is a NW-SE trending Middle Niger Basin. Bida Basin is an intra-cratonic Cretaceous basin trending NW-SE extending 400km from Kontagora in Niger State of Nigeria to areas slightly beyond Lokoja in the south (Fig.2). It is formed during the opening of the Atlantic Ocean which was initiated during the separation of South America from Africa in the Late Jurassic through the process of Sea floor spreading. The basin has sedimentary fill of about 3000m (Udensi and Osazuwa, 2004; Ojo and Akande, 2009). According to Jones (1958) and Adeleye and Dessauvagie (1972), Bida Basin is sub divided in to

Northern and southern sub basins. The northern Bida sub basin comprises of Bida Sandstone, Sakpe Ironstone, Enagi Siltstone and the Batati Ironstone, while the southern Bida sub basin comprises of lateral equivalent of Lokoja Formation (sandstone and conglomerate), Patti Formation (coal, clay stone, shale, sandstone, ironstone) and Agbaja Formation (sandstone and ironstone) respectively in the southern Bida sub basin.

Share is a transitional zone comprising of both Precambrian Basement Complex rocks such as migmatite, granite gneiss (along and behind Share Police college), porphyritic, coarse grained and fine grained granites (behind Share Local Government secretariat), Schist (around Yipata) and sedimentary rocks comprising of conglomeratic sand stones (at the back of Share Central Mosque), Pebbles (directly opposite the Share central mosque) and coarsening and fining upward sandstones (along Zambufu).

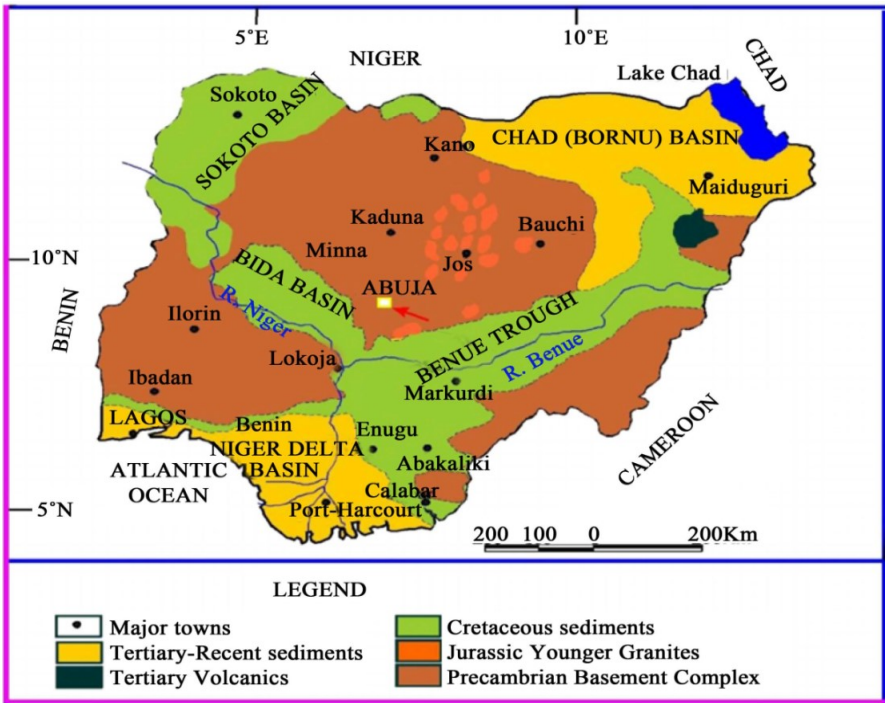


Figure 2: Map of Nigeria showing the NW-SE trending Bida Basin

Hydrology

The hydrology of the catchment is made up of rivers, streams and lakes available in the catchment. Among the notable rivers are Rivers Soose and Bakaji. Nigeria is made up of eight hydrological areas namely Niger North, Niger Central, Niger South, Upper Benue, Lower Benue, Western Littoral, Eastern Littoral and Chad Basin. Kwara State where Share catchment is falls

within the Niger central Hydrological area (Fig.3).

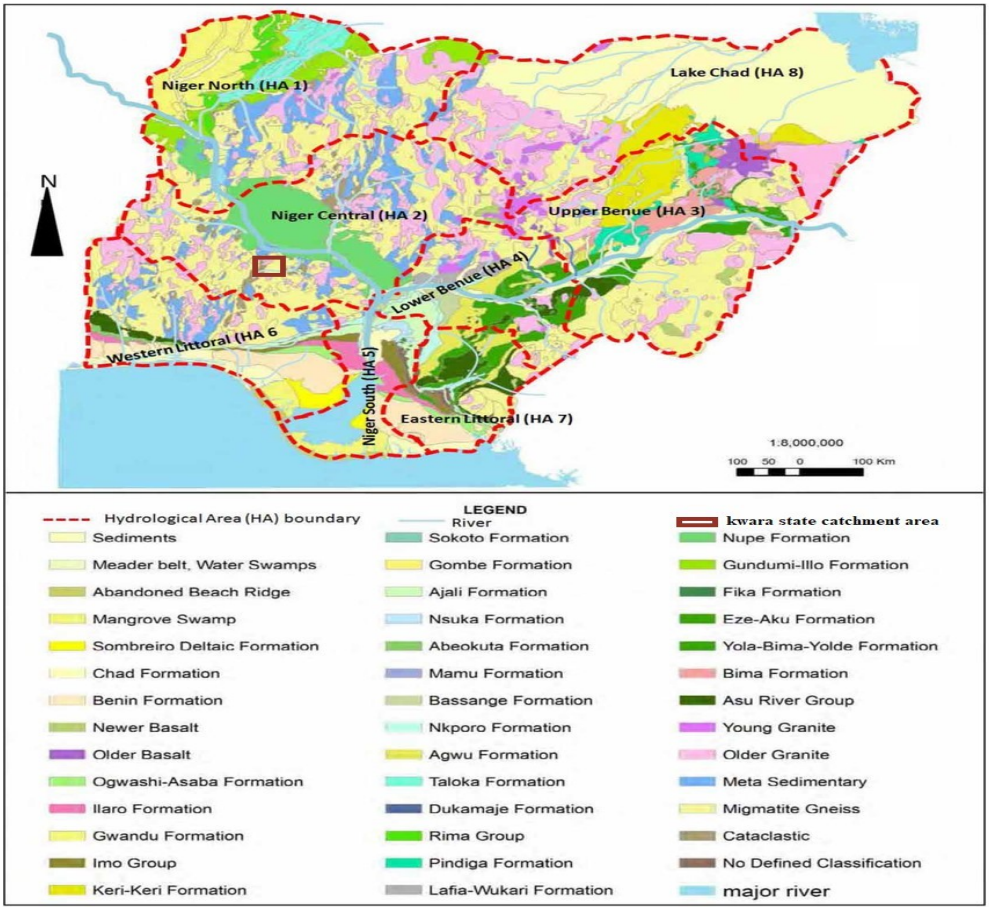


Figure 3: Map of Nigeria showing the location of Kwara state within the Niger central Hydrological area

Hydrogeology

Hydrogeology can be described as the scientific study of groundwater with emphasis on the geology and its occurrence, movement and characteristics of groundwater. The Bida Basin which encompasses Share catchment comprises of porous geological formations that can produce appreciable groundwater. The porous geological formations which include sandstones and conglomerates have enough pores for groundwater storage and availability.

The groundwater level flow direction in the catchment is from high water level elevation (high groundwater potential) to low water level elevation (low groundwater potential). The flow direction is indicated by the arrows drawn perpendicularly to the groundwater contours. The groundwater contour elevation map is to be produced by subtracting the groundwater level

values in the catchment from their respective altitude values and then joining points of equal elevation together. Due to the very scanty number of water samples taken from this catchment (3 groundwater samples and two surface water samples) as a result of unaccommodating nature of the people in the area, the groundwater level contour map could not be generated to indicate the direction of its flow.

iv. Water Resources Availability and Quality

Water resources in Share catchment area comprise both surface water and groundwater. The people of the catchment area depend on hand-dug wells, boreholes and River Soose which has been channeled in to pipes for their water supply. Most of the hand-dug wells in the catchment tapped a weathered overburden and fractured aquifers making the wells productive. Water quality analyses revealed that the physical, chemical and biological parameters analysed for the water's quality assessment fall mostly below the acceptable and permissible limits of the World Health Organization Standard (WHO) and the Nigeria Standards for Drinking Water Quality (NSDWQ)

v. Water sampling and Determination of In-situ Field Parameters

Five water samples from both surface and groundwater sources were collected in the Share catchment using 0.5 litre polyethylene plastic bottles (Fig.4).The bottles were thoroughly rinsed two to three times with the water to be collected with. Two water samples were collected from each collection point; one for cation determination and the other for anion determination. The water samples for cation determination were acidified with two to three drops of concentrated nitric acid (HNO_3) in order to reduce the adsorption of ions in solution and to reduce the bonds between the water and the container. (Fig. 5a, 5b and 5c)

Some parameters such as pH, Electrical Conductivity (EC), turbidity (NTU) and temperature were measured in-situ because of their values which may change soon after leaving the point of collection. The samples were preserved in a refrigerator and taken to the laboratories for analyses.

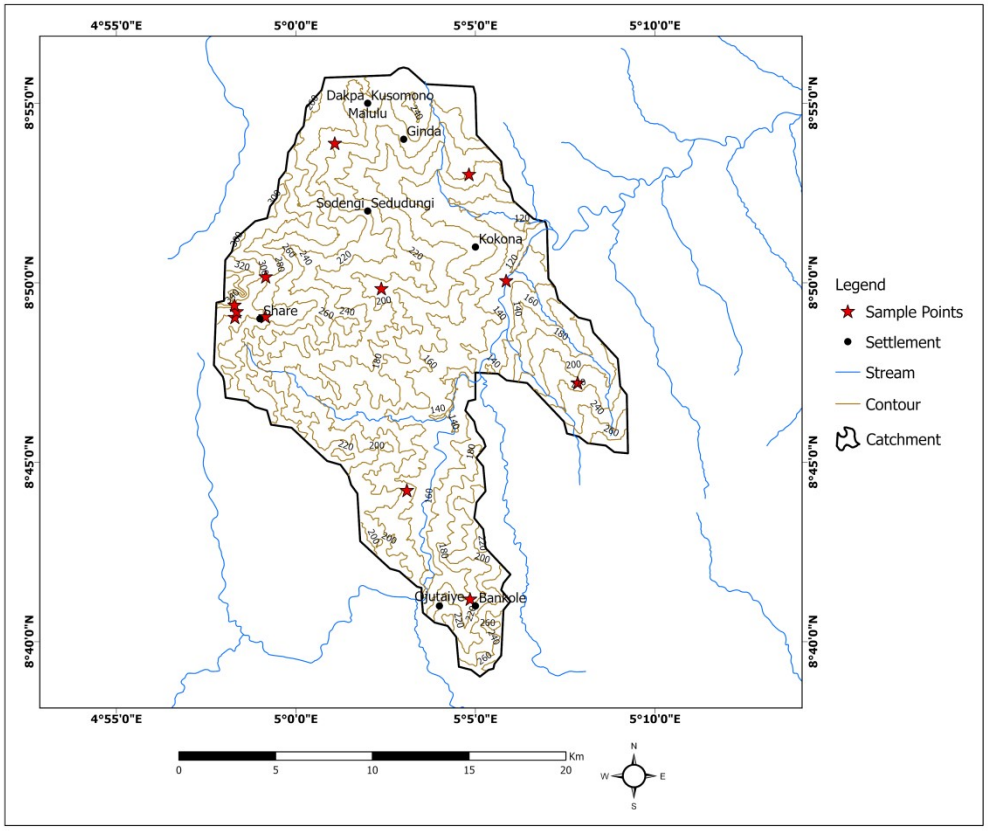


Figure 4: Share catchment map showing the water sampling points



Figure 5a: Surface water collection point



Figure 5b: Groundwater sample collection point and measurement of groundwater level



Figure 5c showing acidification of water samples with 2 to 3 drops of HNO_3

Vi. Physical and Chemical Quality of Water in Share Catchment for Drinking Purpose

The results of the analyses for water quality assessment in the catchment are presented in Tables 1 and 2 and the average values obtained are compared with the World Health Organization (WHO) standard and the Nigeria standards for drinking water quality (NSDWQ) (Table 3). The average values of the physical parameters analysed were all below the acceptable and permissible limits of the World Health Organization standard and the Nigeria Standard for Drinking Water Quality (NSDWQ) except for temperature and Turbidity whose values were above the acceptable limits of WHO and NSDWQ standards but are below their permissible limits (Table 3). Also, the average concentrations of the major cations and anions analysed were all below the acceptable limits and far below the permissible limits of WHO and NSDWQ standards except for bicarbonate whose value is higher than the WHO and NSDWQ acceptable and permissible limits (Table 3). This high concentration of bicarbonate can lead to reduction in the nutrients available for plants in the catchment and can cause a slightly soapy taste in drinking water and causes stomach upset or bloating for those with selective stomachs. The average concentrations of the toxic elements analysed were below the acceptable and permissible limits of WHO and NSDWQ standard except for Manganese whose value is above the acceptable limits and slightly (negligible (0.046) above the permissible limits and Chromium whose value is above the acceptable limit but below the permissible limits (Table 3). From these analyses, it has been revealed that the surface and groundwater sources in the catchment are physically and chemically good but an acid injection method has to be adopted by adding sulphuric acid (H_2SO_4) to the water to lower its PH thereby neutralizing the bicarbonate and reducing its concentration.

Table1: Result of Physical Quality Analysis for Surface and Groundwater Samples in Share Catchment

Sample Code	**Coordinates**	**Locations**	**Water Source**	**PH**	**Temperature(^{0}C)**	**Turbidity** (NTU)	**Electrical Conductivity** (μs/cm)	**TDS (mg/l)**	**TH (mg/l)**
SHR 1	N08^0 49.066, E004^0 58.158,	Onireke Compound	Hand-dug well	7.9	29.7	1875	0.93	0.651	4.06
SHR 2	N08^0 49.043, E004^0 58.309,	Adebi-opon Compound	Hand-dug well	6.5	30.1^{0}c	1110	0.51	0.357	3.691
SHR 3	N08^0 49.209,	Mojapo	Hand-	7.1	30.3^{0}c	1575	0.73	0.511	3.641

	E004^0 58.352$^{'}$	Compound	dug well						
SHR 4	N08^0 49.388$^{'}$ E004^0 58.292$^{'}$	Soose River	River	8.5	26.5^{0}c	33	0	0	1.833
SHR 5	N08^0 50.177$^{'}$ E004^0 59.166$^{'}$	Bakaji River	River	6.5	27.6^{0}c	60	0.01	0.007	1.116
AVERAGES				**7.3**	**29.7**	**930.6**	**0.436**	**0.305**	**2.868**

Note: SHR stands for Share

Table2: Result of Chemical Quality Analysis for Surface and Groundwater Samples in Share Catchment

Sample Code	**Coordinates**	**Na**	**K**	**Ca**	**Mg**	**Fe**	**Pb**	**Zn**	**Cr**	**Mn**	**Cu**	**SO_4**	**NO_3**	**Cl**	**CO_3**	**HCO_3**
SHR 1	N08^0 49.066$^{'}$ E004^0 58.158$^{'}$	2.294	0.491	0.338	0.781	0.001	ND	0.073	0.099	1.101	0.001	0.208	0.233	20.5	80	63.44
SHR 2	N08^0 49.043$^{'}$ E004^0 58.309$^{'}$	1.801	0.403	0.441	0.629	0.001	ND	0.088	0.067	1.041	0.001	0.198	0.3101	18.5	84	370.88
SHR 3	N08^0 49.209$^{'}$ E004^0 58.352$^{'}$	2.046	0.41	0.385	0.651	0.001	ND	0.123	0.08	1.027	0.001	0.194	0.233	34.5	60	551.44
SHR 4	N08^0 49.388$^{'}$ E004^0 58.292$^{'}$	1.447	0.131	0.182	0.335	0.001	ND	0.037	0.086	1.033	0.001	0.202	0.3101	11	136	722.24
SHR 5	N08^0 50.177$^{'}$ E004^0 59.166$^{'}$	1.238	0.147	0.13	0.192	0.001	ND	0.021	0.069	1.03	0.001	0.194	0.233	54.5	64	82.96
AVERAGES		1.765	0.316	0.295	0.518	0.001	ND	0.068	0.08	1.046	0.001	0.199	0.263	27.8	84.8	358.19

Table 3: Comparison of the obtained results for physical and chemical parameters of Surface and Groundwater samples in Share catchment with the World Health Organization (WHO) standard and the Nigeria Standard for Drinking Water Quality (NSDWQ) (2024**)**

S/N	Physical and chemical Parameters	Average concentrations obtained	WHO Acceptable limits	WHO permissible limits	NSDWQ
1	PH	7.3	6.5-8.5	9.2	6.5-8.5
2	Temperature (0 c)	29.7^0C	27^0C		
3	Turbidity (NTU)	930.6	5	1000	5
4	Electrical conductivity (µs/cm)	0.436	1400		1000
5	Total Dissolved Solid (mg/l)	0.305	500	1500	500
6	Total Hardness (mg/l)	2.868	100	500	150
7	Calcium ion (mg/l)	0.295	75	200	75
8	Sodium ion (mg/l)	1.765	50	200	
9	Potassium ion (mg/l)	0.316	20	200	20
10	Magnesium ion (mg/l)	0.518	50	150	0.2
11	Iron ion (mg/l)	0.001	0.05	0.35	0.05
12	Manganese ion (mg/l)	1.046	0.1	1	0.1
13	Chromium (mg/l)	0.08	0.05	1.5	0.05
14	Zinc ion (mg/l)	0.068	1.5	3	1.5
15	Lead ion (mg/l)	ND	0.01	3	0.01
16	Copper (mg/l)	0.001	0.05	1.5	0.003
17	Carbonate (mg/l)	84.8	-	-	-
18	Bicarbonate (mg/l)	358.19	125	350	125
19	Chloride (mg/l)	27.8	250	600	100
20	Sulphate (mg/l)	0.199	200	400	100
21	Nitrate (mg/l)	0.263	50	500	10

vii. Biological Quality of water in Share Catchment

The biological quality assessment for water in the catchment involved the microbial analyses of the water samples for Total colliform count and Escherichia coli (E-coli). The Total colliform count gives the total amount of microbes available in the water while the presence of Escherichia coli indicates evidence of faecal pollution in the water, although absence of this organism does not indicate safe water. The result of the analysis is presented in Table 4. From the table, the average concentrations of the total colliform count and E- coli are 1.8 CFU/ml and 0.3 CFU/ml respectively. The average values of the concentrations were far below the acceptable and permissible limits of the WHO standard which are <10CFU/ml and 10000 CFU/ml respectively; indicating that the water in the catchment is biologically of good quality.

Table 4: Result of Microbial Analysis for surface and Groundwater samples of Lata na Catchment

Sample Code	**Coordinates**	Total colliform count (CFU/ml) D.F x10^3	*E. coli* (CFU/ml) D.F x10^3
SHR 1	N08^0 49.066$^{'}$ E004^0 58.158$^{'}$	0	0
SHR 2	N08^0 49.043$^{'}$ E004^0 58.309$^{'}$	5	1.5
SHR 3	N08^0 49.209$^{'}$ E004^0 58.352$^{'}$	0	0
SHR 4	N08^0 49.388$^{'}$ E004^0 58.292$^{'}$	0	0
SHR 5	N08^0 50.177$^{'}$ E004^0 59.166$^{'}$	4	0
AVERAGES		**1.8**	**0.3**

viii. Quality of the water sources in the catchment for Irrigation purposes

The suitability and Quality of both surface and groundwater samples in Share catchment would be discussed under the following headings:

a. Salinity Hazard

Salinity Hazard of water for irrigation is low, medium, high or very high according to electro-conductivity of water. For irrigation purpose, the water samples in the catchment area are of low

salinity hazard; indicating that the water is excellent for irrigation. The low salinity hazard of the surface and groundwater is due to the values of electrical conductivity of the water samples which range from 0.00µS/cm to 0.93µS/cm (Table 1) making the water to fall within the low salinity hazard class according to Wilcox (1948) and Mohammad *et al*., 2019**)** classification (Table 5).

Table 5: Suitability of water for irrigation in respect of Salinity Hazard (After Wilcox, 1948 and Mohammad *et al*., 2019)

Salinity Hazard	Range of Electrical conductivity (µS/cm)
Low	Less than 250
Medium	250 to 750
High	750 to 2250
Very high	Greater than 2250

a. Sodium Hazard

The sodium Hazard concentration in the water of the catchment is calculated using Sodium Adsorption Ratio (SAR) formular. The SAR was obtained from the following expression:

Sodium Adsorption Ratio: $Na^{+}/\sqrt{(Mg^{2+} + Ca^{2+})/2}$

Where: Na, Mg and Ca are all calculated in milli-equivalents per litre

The calculated SAR for the water samples in the catchment is shown in Table 6

Table 6: Calculated SAR for the water samples in the Catchment

Sample Code	Na^{+}(meq/l)	Ca^{2+}(meq/l)	Mg^{2+}(meq/l)	$\sqrt{(Mg^{2+} + Ca^{2+})/2}$	$Na^{+}/\sqrt{(Mg^{2+} + Ca^{2+})/2}$
SHR 1	0.099	0.017	0.064	0.201	0.493
SHR 2	0.078	0.022	0.052	0.192	0.406
SHR 3	0.089	0.019	0.054	0.191	0.466
SHR 4	0.657	0.009	0.028	0.136	4.831
SHR 5	0.054	0.006	0.016	0.105	0.514

From the Table 6, it is shown that the values of the calculated Sodium Adsorption Ratio (SAR) for the water samples range from 0.406 meq/l to 4.831 meq/l, making the water samples to fall within the excellent water class based on Sodium Adsorption Ratio assessment according to Hem 1959's water classification for irrigation purpose based on SAR (Table 7)

Table 7: Water classification for irrigation purposes based on Sodium Adsorption Ratio (SAR) (After Hem 1959)

SAR	WATER CLASS	QUALITY
0-10	Excellent	Low sodium
10-18	Good	Medium sodium
18-26	Fair	High sodium
26-100	Poor	Very high sodium

- **Biodiversity and Ecosystem Health**: The biodiversity of Share catchment is affected by deforestation where many of the trees in the catchment have been cut down for charcoal production, leading to soil erosion and species loss. In order to have a high biodiversity rate and ensuring ecosystem health, reforestation and community engagement in sustainable tree management are essential.
- **Air Quality Index (AQI)**: Air quality Index is a scale that measures air quality from 0 to 500. It is a means of indicating levels of particulate matter or pollutants such as carbon monoxide (CO), sulfur dioxide (SO_2), and Nitrogen dioxide (NO_2) contained in the air. Air Quality Index is used to communicate how polluted the air is and the associated health risk. It ranges as follows:
    - **i.** Good (if it ranges from 0-50)
    - **ii.** Moderate (if it ranges from 51-100)
    - **iii.** Unhealthy for sensitive groups (if it ranges from 101-150)
    - **iv.** Unhealthy (if it ranges from 151-200)
    - **v.** Very unhealthy (if it ranges from 201-300)
    - **vi.** Hazardous (greater than 300)

The air quality of the Share catchment falls within the moderate range

- **Waste Management**: Environmental pollution and health challenges do arise from open dumping of wastes and bush burning which is a situation attached to this catchment especially in the neighboring villages of Share Township. Proper modern waste management practices for better improvement should be developed and this includes provision of modern waste bins and sensitization of communities on proper disposal of wastes.

- **Socio-Economic Assessment**

i. **Demographic Profile:** The population of the Share Catchment is predominantly urban with a mixture of sedentary farmers and pastoralists. Population growth is medium, contributing to increased demand for land and water resources.

ii. **Agriculture and Livelihoods**: Mixed farming is the type of agricultural practice dominating the catchment. The people of the area especially settlements like Zambufu and Yipata depend for their livelihood on subsistence farming and rearing of domestic animals.

Non-Farm Livelihoods: Apart from agricultural practices in the area, other means of livelihood of the people in the area includes trading and hoe blacksmithing.

Energy and Waste Management: Firewood is the primary source of environmental pollution through burning activities especially in the rural communities of the catchment. This can be curbed by enforcing environmental policies on the people in the catchment to ensure stoppage of such activities

- **Governance and Capacities Assessment**

i. **Policy and Regulatory Framework**: Natural resources in the catchment which are controlled by the Nigeria's comprehensive policies and regulations designed to protect natural resources and promote sustainable development are to be monitored and enforced for good governance.

ii. **Key Governance Issues:** Governance in the Share catchment is challenged by inadequate basic social amenities such as good road especially Tsaraji-Yipata road, pipe born water or boreholes, health care facilities, educational facilities etc. These issues can be solved through government interventions by providing good infrastructures and other basic social amenities for the communities in the catchment.

Conclusion

Share Catchment is a catchment that is underlained by both Precambrian Basement complex rocks and Sedimentary rocks including migmatite, granites, Schist, sandstones, conglomerates siltstones and clay stones. The catchment has a total covering area of 770km^2. The catchment is distributed for its agricultural practices, vegetation cover and trading activities. The availability of water resources in the catchment is challenged by inadequate groundwater resource (boreholes) which needs government intervention especially during the dry seasons. The socio-economic activities of the people in the catchment are hindered by inadequacy in assessing social amenities which are good road, pipe borne water, health care and educational facilities which also need government intervention. The sustainability and quality of the water resources in the catchment for domestic and Agricultural purposes were revealed through the water quality analyses to be of good quality; physically, chemically and biologically but attention is called to improve the reduction in the level of nutrients available for plants as well as soapy-like taste of the drinking water due to high concentration of Bicarbonate by adding sulphuric acid to the water using injection method to neutralize the bicarbonate by lowering the PH of the water.