REPUBLIC OF ZAMBIA

NATURAL CAPITAL ACCOUNTS FOR WATER, 2017 - 2020

PRELIMINARY RESULTS AND ADDITIONAL STEPS

TECHNICAL REPORT

WORLD BANK GROUP

WAVES

GPS Global Program on Sustainability

The Zambia Natural Capital Accounts for Water, covering the period 2017 – 2020 were produced by the Ministry of Water Development and Sanitation (MWDS) in collaboration with the Zambia Statistical Agency (ZAMSTATS), the Ministry of Finance and National Planning (MoFNP), the World Bank and the Global Program on Sustainability (GPS). Further information on the Water Accounts may be obtained from the addresses below:

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Foreword

Natural capital plays a key role in the sustenance of human life and economic activities. It is therefore imperative that Zambia is well informed on its current natural capital stock levels and usage. This is key as it will help ensure that natural resources are protected from overuse and efficiently managed to ensure sustainable socio-economic development. The urgency of the matter is further reinforced by the increasing effects of climatic variations and the widespread degradation of ecosystems and its impact on the country's food security and water system's resilience.

However, the looming local and global threats of declining natural capital stocks should not limit economic progress if countries are committed to sustainable use of renewable capital (land, forests, and water) and the proper management of waste products arising from non-renewable resources. Countries could perpetually benefit from renewable resources if they are efficiently and sustainably managed.

Against this backdrop, Zambia with the support of the World Bank Group (WBG) and other partners, continues to implement the Natural Capital Accounts (NCA) program now under the Global Program on Sustanability (GPS) umbrella, based on the System of Environmental-Economic Accounting (SEEA). The GPS program endeavours to promote sustainable development by ensuring that the nation's natural resources are mainstreamed in development planning and in its national economic accounting systems. The Zambia

Hon Dr. Situmbeko Musokotwane,
M.P. Minister Finance and National Planning

Wealth Accounting and Valuation of Ecosystem Services (WAVES) program has since completed the development of four natural capital accounts namely the Water, Forest, Land and Tourism Accounts. The completed accounts serve as key policy informants on emerging developmental concerns on aquaculture, energy (hydropower), deforestation (driven by insufficient hydropower energy), agricultural activities, enhancement of land productivity and its sustained use, urban and rural development planning, agricultural expansion and carbon sequestration.

The report represents the second attempt at producing water accounts for the country, following the System of Environmental Economic Accounting (SEEA). Water accounts consisting of physical and monetary supply and use tables covering the period 2017 to 2020 have been produced. The results from this account are a buildup from the previous efforts to develop water accounts covering the period 2010 – 2016. The key purpose of the water accounts is to inform policy decisions on effective water management in the country. Other than informing policy, we hope that findings from the Water Natural Capital Accounts will stimulate interest and healthy debates on the linkage of natural capital accounting and sustainable inclusive socio-economic growth.

Furthermore, plans to create two new accounts namely; Minerals, and Energy Accounts are underway. Upon completion, both accounts will also serve as a basis for policy and decision making.

Hon. Mike E. Mposha M.P.
Minister of Water Development and Sanitation

The dependency of economic development on natural resources is underappreciated in many countries across the globe, therefore we commend Zambia for updating their Water, Forest, and Land Natural Capital Accounts as well as developing a new Tourism Account to continue monitoring the countries development progress and natural resource management. This technical report on the Water Asset Accounts covering 2017 – 2020 built on the previous 2010 –2016 report, shows the recent changing interactions between economic activities at the national level and water as a natural resource, and its potential contribution to economic productivity and the Gross Domestic Product (GDP).

The demand for water in Zambia like many countries is growing with an increasing population and increasing economic activity. Therefore, the 2017-2020 water asset accounts are a vital tool for monitoring national water management for Zambia to attain Sustainable Development Goals (SDG) 6 which aims to *"ensure availability and sustainable management of water and sanitation for all"* also in line with Zambia's 8th National Development Plan (NDP).

The water account data from this report provides key inputs for integrated environmental-economic models which can evaluate the potential future water demands under alternative economic development scenarios and as well as to determine their sustainability.

We hope the key findings highlighted in this report will help enable policy makers to make , timely, evidence-based policy interventions that encourage the sustainable use of Zambia's water resources in the process of promoting positive economic development.

We wish to acknowledge the implementing institutions; Ministry of Water Development, and Sanitation (MWDS), Ministry of Lands and Natural Resources (MLNR), Ministry of Tourism (MoT), Zambia Statistics Agency (ZamStats), University of Zambia (UNZA), CopperbeltUniversity (CBU) and National Remote Sensing Centre and the program coordinators under the Ministry of Finance and National Planning (MoFNP) and for their continued commitment to building Zambia's natural capital accounts.

Iain G. Shuker
Practice Manager for Environment, Natural Resources & Blue Economy
The World Bank Group

ACKNOWLEDGEMENTS

The work presented in this report would not have had been possible without the dedicated effort of the technical working group for the water account and facilitation by the Zambia WAVES project coordination unit supported by the World Bank through the Global Program on Sustanability (GPS) trust fund. Furthermore, the data supplied by the various stakeholder institutions was key in the compilation of the report. These comprised the National Water Supply and Sanitation Council (NWASCO), the Water Resources Management Authority (WARMA), the Zambia Electricity Supply Corporation (ZESCO), the Ministry of Agriculture (MOA), the Ministry of Livestock and Fisheries (MoFL), Zambia Statistics Agency (ZAMSTATS) and the Zambezi River Authority to mention but a few. Special mention is made to the Ministry of Finance and National Planning (MoFNP) for their contribution in organizing and coordinating the various activities that made it possible to develop the Water Account, produce and launch this report.

Finally, the feedback received from various stakeholders and experts that helped shape the report is also acknowledged and greatly appreciated. Many of these experts were form local stakeholder institutions and the World Bank Group.

Eng. Joe Kalusa
Permanent Secretary
Ministry of Water Development and Sanitation

Mr. Trevor Kaunda
Permanent Secretary
Ministry of Finance and National Planning - Monitoring and Evaluation

EXECUTIVE SUMMARY

This report builds up from the first water accounts for Zambia that were published in 2019 following the System of Environmental Economic Accounting (SEEA). New accounts for the physical and monetary supply and use of water covering the period 2017 to 2020 were produced. The Water Accounts were supported by the World Bank via the Wealth Accounting and Valuation of Ecosystem Services (WAVES). In addition, the water accounts presented in this report were also the results of efforts to mainstream water accounting within the normal operations of the Zambian Government.

A key feature of the new Water Accounts for 2017 to 2020 is the improvements to data sources and methods, and resultant increase in data quality. This has led to better estimates of physical water use by irrigated agriculture and groundwater by households as well as the value of water used by households. Despite the improvements, a significant volume of water cannot be accounted for.

Key findings from the 2017 to 2020 Water Accounts are:

- The **energy sector** accounted for the largest amount of the water used, in the order of 60,000 million cubic metres per annum. However, water use by the energy sector is for hydro-electric power generation and is non-consumptive except for the displacement of water in time and space;
- **Rain-fed agriculture** used about 12,000 million cubic metres of water per annum;
- **Irrigated agriculture** water use was about 3,300 million cubic metres per annum. The water use in the years 2017 to 2020 is three orders of magnitude higher than what was reported in the 2010 to 2016 Water Accounts. This change is due to improved data sources and methods, rather than reflecting real changes in the amount of water used in irrigation;
- Water use by **livestock** was small at around 114 million cubic metres per annum;
- **Households** used about 1,000 million cubic metres per year, obtaining more than half of their water requirements from own abstraction from the environment. There was a slight reduction in the amount of water supplied to households by water utilities;
- The value of water used by **households** was about ZMW 2.16 Billion per annum, far more than the reported figure in the 2010 to 2016 Water Accounts. This change is due to improved data sources and methods, rather than reflecting real changes in the value of water used by households;
- **Households** paid more for water, approximately ZMW 3.08 per cubic metre, than other sectors;
- **Mining** used approximately 200 million cubic metres per annum.

In order to realize the potential of the Water Accounts to inform decision making related to water resource management, agriculture, human health, and climate change, the accounts need to move from the experimental phase into regular production. Hence, a National Water Statistical Survey Programme is needed. The suggested survey programme should support SEEA-based Water Accounts and be based on the principles of the International Recommendations on Water Statistics (IRWS) as well as the information systems used by the World Health Organisation (WHO), World Meteorological Organisation (WMO) and United Nations Children's Fund (UNICEF).

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1. Introduction

1. Introduction

Wealth Accounting and Valuation of Ecosystem Services (WAVES) is a global partnership that uses natural capital accounting to mainstream natural capital considerations into economic policy. Natural capital accounting helps to underscore the contribution of natural resources from the environment to the economy as well as highlight the impact of the economy on the environment. It is for this reason that the Government of the Republic of Zambia became part of the global WAVES program supported by the World Bank.

This document is a technical report for the Water Accounts for Zambia covering the period 2017 to 2020 and follows extensive work done by the Technical Working Group (TWG) on Water Accounts with support from the World Bank and key government institutions. This report builds on the first Water Accounts report for Zambia that was published in April, 2019. It extends the work to cover an additional period between 2017 and 2020. The previous report served as a starting point, proving that water accounts can be produced for the nation but also recognized that there was a lot of work to be done in order to improve, expand and institutionalize the practice of water accounting as a means of addressing key policy issues with respect to water security in Zambia. This report is also drafted in the same spirit.

It is hoped that this report will enhance further discussions and action leading to improved coverage, data sources and methods and also lead to applications of the accounts within the government and beyond. The full spectrum of water accounting is very broad, covering physical supply and use, water pollution accounts, water asset accounts and a range of monetary accounts. However, this report, like the previous one, focuses on the flow accounts, including physical and monetary supply and use accounts for 2017 to 2020. The development of water pollution accounts and water asset accounts will be undertaken when a more comprehensive water statistical survey programme for Zambia is formulated and implemented. This is because experience in developing the previous and current reports have shown that a more mainstreamed and well resourced approach should be taken in the development of the water asset and water pollution accounts.

Basic economic, environmental and social information about Zambia is found in Box 1. This information is to place the report into a national context. Some of this information is also important for the derivation of indicators, for example, per capita water use and productivity of water use as measured by GDP per m^3 of water used.

Box 1. Information on Zambia

The Republic of Zambia is located in southern Africa. The country has an area of 752 thousand km^2, with 32% of this agricultural land and 65% forested area (FAO country databases). In 2017 Zambia had a population of 17.1 million (CSO 2018) and approximately 57% of the population lived below the poverty line (World Bank 2019). Gross Domestic Product (GDP) was USD$25.868 billion (current price) in 2017, with an average annual growth rate of 3.4% (World Bank database) while GDP per capita was USD$3,652 in 2016 (FAO country database). Mining contributes 14.8% to GDP while agriculture contributes 7.2% (CSO national accounts). The development aspirations, opportunities and challenges of the country are outlined in 8th National Development Plan 2022-2026 (GRZ , 2022).

This report has six sections: Introduction (Section 1); Main findings (Section 2); Concepts, data sources and methods (Section 3); Next steps (Section 4), Acknowledgements (Section 5); and References (Section 6). The report also has an Annex containing the diagrams and tables showing the physical and monetary supply and use of water in Zambia for 2017 to 2020. Section 2 outlines the main findings which mostly represent the impressions and policy issues derived from the Water Accounts. On the other hand the sources of the data that were used to compile the Water Accounts as well as approaches and assumptions that were used to make estimates for missing data are elaborated in section 3 which also briefly narrates the concepts for compilation of the water accounts following the System of Environmental Economic Accounting (SEEA) Central Framework (UN, 2014) and SEEA Water (UN, 2012). Section 4 outlines the next steps for the continued development and application of Water Accounts in Zambia through a proposed water statistical survey programme or hydro census programme.

1.1 Process

The Water Accounts presented in this report were developed between January, 2021 and April, 2022. The process included the following steps:

i. Developing a work plan for compilation of the 2017 – 2020 Water Accounts;
ii. Collecting data and holding technical working sessions;
iii. Preparing a draft technical report and subjecting it to peer review;
iv. Publishing and launching the report.

The ongoing development of the Water Accounts and their relationship to other accounts being developed in Zambia is discussed in Section 4.

2. Main findings

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2.1 Trends in data and basic analysis

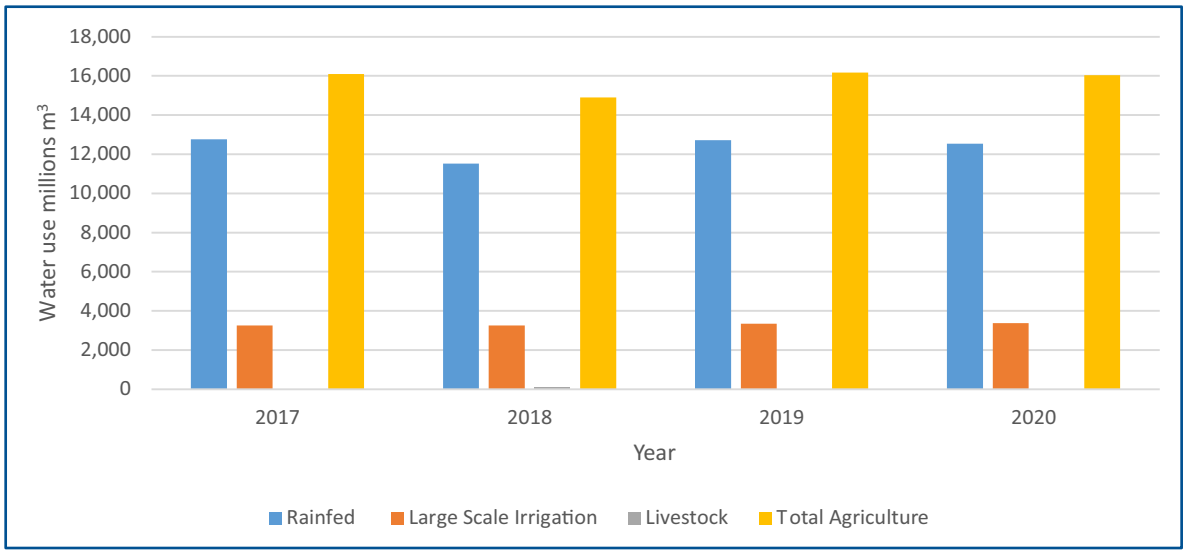
This section outlines the main trends identified in the accounts. This is done by industry and sector, beginning with agriculture followed by other industries (e.g. mining, energy, and manufacturing) and the household sector. The information is drawn from the physical and monetary supply and use tables shown in the Annex (Tables 1 to 8).

2.1.1 Agricultural water use

Total agricultural water use comprised three main components, that is, large scale irrigation of agriculture, livestock watering and rain-fed agriculture. Rain-fed agriculture used by far the largest amount of water in the order of around 12,000 Mm^3/ annum. Livestock used around 114 Mm^3/ annum for livestock and irrigated agriculture used about 3,300 Mm^3/ annum. It is important to note that in the 2010 -2016 water account report, the irrigation water requirement that was computed was with respect to the incremental area brought under irrigation during that period. The irrigation water requirement reported in this report is referenced against the total area under irrigation during the review period. The lack of comprehensive statistics on irrigation resulted in reporting incremental area under irrigation as the total irrigated area in the previous report. Therefore, it can be seen that the establishment of comprehensive national water statistics following the international recommendation is critically important if such oversights are to be avoided in furthering water accounting in Zambia. From the data on irrigation presented in the 2017-2020 accounts, it can be seen that irrigated agriculture also uses a very significant amount of water resources. However, rain-fed agriculture still accounts for the bulk water resource utilization in the Agricultural Sector. The variation in water use by agriculture is shown in Figure 1.

Figure 1 shows a difference of a factor of about four between the water use for rain-fed agriculture and irrigated agriculture, which highlights a policy issue that needs to be dealt with if government development objectives are to be met. The objectives include diversification of the economy, job creation, poverty reduction and value addition for agricultural produce. The link to poverty is the fact that rain-fed agriculture is mostly associated with subsistence farming and low value crops, whereas irrigation is often tied to high value crops and commercial agriculture. The accounts show that there is a fair level of irrigation taking place in the country, however, there is still space to enhance this by providing for irrigation through subsistence and small holder farmers. If efforts are not made to advance commercial irrigation among subsistence and small holder farmers, this will denote a situation of loss of potential economic productivity and contribution to GDP from the agricultural sector. Therefore, an appropriate policy intervention would be to implement measures that promote irrigation development as a means to increasing agricultural production and productivity in terms of area under cultivation for high value crops. Much of the drive for irrigation development will have to focus on development of water resources infrastructure to support irrigation; organizing and capacitating rural and urban communities into viable cooperatives capable of operating as commercial entities; developing and guaranteeing markets for agricultural produce from rural areas; and value chain addition for excess agricultural produce.

Figure 1: *Agricultural water use histogram.*

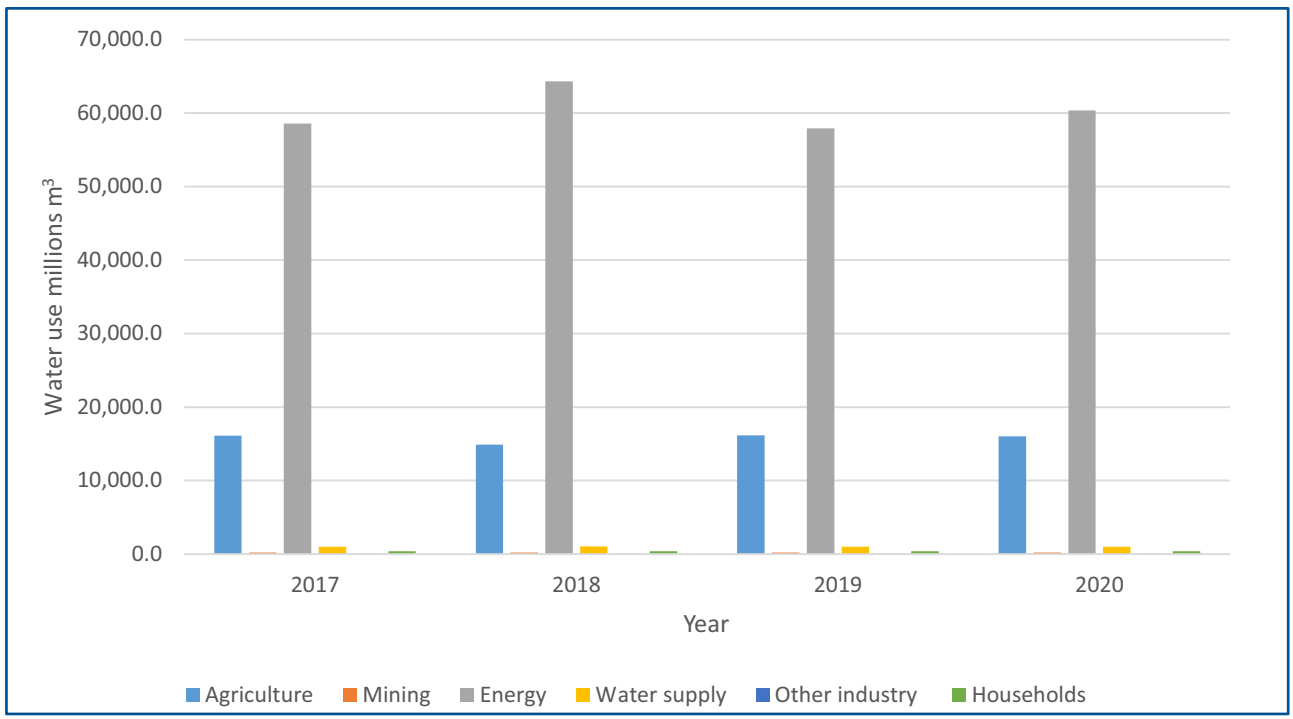


Source: *Physical supply and use tables, see Annex*

2.1.2 Industry and sector water use

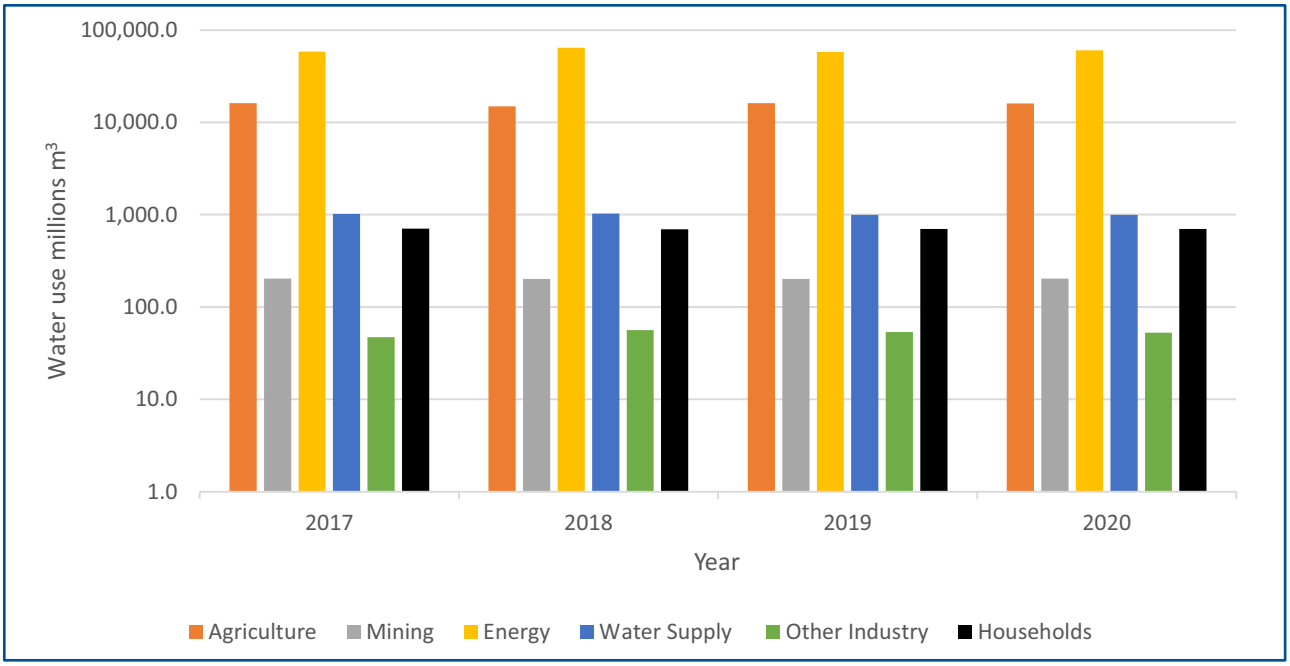
In terms of industrial water usage, the energy sector (for hydropower generation) is the largest user of water. The water use in the energy industry is non-consumptive and thus the water is available for further use after the generation of hydropower. Agriculture is the second largest user of water and over time, there has not been any significant increase in the usage. The third largest user of water is the household sector, followed by all other industries, and mining being the smallest user. Figure 2 below shows the industry and sector water use on a linear scale, whereas Figure 3 shows industry and sector water use on a logarithmic scale.

Figure 2: *Industry and sector water use histogram (Linear scale).*



Source: *Physical supply and use tables, see Annex*

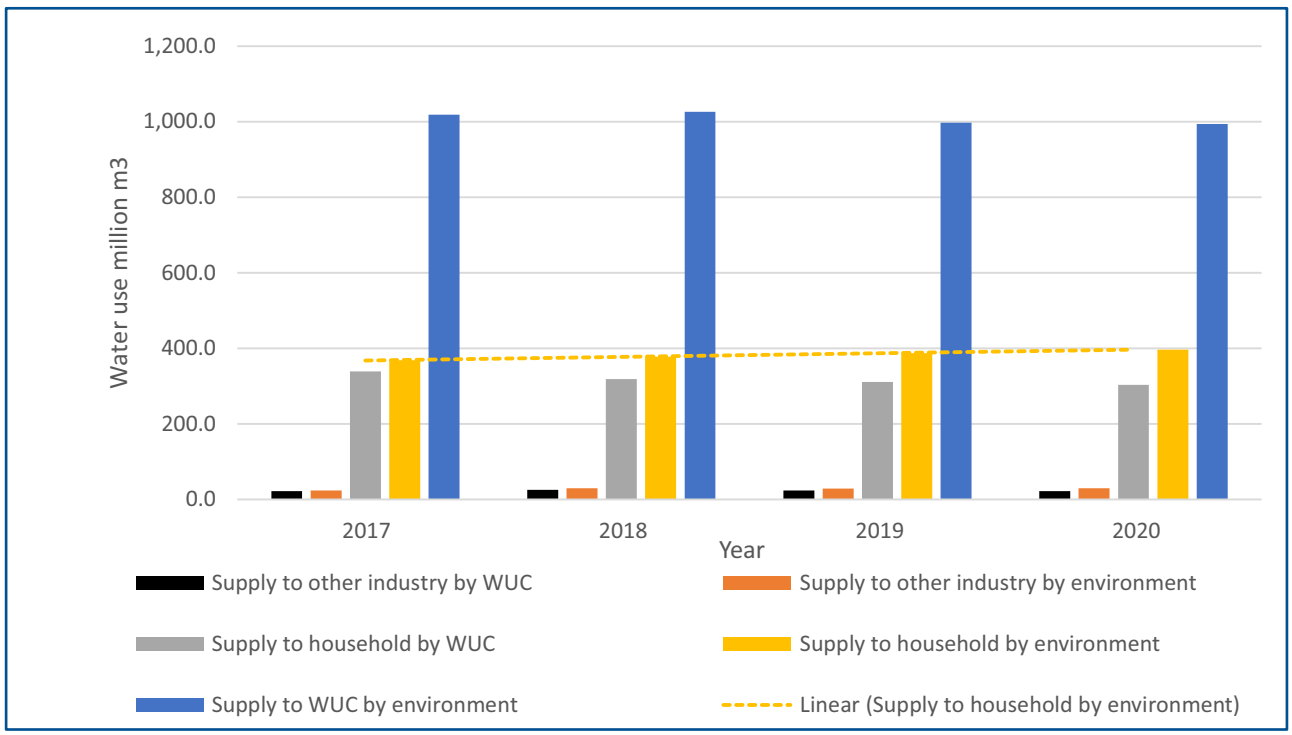
Figure 3: *Industry and sector water use (Log scale).*



2.1.3 Household and other industry water use

The observed trend from the data collected on water use by households, other industry and water utility companies indicates that abstractions from the environment by Water Utility Companies (WUC) have been declining, whereas abstractions from the environment by households have been increasing, as depicted by the trend line in Figure 4 below. The reasons for these changes are not known with certainty but are probably related to increases in population not connected to the water supply network. These households, that are not connected to the water supply network, depend on their own sources of water supply which includes boreholes and shallow wells. In most cases, the water quality and quantity of these water supply sources are unknown. This poses risks to human health, environment condition, and the sustainability of water utility companies, which requires the government's intervention.

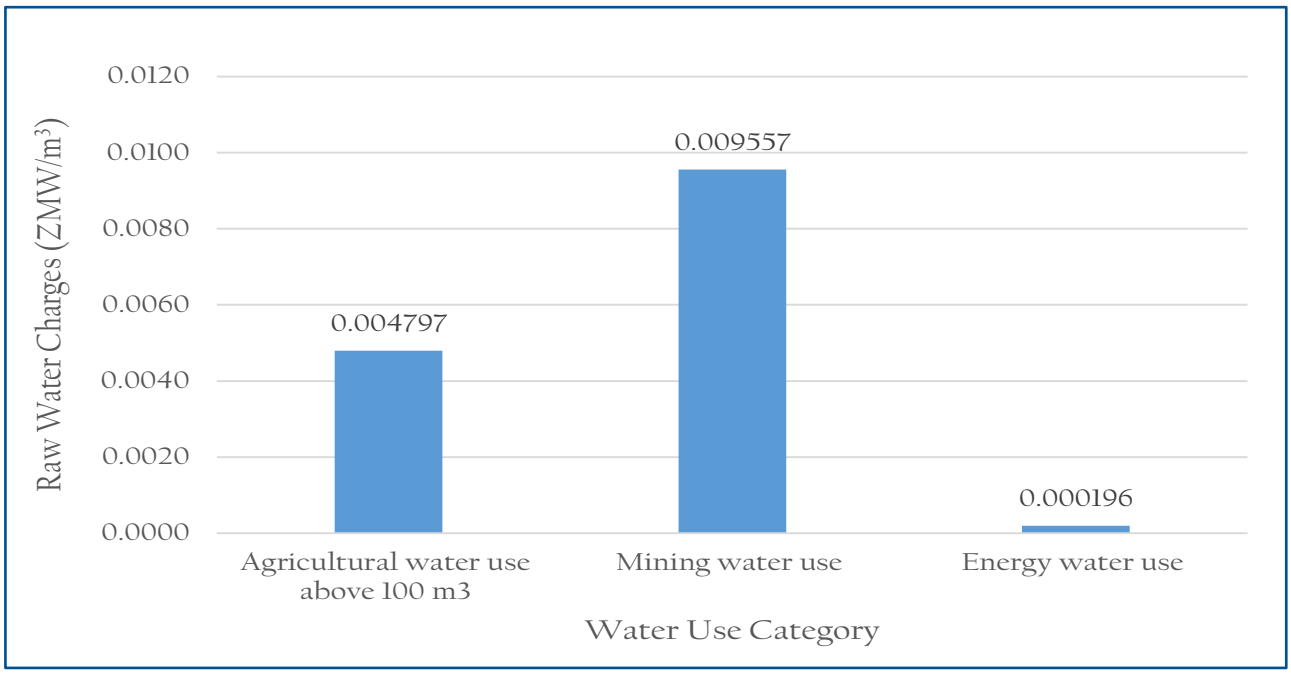
Figure 4: *Household and other industry water use: supply by water utilities and environment*



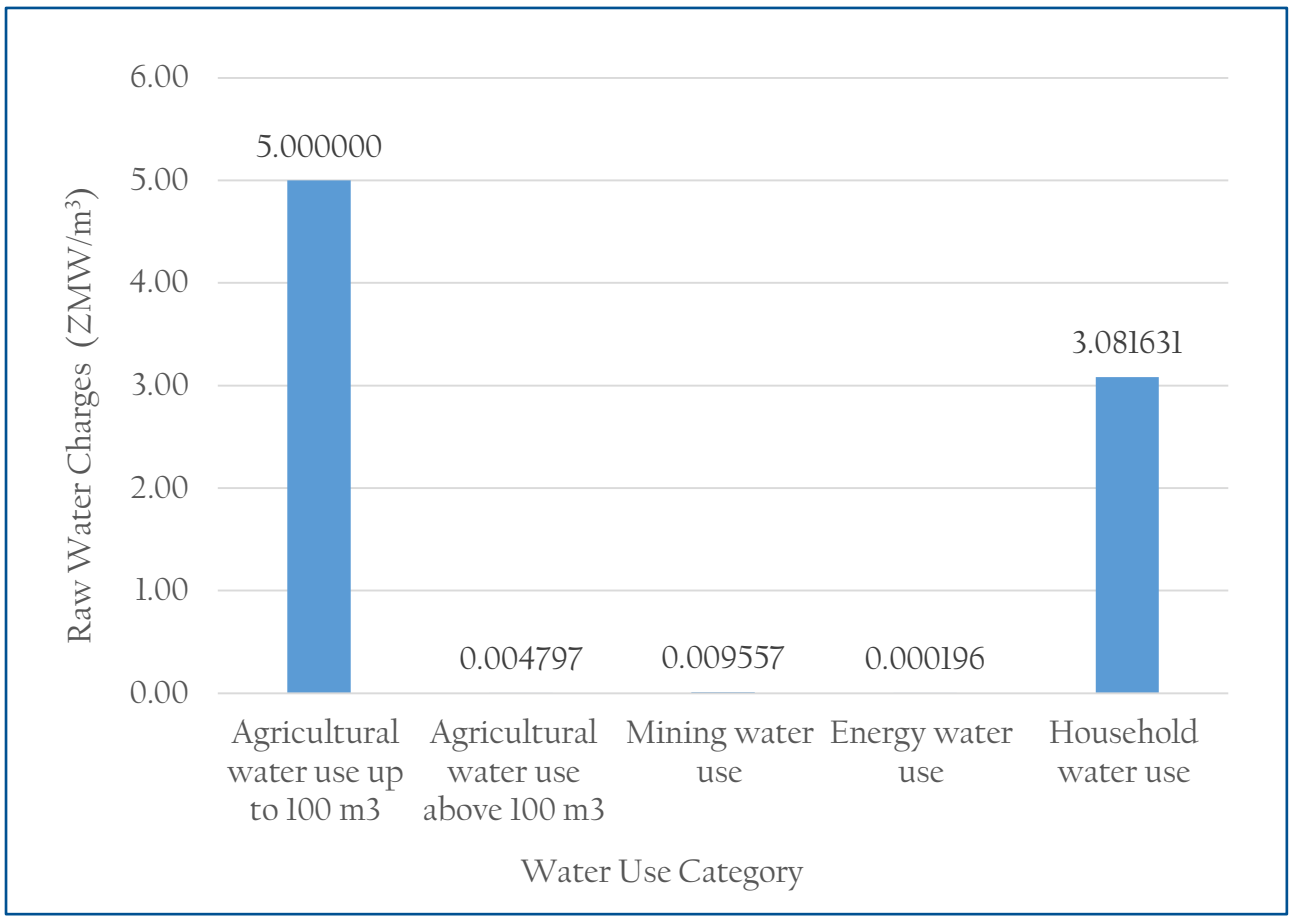
The data collected showed that the households pay more for water than the other sectors. It is estimated that the value of household water use is ZMW 3.08/ m^3 whereas that for energy water use, mining water use and agricultural water use above 100 m^3 is ZMW 0.000196, ZMW 0.009557 and ZMW 0.004797 per cubic meter respectively. However, the first 100 $m^3$of agricultural water use are valued at ZMW 5.0/ m^3. The estimated value of water use by households arises from a combination of water use supplied from the water utility companies as well as own abstraction from the environment. Supply from water utility companies was charged at the approved NWASCO tarrif, whereas own abstraction was associated with the municipal raw water charge based on the new raw water pricing regime. The new regulations for pricing of raw water were established through Statutory Instrument No.18 of 2018. Figure 5 illustrates the comparative water use value per cubic meter of water for the various sectors. Some of this can be explained by the fact that the quality of water supplied to households by water utility companies is higher since it needs to conform to local and international standards of potable drinking water and thus undergoes sophisticated treatment at a considerable cost before distribution to clients. However, the water supplied to the other sectors including own abstraction by households normally does not require prior treatment and is usually used as absracted from the environment.

Figure 5: *Comparative water use values*

(a.) Agricultural water use (above 100 m^3), mining water use and energy water use.



(b.) Agricultural water use (upto 100m^3) and Household water use.



Source: *Physical and monetary supply and use tables, see Annex*

2.2 Possible applications of accounts

The global push for economic development, and its effects on climate change and variability, has brought with it increased pressure on water resources. Zambia has not been spared from these issues and is particularly disadvantaged due to an inadequate provision of basic services, largely as a result of limited infrastructure. There is also non-climate related issues such as the loss and degradation of freshwater ecosystems; pollution leading to contamination; increased occurrence of waterborne diseases, and; increasing demand for water casued through a growing popluation and economy.

Water management under such circumstances is very challenging. The traditional focus of water statiustics is on hydrology and water quality aspects with little emphasis on the economic and social aspects of water. The Water Accounts are particularly suited for dealing with the challenges of water management because of their ability to integrate both environmental and economic data with respect to water supply and use. The water accounts can be an effective tool for water management at various levels including national, catchment and basin levels. In this regard, some of the possible applications amenable to the water accounts include:

i. Determining water demand for livelihood, economic growth, patterns of domestic consumption, and international trade on water resources;
ii. Understanding the social and economic implications of water policy instruments like water pricing, abstraction permits, property rights and regulation. One example for Zambia in this regard would be the evaluation of the impact of the recently introduced statutory instruments for groundwater regulations on agriculture and industry;
iii. Determining the specific contributions of economic activities to the various needs and pressures on water resources, such as pollution and over-abstraction, as well as the opportunities for reducing these pressures;

iv. Determining the impact from changes in the natural environment, including climate change on water resource availability in time and space and subsequently the uses in and impact on particular economic sectors;
v. Providing key inputs to models for evaluating the possible future water demands under alternative economic development scenarios and determining their sustainability;
vi. Understanding how changes in sector policies such as agricultural, energy, forestry, land, etc. can affect water resource utilization;
vii. Linking and enhancing with already existing initiatives such as the Integrated Water Resource Management Information System (IWRMIS) under the Water Resources Management Agency (WARMA) required for capturing and storing integrated information on environment, water and economic sectors. The database for this would need to be configured along the lines of the International Recommendations for Water Statistics (IRWS) (UN, 2012a); and
viii. Visualizing the possible social and economic impacts of pricing reforms for water among others.

The main power of the water accounts lies in providing information on:

i. Indicators and descriptive statistics at the *macro* level that enable monitoring and evaluation. These indicators can serve the purpose of warning signs with respect to unsustainable and socially undesirable trends in water resource utilization and status at national level;
ii. Indicators and descriptive statistics at the *meso* level, i.e. by industry, such as agriculture, mining, energy, manufacturing industry, allowing to do cross-sectoral comparison. The same industry comparison for benchmark studies across countries;
iii. Detailed statistics for policy analysis which enable determination of the sources of pressure on water resources as well as the opportunities for mitigating against these pressures. Furthermore, the detailed statistics allow for the determination of the effect of economic instruments such as pricing to address the problem and associated possibility of solutions (UN, 2012b);
iv. The linkage of physical water resource use by sectors (in a physical supply and use table), with the economic information from the National Accounts and the natural water resources available for the country in Water Asset tables. This allows us to derive integrated indicators, either from integrating physical flows, stocks and assets, but also integrating physical water flows with economic flows or transactions in the economy;
v. The range of flow and asset accounts allow to inform investments and finance & funding on priorities for the country;
vi. Linkage between water accounts and other physical accounts (e.g. Forest and Land Accounts) and key water related ecosystem services that could possibly be monitored by ecosystem accounts.; and
vii. Input to setting water permit fees for groundwater abstraction.

Consideration for further analysis and application to policy of the water accounts would be most appropriate in the following areas:

i. Evaluating the current and future water demands for the country and determining the appropriate interventions or investments with respect to water security such as the required water storage or water transport;
ii. Evaluating the current and potential impact of current and projected economic growth on the water resources;
iii. Determining development options that maximize economic benefits while ensuring sustainable water resource utilization;
iv. Monitoring and evaluation of the impact of water pricing and regulatory instruments in the water supply and sanitation, and water resources subsectors.

3. Concepts, data sources and methods

3. Concepts, data sources and methods

3.1 Concepts for the Zambia Water Accounts

The water accounts presented in the publication were compiled based on the SEEA (UN, 2014, 2012b). The tables presented are for the supply and use of water in both physical (m^3) and monetary terms (ZMW). The data used to populate the tables were drawn from a variety of sources to produce a consolidated water data set that can be linked to the System of National Accounts, which among other things produces the metric GDP (Gross Domestic Product).

The first version of the SEEA was published in 1993 and was made an international statistical standard in 2012. Environmental accounts extend the boundaries of the System of National Accounts to more fully include environmental resources and the economic activities that degrade the environment (e.g. pollution). The water supply and use tables also provide the means to link water information to other environmental data presented according to the SEEA (e.g. forest, land and energy accounts).

The first Water Accounts for Zambia, which were based on the SEEA, were published in April, 2019 (GRZ, 2019). Whereas this, as the second set of water accounts for the period 2017-2020, improves on the first set of accounts, while also using the SEEA. The main data sources and methods, including the improvements, are described in the sub-sections that follow.

3.2 Data Sources and Methods

3.2.1 Water Supply and Sanitation

Data on water supply and sanitation was obtained from the National Water Supply and Sanitation Council (NWASCO) sector reports on urban and peri-urban water supply and sanitation for the period 2017-2020 (NWASCO, 2017; 2018; 2019; 2020). This is in contrast to water supply and sanitation data for 2010 -2016 which was obtained through a questionnaire that was designed to capture the data in a format aligned to the Water Accounts. The data covers mostly urban areas serviced by the Water Utility Companies and does not include water supply and use in the rural areas. Estimates of water supply and use for rural areas is covered under Section 3.2.5.

3.2.2 Agriculture

Data on total area under irrigation in terms of crops and area cultivated were obtained from the Ministry of Agriculture during the technical working sessions. At the time when the agriculture water use was being compiled, it was clarified that the data obtained for the 2010-2016 water accounts concerning irrigation was for the incremental area brought under irrigation since 2013 and not for total area irrigated, as was the assumption. This means that the estimate of irrigation water use presented in the 2010-2016 water accounts was not the total amount of irrigation water used. The irrigation water estimate presented in the 2017-2020 water accounts corrects this assumption and is based on the total area under irrigation for the review period.

The Food and Agricultural Organization (FAO) CropWat software (Clarke, 1998), water requirements for irrigation for the 2017, 2018, 2019 and 2020 were estimated for the driest growing period. Similarly, water utilization by rainfed agriculture was estimated using the FAO CropWat Software and applied to the area under cultivation for each crop in the different provinces. Data on crops grown and area under cultivation were obtained from the Zambia Data Portal (http://zambia.opendataforafrica.org). The reference climatic conditions were for the Kabwe station and soils were assumed to be red loamy soils except for rice where the soils were assumed to be black clayey soils. Going forward, other sources of information on soil can be investigated (e.g. international soil databases).

3.2.3 Energy

Data on power production was obtained from the Ministry of Energy during the technical working sessions. Water use for power production was derived by applying a unit rate of water consumption per Gigawatt-hour (GWh) of energy produced as established in the 2019 water accounts technical report (GRZ, 2019). It is

important to note that water use for hydro-power generation was assumed to be 100 % non-consumptive. It should be noted that though hydro-power did not consume any water (i.e. it was available to other users after it had been used for electricity generation), the water was displaced in time and space so it limited when and where the water could subsequnetly be used.

3.2.4 Mining

Data on water use by the mining industry was estimated from available data from two of the largest mines in the country. From one mine, water use data was available for the review period whereas for the other, it was estimated from official published information (KCM, 2022). This information was an estimate of the amount of water de-watered by the mine on a daily basis. This estimate was then applied to give annual water abstraction rates for the review period. Thus, the total water use for mining industry was the summation of the water use estimates from these two large mines on an annual basis. This is a departure from the approach used in the 2019 water accounts technical report which considered water use by the mines as a ratio of all volume generated based on estimates of porosity or void space. When the 2010-2016 water accounts were being compiled, water use data from mines was not readily available, hence the decision to use porosity based estimates.

3.2.5 Households and Other Industry

Water supply and use for households from sources other than the Water Utility Companies was estimated based on data in the CSO Living Conditions Monitoring Survey (LCMS) report for 2015 (CSO, 2016) and projected or discounted for the other years from 2017 to 2020 based on the rate of population growth (CSO, 2012, 2003). Furthermore, water supply and use for Other Industry (which excludes agriculture, mining and energy) was estimated by applying the ratio between household supply and industry supply from water utility companies to the water use by households from other sources for each of the respective years.

3.2.6 Monetary Estimates

The monetary estimates were based on the application of a tariff to the physical quantities of flows for the various sectors. The applicable tariffs were broadly split in to two categories: raw water tariffs; and water supply & sewerage tariffs. A flat rate tariff based on the old regime of water use charges which was pegged at ZMW 0.55/m^3 of raw water usage was applied for 2017, wheras new regulations on pricing of raw water (GRZ, 2018) were applied to the period 2018 to 2020. These new regulations became effective on 7th March 2018 and were thus not applicable to the Water Accounts for 2017. As a result of the change in the raw water pricing regime, financial flows associated with abstraction of water from the environment substantialy reduced to about an order of magnitude lower than the previous estimates associated with the 2010 – 2016 Water Accounts. This is an example of how policy measures can affect the contribution of water resources to the economy and vice versa. Furthermore, it is important to note that there are no charges that are applicable to the use of soil water. However, in order to estimate a value of soil water use, agricultural water use charges based on the new regulations for volumes of water exceeding 100 m^3 were applied. This is a simple replacement cost method and it is realized that further research is needed to better estimate the value of the use of soil water. On the other hand, the water supply and sewerage tariff that was applicable was a national average tariff for each year based on the NWASCO approved tariffs covering the review period 2017 to 2020 (NWASCO, 2017; 2018; 2019; 2020). Table 1 and 2 below give an overview of the tarrifs aforementioned.

Table 1: Raw water use fees based on Statutory Instrument No. 18 of 2018 under the Water Resources Management Act No. 21 of 2011.

Category	Statutory fee unit	Statutory unit charge	Conversion factor (Statutory fee unit to Zambian Kwacha)	Additional conversion factor where applicable	Kwacha Unit Charge
Agriculture (up to 100m^3)	Fee Units/m^3/day	16.67000	0.300000	-	5.001000
Agriculture (above 100m^3)	Fee Units/m^3/day	0.015990	0.300000	-	0.004797
Mining	Fee Units/m^3	0.031857	0.300000	-	0.009557
Energy*	per kilowatt hour generated	0.003069	0.300000	0.212766	0.000196
Municipal	Fee Units/m^3	0.010346	0.300000	-	0.003104

*Additional conversion factor units: kwh/m^3

Table 2: Water supply tariffs for 2017 to 2020

YEAR / UTILITY COMPANY	2017	2018	2019	2020
Lusaka Water Supply & Sanitation Company (LWSC)	6.90	6.90	9.18	9.62
Nkana Water Supply & Sanitation Company (NWSC)	5.61	5.61	7.72	7.58
Kafubu Water Supply & Sanitation Company (KWSC)	5.71	5.71	6.55	6.33
Mulonga Water Supply & Sanitation Company (MWSC)	6.60	6.60	8.14	7.28
Lukanga Water Supply & Sanitation Company (LGWSC)	4.73	4.73	5.92	7.64
Southern Water Supply & Sanitation Company (SWSC)	6.11	6.11	7.18	7.24
Chambeshi Water Supply & Sanitation Company (CHWSC)	4.80	4.80	5.95	6.42
Northwestern Water Supply & Sanitation Company (NWWSC)	7.11	7.11	7.18	7.26
Western Water Supply & Sanitation Company (WWSC)	5.55	5.55	5.95	7.04
Eastern Water Supply & Sanitation Company (EWSC)	6.97	6.97	7.12	8.41
Luapula Water Supply & Sanitation Company (LPWSC)	6.19	6.19	7.03	7.23
NATIONAL AVERAGE	6.03	6.03	7.08	7.46

Note:

a) Sewerage Tariffs = 29.4% of water tariffs
b) Units: ZMW/m^3
c) Average applicable tariffs as indicated in the Urban Water Supply and Sanitation Sector Reports 2017 -2020(NWASCO, 2017; 2018; 2019; 2020).

3.3 Data quality and data gaps

The water accounts presented in this report were based on available data, which are incomplete. The ideal situation would have been to obtain direct water usage data from each sector. Having a system in place that required entities from all sectors to report their water sources and uses into a central repository configured along the lines of the International Recommendations for Water Statistics (UNSD, 2011) would address thee problems with data quality and data gaps.

The kind of data required for the supply side data came from the water utility companies through the NWASCO annual reports. Estimates of water supply and use for the other sectors were mostly based on estimates derived from secondary data such as national patterns on water use as published from the CSO and other sources. In addition, modelling approaches such as the estimation of soil water use using the FAO irrigation modelling tool CropWat were also utilized. These data sources and methods used for estimates of physical water usee were considered the best option available at the time of compiling the water accounts given the general lack of water statistics for Zambia. Similarly, the value of soil water use using a simple replacement cost was the best option avaible and it is recognised that further research on water valuation is needed. Having better local data sources and methods would lead to increased accuracy and usefullness of the accounts.

4. Next steps

4. Next steps

The value of water accounting for planning, decision making and water management is increasingly being appreciated within the country. The water accounts produced so far are being used as a reference on water statistics and water use. So far, the water accounts have been produced on an experimental basis, i.e. not yet mainstreamed into policy and decision making, planning and water resources management, which requires regular and consistent data. In order to regulalry produce water accounts that are fit for decision-making, critical underlying issues related to how water data and information is collected, processed, managed and disseminated must be addressed.

To do this, there is need to formulate a National Water Satistics Survey programme which can be repeated periodically every one or two years to provide the base data for water accounts and other water indicators. The survey programme needs to be included as part of the Government work plan and budget. The survey programme suggested should be based on the principles outlined in the International Recommendations on Water Statistics and the System for Environmental Economic Accounting for Water (SEEA-Water). Other statistical standards for water are published by the World Health Organisation, the World Metrological Organisation and UNICEF and should also be incorporated.

The next steps that should be undertaken in formulating the National Water Statistics Survey are:

i. Draft Terms of Reference for a Steering Committee for the development of the National Water Statistics Survey programme
ii. The Steering Committee should:
a. Determine the types of water statistics needed at various spatial levels (national, provincial and district) and for particular policy areas including water resource management, agriculture, human health and climate change;
b. Indentify appropriate data collection strategies and approaches, data sources and methods, meta data and data quality issues, data dissemination;
c. Ensure linkages to compile the water accounts; and
d. Based on the above, develop a Road Map to implement the National Water Statistics Survey programme, considering how to mobilise the partnerships, capiacity and resources needed to mainstream the program and theproduction and use of water accounts.

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iv. Stakeholders that provied written comments and feed back to the consultation draft of the report.

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6. References

6. References

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ANNEX: DIAGRAMS OF PHYSICAL FLOWS AND PHYSICAL AND MONETARY SUPPLY AND USE TABLES

Figure 6: PSUT diagram for 2017

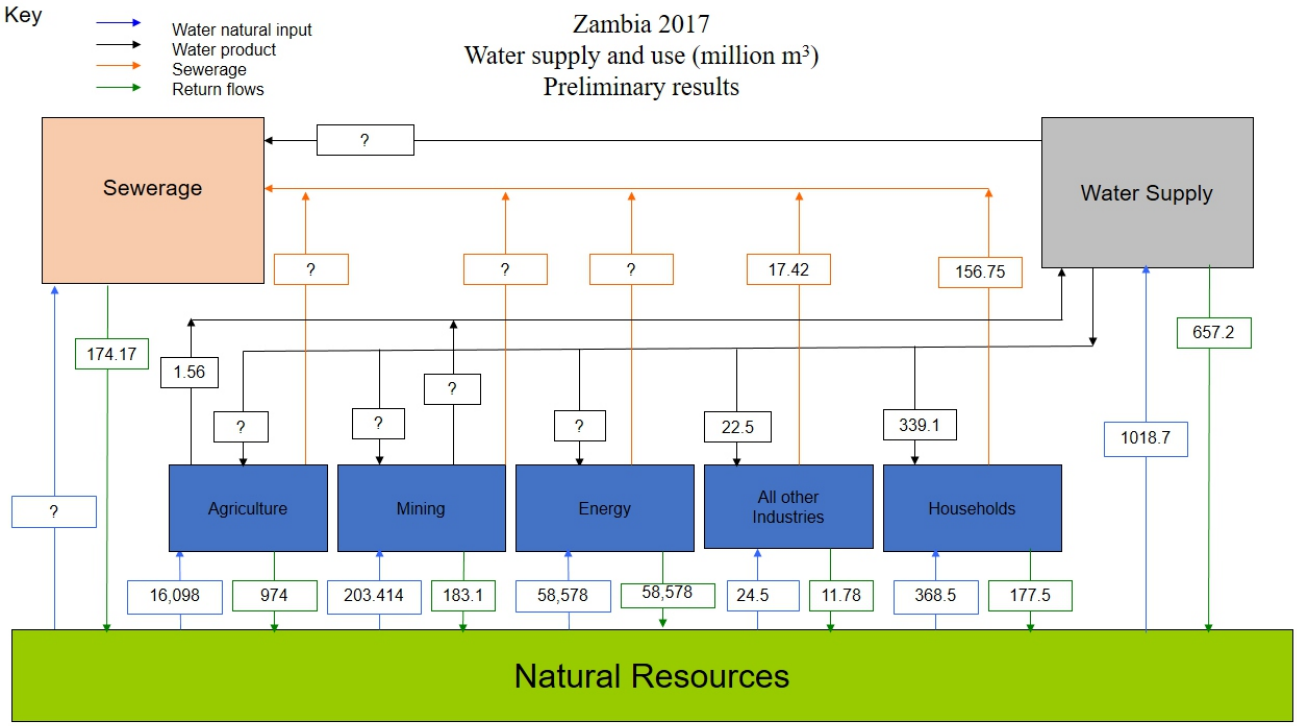

Figure 7: PSUT diagram for 2018

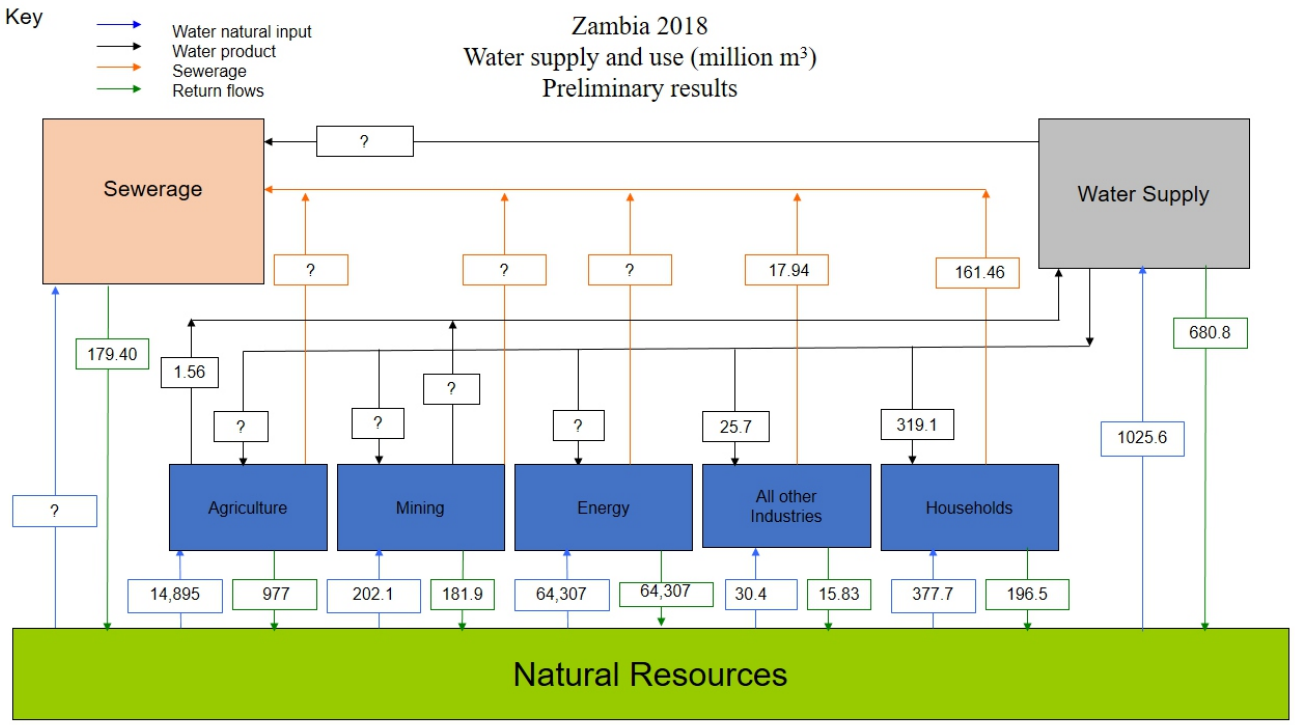

Figure 8: PSUT diagram for 2019

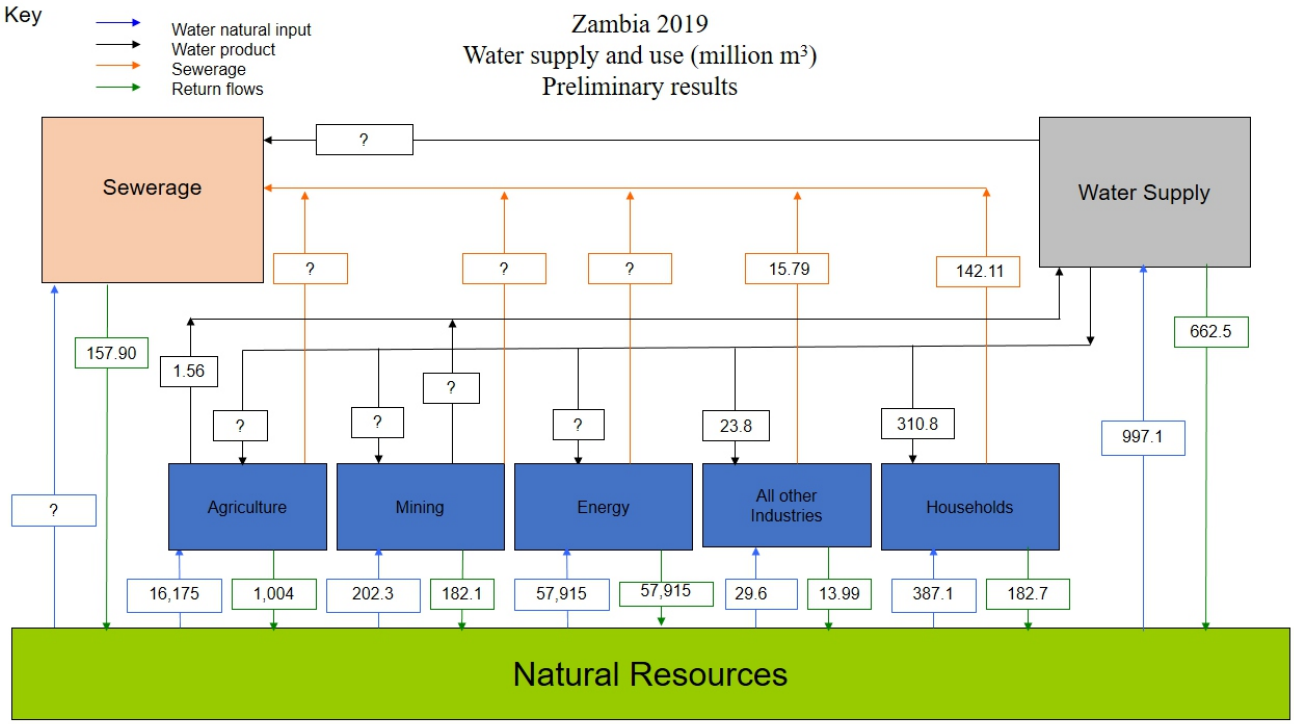

Figure 9: PSUT diagram for 2020

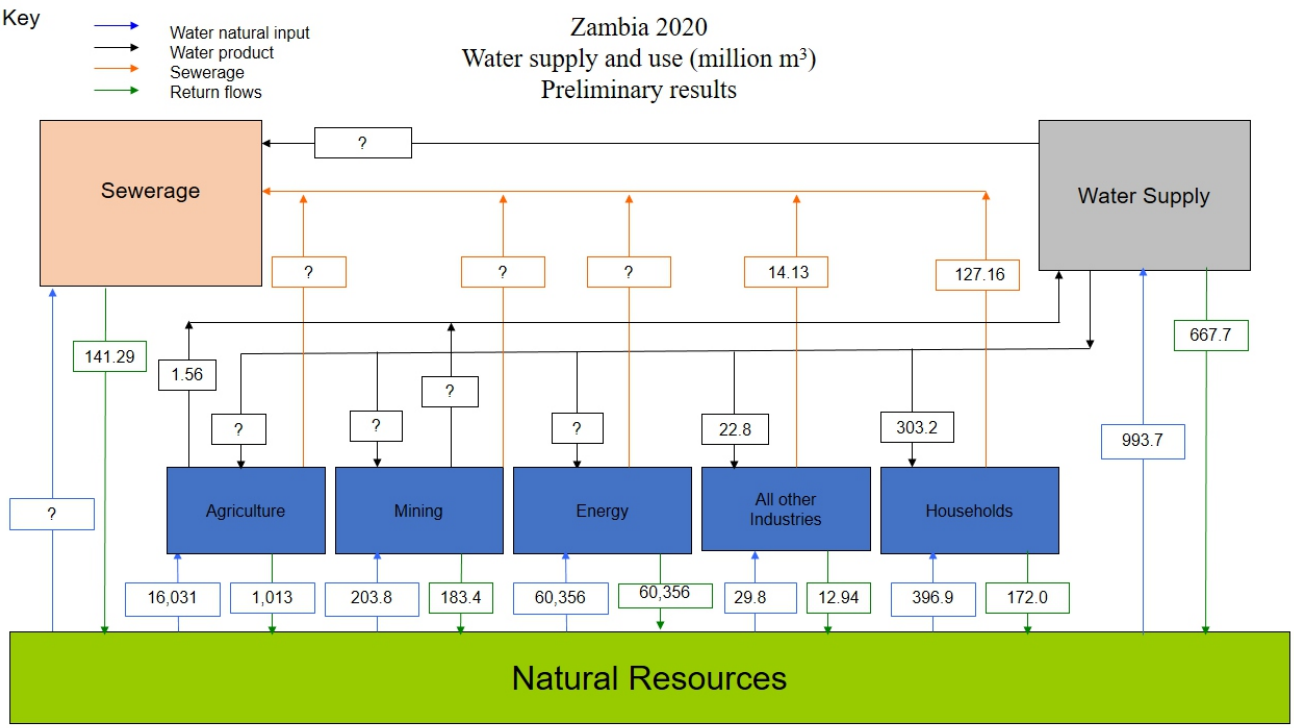

Table 3 (a): Water accounts physical supply tables for Zambia, 2017 (Mm^3)

Physical supply table	Agriculture					Industry							Households	Environment	TOTAL
	Agriculture (rainfed)	Agriculture (large-scale irrigation)	Agriculture (small holder irrigation)	Agriculture (livestock)	***Subtotal agriculture***	Mining	Energy	Water utilities	Irrigation schemes	***Subtotal water supply industry***	Sewerage	All other industries	***Subtotal industry***			
Natural resources																
Surface water															60,971.68	**60,971.7**
Groundwater															2,563.43	**2,563.4**
Soil water															12,756.00	**12,756.0**
Total natural resources															76,291.11	**76,291.1**
Products																
Natural water		1.6	-		1.6			360.0		360.0			***361.6***	-		**361.6**
Sewerage					-							17.4	***17.4***	156.8		**174.2**
Total water and sewerage products	-	***1.6***	-	-	***1.6***			***360.0***	-	***360.0***	-	***17.4***	***379.0***	***156.8***		**535.8**
Return flows																
To surface water		974.0			974.0	183.1	58,578.0				174.2		***59,909.3***			**59,909.3**
To groundwater*					-			657.2		657.2		24.5	***681.7***	177.5		**859.2**
Total return flows	-	***974.0***	-	-	***974.0***	***183.1***	***58,578.0***	***657.2***		657.2	***174.2***	***24.5***	***60,591.0***	***177.5***		**60,768.5**
TOTAL SUPPLY	-	975.6	-	-	***975.6***	183.1	58,578.0	1,017.2	-	1,017.2	174.2	41.9	***60,970.0***	334.3	76,291.1	**137,595.4**

Table 3 (b): Water accounts physical use tables for Zambia, 2017(Mm^3)

Physical use table	Agriculture					Industry								Households	Environment	TOTAL
	Agriculture (rainfed)	Agriculture (large-scale irrigation)	Agriculture (small holder irrigation)	Agriculture (livestock)	Subtotal agriculture	Mining	Energy	Water utilities	Irrigation schemes	*Subtotal water supply industry*	Sewerage	All other industries	*Subtotal industry*			
Natural resources																
Surface water		1,948.2		38.0	1,986.2		58,578.0	407.5		*407.5*			*60,971.7*	-		60,971.7
Groundwater		1,298.8		57.0	1,355.8	203.4		611.2		*611.2*	-	24.5	*2,194.9*	368.5		2,563.4
Soil water	12,756.0				12,756.0			-			-	-	*12,756.0*			12,756.0
Total natural resources	12,756.0	3,247.0	-	95.0	16,098.0	203.4	58,578.0	*1,018.7*	-	*1,018.7*	-	*24.5*	*75,922.6*	368.5		76,291.1
Products																
Natural water		-	-		-			-		-		22.5	*22.5*	339.1		361.6
Sewerage					-						174.2		*174.2*	-		174.2
Total water and sewerage products			-		-			-		-	174.2	22.5	*196.7*	339.1		535.8
Return flows																
To surface water															59,909.3	59,909.3
To groundwater*															859.2	859.2
Total return flows															60,768.5	60,768.5
TOTAL USE	12,756.0	3,247.0	-	95.0	16,098.0	203.4	58,578.0	1,018.7	-	*1,018.7*	174.2	*47.0*	*76,119.3*	707.6	60,768.5	*137,595.4*

*Losses in distribution plus unaccounted for water (e.g. from leaky pipes)

Table 4 (a): Water accounts physical supply tables for Zambia, 2018 (Mm^3)

Physical supply table	Agriculture					Industry								Households	Environment	TOTAL
	Agriculture (rainfed)	Agriculture (large-scale irrigation)	Agriculture (small holder irrigation)	Agriculture (livestock)	***Subtotal agriculture***	Mining	Energy	Water utilities	Irrigation schemes	***Subtotal water supply industry***	Sewerage	All other industries	***Subtotal industry***			
Natural resources																
Surface water															66,717.06	66,717.1
Groundwater															2,596.94	2,596.9
Soil water															11,524.00	11,524.0
Total natural resources															80,838.00	80,838.0
Products																
Natural water		1.6	-		1.6			343.2		343.2			***344.8***	-		344.8
Sewerage					-							17.9	***17.9***	161.5		179.4
Total water and sewerage products	-	***1.6***	-	-	***1.6***			***343.2***	-	***343.2***	-	***17.9***	***362.7***	***161.5***		524.2
Return flows																
To surface water		977.0			977.0	181.9	64,307.0				179.4		***65,645.3***			65,645.3
To groundwater*					-			680.8		680.8		15.8	***696.6***	196.5		893.1
Total return flows	-	***977.0***	-	-	***977.0***	***181.9***	***64,307.0***	***680.8***		680.8	***179.4***	***15.8***	***66,341.9***	***196.5***		66,538.4
TOTAL SUPPLY	-	978.6	-	-	***978.6***	181.9	64,307.0	1,024.0	-	1,024.0	179.4	33.8	***66,704.7***	358.0	80,838.0	147,900.6

Table 4 (b): Water accounts physical use tables for Zambia, 2018 (Mm^3)

Physical use table	Agriculture					Industry								Households	Environment	TOTAL
	Agriculture (rainfed)	Agriculture (large-scale irrigation)	Agriculture (small holder irrigation)	Agriculture (livestock)	***Subtotal agriculture***	Mining	Energy	Water utilities	Irrigation schemes	***Subtotal water supply industry***	Sewerage	All other industries	***Subtotal industry***			
Natural resources																
Surface water		1,954.0		45.8	1,999.8		64,307.0	410.2		410.2			***66,717.1***	-		66,717.1
Groundwater		1,302.7		68.7	1,371.4	202.1		615.4		615.4	-	30.4	***2,219.2***	377.7		2,596.9
Soil water	11,524.0				11,524.0			-			-	-	***11,524.0***			11,524.0
Total natural resources	***11,524.0***	***3,256.7***	-	***114.5***	***14,895.2***	***202.1***	***64,307.0***	***1,025.6***	-	***1,025.6***	-	***30.4***	***80,460.3***	377.7		80,838.0
Products																
Natural water		-	-		-			-		-		25.7	***25.7***	319.1		344.8
Sewerage					-						179.4		***179.4***	-		179.4
Total water and sewerage products			-		-			-		-	179.4	25.7	***205.1***	319.1		524.2
Return flows																
To surface water															65,645.3	65,645.3
To groundwater*															893.1	893.1
Total return flows															***66,538.4***	66,538.4
TOTAL USE	11,524.0	3,256.7	-	114.5	***14,895.2***	202.1	64,307.0	1,025.6	-	***1,025.6***	179.4	***56.1***	***80,665.4***	***696.8***	***66,538.4***	***147,900.6***

*Losses in distribution plus unaccounted for water (e.g. from leaky pipes)

Table 5 (a): Water accounts physical supply tables for Zambia, 2019 (Mm^3)

Physical supply table	Agriculture					Industry								Households	Environment	TOTAL
	Agriculture (rainfed)	Agriculture (large-scale irrigation)	Agriculture (small holder irrigation)	Agriculture (livestock)	***Subtotal agriculture***	Mining	Energy	Water utilities	Irrigation schemes	***Subtotal water supply industry***	Sewerage	All other industries	***Subtotal industry***			
Natural resources																
Surface water															60,367.56	60,367.6
Groundwater															2,623.94	2,623.9
Soil water															12,715.00	12,715.0
Total natural resources															75,706.50	75,706.5
Products																
Natural water		1.6	-		1.6			333.0		333.0			***334.6***	-		334.6
Sewerage					-							15.8	***15.8***	142.1		157.9
Total water and sewerage products	-	***1.6***	-	-	***1.6***			***333.0***	-	***333.0***	-	***15.8***	***350.4***	***142.1***		492.5
Return flows																
To surface water		1,004.0			1,004.0	182.1	57,915.0				157.9		***59,259.0***			59,259.0
To groundwater*					-			662.5		662.5		14.0	***676.5***	182.7		859.2
Total return flows	-	***1,004.0***	-	-	***1,004.0***	***182.1***	***57,915.0***	***662.5***		662.5	***157.9***	***14.0***	***59,935.5***	***182.7***		60,118.2
TOTAL SUPPLY	-	1,005.6	-	-	***1,005.6***	182.1	57,915.0	995.5	-	995.5	157.9	29.8	***60,285.9***	324.8	75,706.5	136,317.2

Table 5 (b): Water accounts physical use tables for Zambia, 2019 (Mm^3)

Physical use table	Agriculture					Industry								Households	Environment	TOTAL
	Agriculture (rainfed)	Agriculture (large-scale irrigation)	Agriculture (small holder irrigation)	Agriculture (livestock)	***Subtotal agriculture***	Mining	Energy	Water utilities	Irrigation schemes	***Subtotal water supply industry***	Sewerage	All other industries	***Subtotal industry***			
Natural resources																
Surface water		2,008.7		45.0	2,053.7		57,915.0	398.8		398.8			***60,367.6***	-		60,367.6
Groundwater		1,339.1		67.6	1,406.7	202.3		598.3		598.3	-	29.6	***2,236.8***	387.1		2,623.9
Soil water	12,715.0				12,715.0			-			-	-	***12,715.0***			12,715.0
Total natural resources	***12,715.0***	***3,347.8***	-	***112.6***	***16,175.4***	***202.3***	***57,915.0***	***997.1***	-	***997.1***	-	***29.6***	***75,319.4***	387.1		75,706.5
Products																
Natural water		-	-		-			-		-		23.8	***23.8***	310.8		334.6
Sewerage					-						157.9		***157.9***	-		157.9
Total water and sewerage products			-		-			-		-	157.9	23.8	***181.7***	310.8		492.5
Return flows																
To surface water															59,259.0	59,259.0
To groundwater*															859.2	859.2
Total return flows															***60,118.2***	60,118.2
TOTAL USE	12,715.0	3,347.8	-	112.6	***16,175.4***	202.3	57,915.0	997.1	-	***997.1***	157.9	***53.4***	***75,501.1***	***697.9***	***60,118.2***	***136,317.2***

*Losses in distribution plus unaccounted for water (e.g. from leaky pipes)

Table 6 (a): Water accounts physical supply tables for Zambia, 2020(Mm^3)

Physical supply table		Agriculture					Industry								Households	Environment	TOTAL
		Agriculture (rainfed)	Agriculture (large-scale irrigation)	Agriculture (small holder irrigation)	Agriculture (livestock)	Subtotal agriculture	***Mining***	Energy	Water utilities	Irrigation schemes	Subtotal water supply industry	***Sewerage***	All other industries	Subtotal industry			
Natural resources																	
	Surface water															62,825	62,824.72
	Groundwater															2,645	2,645.38
	Soil water															12,542	12,542.00
	Total natural resources															78,012	78,012.10
Products																	
	Natural water		1.56	-		1.6			324.4		324.4			326.0	-		326.0
	Sewerage					-							14	14.1	***394.7***		408.8
	Total water and sewerage products	***0***	***1.6***	***-***	***-***	***1.6***			***324.4***	***-***	***324.4***	***-***	***14***	***340.1***	***394.7***		***734.8***
Return flows																	
	To surface water		1013			1,013.0	183.4	60,356.0				141.3		61,693.7			61,693.7
	To groundwater*					-			667.7		667.7		12.9	680.6	***172.0***		852.6
	Total return flows	***0***	***1,013.0***	***-***	***-***	***1,013.0***	***183.4***	***60,356.0***	***667.7***		***667.7***	*141.3*	***12.9***	***62,374.3***	***172.0***		***62,546.3***
TOTAL SUPPLY		0	1,014.6	-	-	1,014.6	***183.4***	60,356.0	992.1	-	992.1	141.3	27.1	62,714.5	***566.7***	78,012.1	141,293.3

Table 6 (b): Water accounts physical use tables for Zambia, 2020 (Mm^3)

Physical use table		Agriculture					Industry								Households	Environment	TOTAL
		Agriculture (rainfed)	Agriculture (large-scale irrigation)	Agriculture (small holder irrigation)	Agriculture (livestock)	Subtotal agriculture	***Mining***	Energy	Water utilities	Irrigation schemes	Subtotal water supply industry	***Sewerage***	All other industries	Subtotal industry			
Natural resources																	
	Surface water		2025.84		45.4	2,071.2		60,356.0	397.5		397.5			62,824.7	-		62,824.7
	Groundwater		1350.56		68.1	1,418.7	203.8		596.2		596.2	-	29.8	2,248.5	***396.9***		2,645.4
	Soil water	12542				12,542.0			-			-	-	12,542.0			12,542.0
	Total natural resources	***12542***	***3,376.4***	***-***	***113.5***	***16,031.9***	***203.8***	***60,356.0***	***993.7***	***-***	***993.7***	***-***	***29.8***	***77,615.2***	***396.9***		78,012.1
Products																	
	Natural water		0	-		-			-		-		22.8	22.8	***303.2***		326.0
	Sewerage					-						408.8		408.8	-		408.8
	Total water and sewerage products			***-***		***-***			***-***		-	408.8	22.8	431.6	***303.2***		734.8
Return flows																	
	To surface water															61,693.7	61,693.7
	To groundwater*															852.6	852.6
	Total return flows															62,546.3	***62,546.3***
TOTAL USE		12542	3,376.4	-	113.5	16,031.9	***203.8***	60,356.0	993.7	-	993.7	***408.8***	52.6	***78,046.8***	***700.1***	***62,546.3***	***141,293.3***

*Losses in distribution plus unaccounted for water (e.g. from leaky pipes)

Table 7 (a): Water accounts monetary supply tables for Zambia, 2017 (ZMW 'Million')

Monetary supply table	Agriculture					Industry								Households	Environment	TOTAL
	Agriculture (rainfed)	Agriculture (large-scale irrigation)	Agriculture (small holder irrigation)	Agriculture (livestock)	***Subtotal agriculture***	Mining	Energy	Water utilities	Irrigation schemes	***Subtotal water supply industry***	Sewerage	All other industries	***Subtotal industry***			
Natural resources																
Surface water															33,534,424.00	33,534,424.0
Groundwater															1,409,888.70	1,409,888.7
Soil water															7,015,800.00	7,015,800.0
Total natural resources															41,960,112.70	41,960,112.7
Products																
Natural water		858.0	-		858.0			2,122,665.0		2,122,665.0			***2,123,523.0***	-		2,123,523.0
Sewerage					-							13,315.8	***13,315.8***	277,889.5		291,205.4
Total water and sewerage products	-	***858.0***	-	-	***858.0***			***2,122,665.0***	-	***2,122,665.0***	-	***13,315.8***	***2,136,838.8***	***277,889.5***		2,414,728.4
Return flows																
To surface water		535,700.0			535,700.0	100,705.0	32,217,900.0				133,135.5		***32,987,440.5***			32,987,440.5
To groundwater *					-			361,460.0		361,460.0		13,475.0	***374,935.0***	97,625.0		472,560.0
Total return flows	-		-	-	***535,700.0***	***100,705.0***	***32,217,900.0***	***361,460.0***		361,460.0	***133,135.5***	***13,475.0***	***33,362,375.5***	***97,625.0***		33,460,000.5
TOTAL SUPPLY	-	536,558.0	-	-	***536,558.0***	100,705.0	32,217,900.0	2,484,125.0	-	2,484,125.0	133,135.5	26,790.8	***35,499,214.4***	375,514.5	41,960,112.7	77,834,841.6

Table 7 (b): Water accounts monetary use tables for Zambia, 2017 (ZMW 'Million')

Monetary use table	Agriculture					Industry								Households	Environment	TOTAL
	Agriculture (rainfed)	Agriculture (large-scale irrigation)	Agriculture (small holder irrigation)	Agriculture (livestock)	*Subtotal agriculture*	Mining	Energy	Water utilities	Irrigation schemes	*Subtotal water supply industry*	Sewerage	All other industries	*Subtotal industry*			
Natural resources																
Surface water		1,071,510.0		20,900.0	1,092,410.0		32,217,900.0	224,114.0		*224,114.0*			*33,534,424.0*	-		33,534,424.0
Groundwater		714,340.0		31,350.0	745,690.0	111,877.7		336,171.0		*336,171.0*	-	13,475.0	*1,207,213.7*	202,675.0		1,409,888.7
Soil water	7,015,800.0				7,015,800.0			-			-	-	*7,015,800.0*			7,015,800.0
Total natural resources	*7,015,800.0*	*1,785,850.0*	-	*52,250.0*	*8,853,900.0*	*111,877.7*	*32,217,900.0*	560,285.0	-	560,285.0	-	*13,475.0*	*41,757,437.7*	202,675.0		41,960,112.7
Products													*41,757,437.7*			
Natural water		-	-		-			-		-		78,750.0	*78,750.0*	2,044,773.0		2,123,523.0
Sewerage					-						291,205.4		*291,205.4*	-		291,205.4
Total water and sewerage products			-		-			-		-	291,205.4	78,750.0	*369,955.4*	2,044,773.0		2,414,728.4
Return flows																
To surface water															32,987,440.5	32,987,440.5
To groundwater*															472,560.0	472,560.0
Total return flows															*33,460,000.5*	33,460,000.5
TOTAL USE	7,015,800.0	1,785,850.0	-	52,250.0	*8,853,900.0*	111,877.7	32,217,900.0	560,285.0	-	*560,285.0*	291,205.4	*92,225.0*	*42,127,393.1*	*2,247,448.0*	*33,460,000.5*	*77,834,841.6*

Table 8 (a): Water accounts monetary supply tables for Zambia, 2018 (ZMW 'Million')

Monetary supply table		Agriculture					Industry								Households	Environment	TOTAL
		Agriculture (rainfed)	Agriculture (large-scale irrigation)	Agriculture (smallholder irrigation)	Agriculture (livestock)	***Subtotal agriculture***	Mining	Energy	Water utilities	Irrigation schemes	***Subtotal water supply industry***	Sewerage	All other industries	***Subtotal industry***			
Natural resources																	
	Surface water															877,259.85	877,259.8
	Groundwater															597,174.20	597,174.2
	Soil water															4,975,256.52	4,975,256.5
	Total natural resources															6,449,690.56	6,449,690.6
Products																	
	Natural water		673.5	-		673.5			2,013,449.5		2,013,449.5			***2,014,123.0***	-		2,014,123.0
	Sewerage					-							13,713.3	***13,713.3***	286,239.5		299,952.9
	Total water and sewerage products	-	***673.5***	-	-	***673.5***			***2,013,449.5***	-	***2,013,449.5***	-	***13,713.3***	***2,027,836.3***	***286,239.5***		2,314,075.9
Return flows																	
	To surface water		421,800.2			421,800.2	1,738.4	12,604.2				137,133.4		***573,276.2***			573,276.2
	To groundwater*					-			2,113.2		2,113.2		49.1	***2,162.3***	609.9		2,772.3
	Total return flows	-	***421,800.2***	-	-	***421,800.2***	***1,738.4***	***12,604.2***	***2,113.2***		2,113.2	***137,133.4***	***49.1***	***575,438.5***	***609.9***		576,048.5
TOTAL SUPPLY		-	422,473.7	-	-	***422,473.7***	1,738.4	12,604.2	2,015,562.7	-	2,015,562.7	137,133.4	13,762.5	***2,603,274.9***	286,849.5	6,449,690.6	9,339,814.9

Table 8 (b): Water accounts monetary use tables for Zambia, 2018 (ZMW 'Million')

Monetary use table		Agriculture					Industry								Households	Environment	TOTAL
		Agriculture (rainfed)	Agriculture (large-scale irrigation)	Agriculture (small holder irrigation)	Agriculture (livestock)	***Subtotal agriculture***	Mining	Energy	Water utilities	Irrigation schemes	***Subtotal water supply industry***	Sewerage	All other industries	***Subtotal industry***			
Natural resources																	
	Surface water		843,609.1		19,773.2	863,382.3		12,604.2	1,273.4		1,273.4			***877,259.8***	-		877,259.8
	Groundwater		562,406.0		29,659.9	592,065.9	1,931.5		1,910.1		1,910.1	-	94.4	***596,001.8***	1,172.4		597,174.2
	Soil water	4,975,256.5				4,975,256.5			-			-	-	***4,975,256.5***			4,975,256.5
	Total natural resources	***4,975,256.5***	***1,406,015.1***	-	***49,433.1***	***6,430,704.7***	***1,931.5***	***12,604.2***	***3,183.5***	-	***3,183.5***	-	***94.4***	***6,448,518.2***	1,172.4		6,449,690.6
Products																	
	Natural water		-	-		-			-		-		89,950.0	***89,950.0***	1,924,173.0		2,014,123.0
	Sewerage					-						299,952.9		***299,952.9***	-		299,952.9
	Total water and sewerage products			-		-			-		-	299,952.9	89,950.0	***389,902.9***	1,924,173.0		2,314,075.9
Return flows																	
	To surface water															573,276.2	573,276.2
	To groundwater*															2,772.3	2,772.3
	Total return flows															***576,048.5***	576,048.5
TOTAL USE		4,975,256.5	1,406,015.1	-	49,433.1	***6,430,704.7***	1,931.5	12,604.2	3,183.5	-	***3,183.5***	299,952.9	***90,044.4***	***6,838,421.0***	***1,925,345.4***	***576,048.5***	***9,339,814.9***

Table 9 (a): Water accounts monetary supply tables for Zambia, 2019 (ZMW 'Million')

Monetary supply table		Agriculture					Industry								Households	Environment	TOTAL
		Agriculture (rainfed)	Agriculture (large-scale irrigation)	Agriculture (small holder irrigation)	Agriculture (livestock)	***Subtotal agriculture***	Mining	Energy	Water utilities	Irrigation schemes	***Subtotal water supply industry***	Sewerage	All other industries	***Subtotal industry***			
Natural resources																	
	Surface water															899,241.87	899,241.9
	Groundwater															612,389.79	612,389.8
	Soil water															5,489,446.95	5,489,447.0
	Total natural resources															7,001,078.62	7,001,078.6
Products																	
	Natural water		673.5	-		673.5			2,283,090.5		2,283,090.5			***2,283,764.0***	-		2,283,764.0
	Sewerage					-							12,069.9	***12,069.9***	295,804.8		307,874.7
	Total water and sewerage products	***-***	***673.5***	***-***	***-***	***673.5***			***2,283,090.5***	***-***	***2,283,090.5***	***-***	***12,069.9***	***2,295,833.9***	***295,804.8***		2,591,638.7
Return flows																	
	To surface water		433,456.9			433,456.9	1,740.3	11,351.3				120,698.8		***567,247.4***			567,247.4
	To groundwater*					-			2,056.4		2,056.4		43.4	***2,099.8***	567.1		2,666.9
	Total return flows	***-***	***433,456.9***	***-***	***-***	***433,456.9***	***1,740.3***	***11,351.3***	***2,056.4***		2,056.4	***120,698.8***	***43.4***	***569,347.2***	***567.1***		569,914.3
TOTAL SUPPLY		-	434,130.4	-	-	***434,130.4***	1,740.3	11,351.3	2,285,146.9	-	2,285,146.9	120,698.8	12,113.3	***2,865,181.1***	296,371.9	7,001,078.6	10,162,631.6

Table 9 (b): Water accounts monetary use tables for Zambia, 2019 (ZMW 'Million')

Monetary use table		Agriculture					Industry								Households	Environment	TOTAL
		Agriculture (rainfed)	Agriculture (large-scale irrigation)	Agriculture (small holder irrigation)	Agriculture (livestock)	***Subtotal agriculture***	Mining	Energy	Water utilities	Irrigation schemes	***Subtotal water supply industry***	Sewerage	All other industries	***Subtotal industry***			
Natural resources																	
	Surface water		867,207.4		19,445.1	886,652.5		11,351.3	1,238.0		1,238.0			***899,241.9***	-		899,241.9
	Groundwater		578,138.3		29,167.7	607,306.0	1,933.4		1,857.0		1,857.0	-	91.9	***611,188.2***	1,201.6		612,389.8
	Soil water	5,489,447.0				5,489,447.0			-			-	-	***5,489,447.0***			5,489,447.0
	Total natural resources	***5,489,447.0***	***1,445,345.7***	***-***	***48,612.8***	***6,983,405.4***	***1,933.4***	***11,351.3***	***3,095.0***	***-***	***3,095.0***	***-***	***91.9***	***6,999,877.1***	1,201.6		7,001,078.6
Products						6,983,405.4											
	Natural water		-	-		-			-		-		83,300.0	***83,300.0***	2,200,464.0		2,283,764.0
	Sewerage					-						307,874.7		***307,874.7***	-		307,874.7
	Total water and sewerage products			-		-			-		-	307,874.7	83,300.0	***391,174.7***	2,200,464.0		2,591,638.7
Return flows																	
	To surface water															567,247.4	567,247.4
	To groundwater*															2,666.9	2,666.9
	Total return flows															***569,914.3***	569,914.3
TOTAL USE		5,489,447.0	1,445,345.7	-	48,612.8	***6,983,405.4***	1,933.4	11,351.3	3,095.0	-	***3,095.0***	307,874.7	***83,391.9***	***7,391,051.7***	***2,201,665.6***	***569,914.3***	***10,162,631.6***

Table 10 (a): Water accounts monetary supply tables for Zambia, 2020 (ZMW 'Million')

Monetary supply table		Agriculture					Industry								Households	Environment	TOTAL
		Agriculture (rainfed)	Agriculture (large-scale irrigation)	Agriculture (smallholder irrigation)	Agriculture (livestock)	***Subtotal agriculture***	Mining	Energy	Water utilities	Irrigation schemes	***Subtotal water supply industry***	Sewerage	All other industries	***Subtotal industry***			
Natural resources																	
	Surfac e water															907,280.00	907,280.0
	Groundwater															617,600.96	617,601.0
	Soil water															5,414,757.66	5,414,757.7
	Total natural resources															6,939,638.62	6,939,638.6
Products																	
	Natural water		673.5	-		673.5			2,340,998.5		2,340,998.5			***2,341,672.0***	-		2,341,672.0
	Sewerage					-							10,801.0	***10,801.0***	278,892.4		289,693.4
	Total water and sewerage products	-	***673.5***	-	-	***673.5***			***2,340,998.5***	-	***2,340,998.5***	-	***10,801.0***	*2,352,473.0*	*278,892.4*		2,631,365.4
Return flows																	
	To surface water		437,342.5			437,342.5	1,752.8	11,829.8				108,002.1		***558,927.1***			558,927.1
	To groundwater*					-			2,072.5		2,072.5		40.2	***2,112.7***	533.9		2,646.6
	Total return flows	-	***437,342.5***	-	-	***437,342.5***	***1,752.8***	***11,829.8***	***2,072.5***		2,072.5	***108,002.1***	***40.2***	***561,039.8***	***533.9***		561,573.7
TOTAL SUPPLY		-	438,016.0	-	-	***438,016.0***	1,752.8	11,829.8	2,343,071.0	-	2,343,071.0	108,0021	10,841.1	***2,913,512.8***	279,426.3	6,939,638.6	10,132,577.7

Table 10 (b): Water accounts monetary use tables for Zambia, 2020 (ZMW 'Million')

Monetary use table		Agriculture					Industry								Households	Environment	TOTAL
		Agriculture (rainfed)	Agriculture (large-scale irrigation)	Agriculture (small holder irrigation)	Agriculture (livestock)	***Subtotal agriculture***	Mining	Energy	Water utilities	Irrigation schemes	***Subtotal water supply industry***	Sewerage	All other industries	***Subtotal industry***			
Natural resources																	
	Surface water		874,615.9		19,600.5	894,216.4		11,829.8	1,233.8		*1,233.8*			***907,280.0***	-		907,280.0
	Groundwater		583,077.3		29,400.8	612,478.1	1,947.7		1,850.7		*1,850.7*	-	92.5	***616,369.0***	1,232.0		617,601.0
	Soil water	5,414,757.7				5,414,757.7			-			-	-	***5,414,757.7***			5,414,757.7
	Total natural resources	***5,414,757.7***	***1,457,693.2***	-	***49,001.4***	***6,921,452.2***	***1,947.7***	***11,829.8***	***3,084.4***	-	***3,084.4***	-	***92.5***	***6,938,406.6***	1,232.0		6,939,638.6
Products																	
	Natural water		-	-		-			-		-		79,800.0	***79,800.0***	2,261,872.0		2,341,672.0
	Sewerage					-						289,693.4		***289,693.4***	-		289,693.4
	Total water and sewerage products			-		-			-		-	289,693.4	79,800.0	***369,493.4***	2,261,872.0		2,631,365.4
Return flows																	
	To surface water															558,927.1	558,927.1
	To groundwater*															2,646.6	2,646.6
	Total return flows															*561,573.7*	561,573.7
TOTAL USE		5,414,757.7	1,457,693.2	-	49,001.4	*6,921,452.2*	1,947.7	11,829.8	3,084.4	-	*3,084.4*	289,693.4	*79,892.5*	*7,307,900.0*	*2,263,104.0*	*561,573.7*	*10,132,577.7*