UNITED NATIONS COMMISSION ON SCIENCE AND TECHNOLOGY FOR DEVELOPMENT (CSTD), twenty-sixth session
Geneva, 27-31 March 2023

Ensuring safe water and sanitation for all: a solution through science, technology and innovation

Statement by

Mr. Nchidzi Mmolawa
Deputy Permanent Secretary
Ministry of Lands and Water Affairs
Botswana

Republic of Botswana

MINISTRY OF LANDS AND WATER AFFAIRS

STATEMENT BY

NCHIDZI MMOLAWA

Deputy Permanent Secretary – Water & Sanitation

AT

Commission on Science and Technology for Development, twenty-sixth session

27th – 31st March 2023

Geneva

BOTSWANA
Our pride, your destination

Salutations;

1. I am greatly honoured to be part of this important deliberations this week. It is undeniable that Water and good sanitation plays a crucial role in all aspects of life. That is why every other Sustainable Development Goal relies in some way or the other on the achievement of Goal 6, such as good health, food security, decent work and economic growth, as well as ending poverty.

2. The role of science, technology, and innovation in on ensuring safe water and sanitation for sustainable development is therefore, timely and critical to addressing the current and future water-related challenges. For my country, Botswana, the arid to semi-arid climatic conditions, and water shortages continue to persist as a result of growing demand, mostly worsened by the effects of climate change. We also experience hydrological droughts which have become severe and more frequent, over the years, resulting in water supply challenges that overwhelm our insufficient resources.

3. Furthermore, the sparse population distribution of our country creates major engineering and financial challenges pertaining to water infrastructure development. In some cases there is either little or no water source near the settlements, thus creating the need to reticulate, clean, store and transfer water from source to settlements are at great cost. Botswana Government has prioritized the development of water resources and infrastructure through increasing the Development Budget for Water and Sanitation projects from an

average of 16% prior to 2020/2021 financial year to an average of 32% during the past two years.

4. Botswana Government is making significant strides towards attainment of targets under SDG 6, overall 92% of our population uses basic drinking water services; 83% of urban population use safely managed drinking water services with another 15% using basic services; compared to 70% rural population who use basic services and 15% using only limited services.

5. Furthermore, approximately 77% of Botswana's population has access to at least basic sanitation services while 11% of the population has no form of sanitation facilities and hence practice unsanitary hygienic methods. The remaining 12% of the population either has access to shared or unimproved sanitation facilities.

6. Botswana was not spared by the impacts of COVID-19, one of which being the shortage of chemicals required for cleaning and disinfection of water. Water Utilities Corporation, had to be innovative and replace the conventional Chlorination of water using chlorine gas manufacturing of chlorine dioxide at the water treatment plant sites.

7. Manufacturing of Chlorine dioxide was found to be more cost effective than the use of Chlorine due to the need to have booster stations required when using chlorine gas and calcium hypochlorite. Chlorine dioxide method is observed to be most economic and efficient as it only needs one unit or

dosing point for the whole system. Its efficacy covers a distance of over 100 km.

8. Botswana National Water Conservation and Demand Management Strategy of 2021 promote water efficiency and the exploration of alternative water sources, such as greywater recycling, rainwater harvesting, storm-water collection, saline water and wastewater utilization, thus reducing pressure on the fresh water sources.

9. We are also making efforts to improve water use efficiency techniques, One of the stand-out efforts is the implementation a device agnostic internet of things (IoT) platform which is intended to connect all connectable devices within the Water Utilities Corporation water supply and distribution network in order to allow for real-time access to operational data from the devices (including **smart meters**) to enable data-based decision making.

10. So far 1027 smart meters have been installed and piloted successfully in Gaborone. Full rollout of the smart meters will be done during the second half of the 2023, procured as a service. The Smart meters will have capability of pre-paid function.

11. The semi-arid climate conditions of Botswana relates to rainfall amounts limited to average of about 450 Millimeters per annum and high rates of evaporation in excess of 2000 millimeters per annum. It is within this context

that Government undertook a feasibility of Managed Aquifer Recharge at one of the wellfields using borehole injection to improve ground water sustainability (storage systems and additional yields). This will improve resilience of the existing water transfers schemes and build capacity on groundwater management and artificial recharge. A MAR-scheme can reduce surface water losses from dam due to evaporation and spill over with 26.4 million cubic meters between 2020-2040.

12. As I conclusion, there is optimism that all these sets of coordinated efforts, strategic action and innovation, premised on partnerships and the principle of *leaving no one behind* will direct Botswana towards a water secure nation.

13. I therefore, look forward to the deliberations at this important session which is coordinating our efforts towards a sustainable water and sanitation resources through science, technology, and innovation.

I thank you

REPUBLIC OF BOTSWANA

MINISTY OF LANDS AND WATER AFFAIRS

ENSURING SAFE WATER AND SANITATION FOR ALL: - A SOLUTION THROUGH SCIENCE, TECHNOLOGY AND INNOVATION

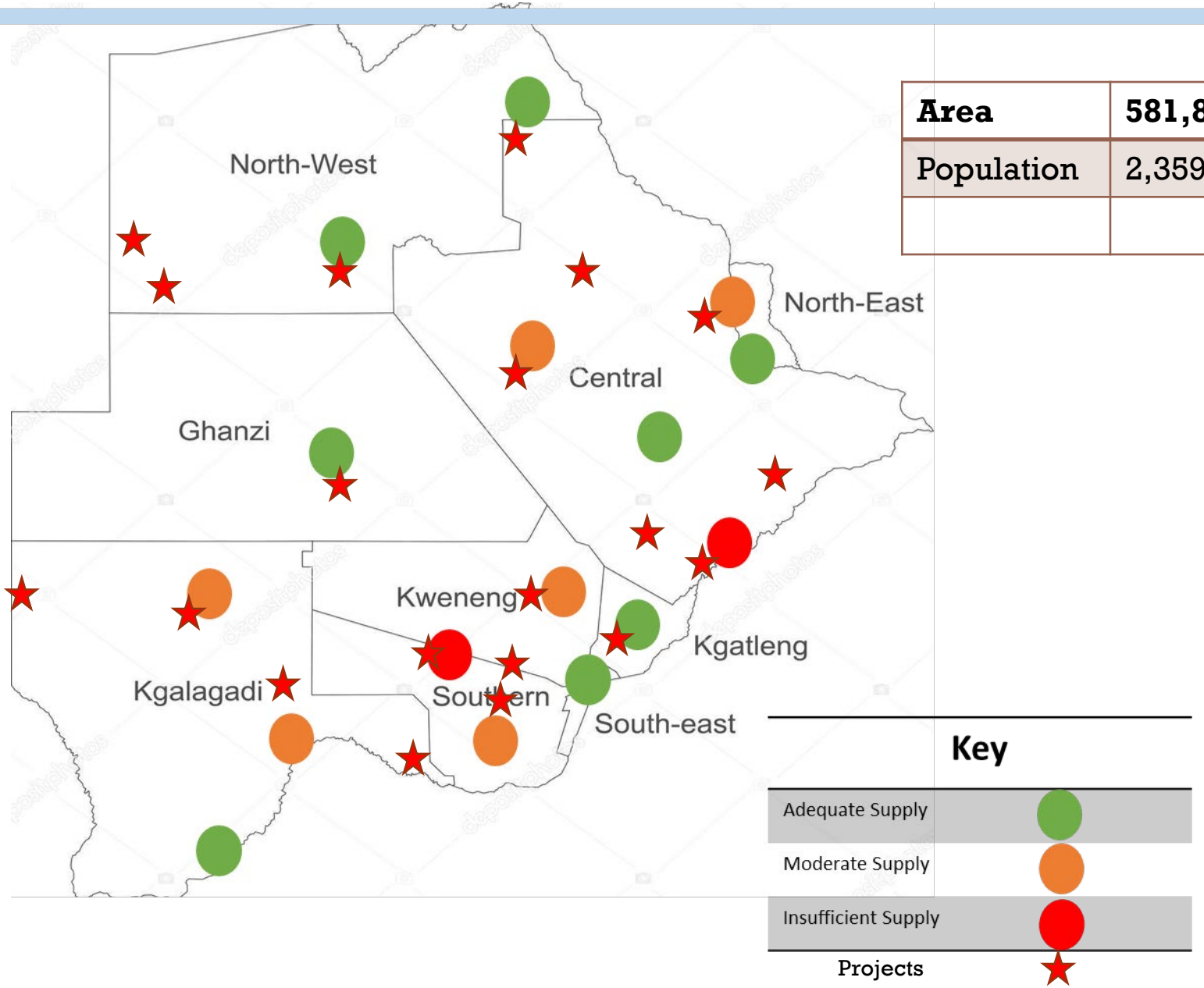
28TH MARCH 2023

BY: NCHIDZI MMOLAWA

PRESENTATION OUTLINE

- Water Supply Situation in Botswana
- Botswana water and sanitation situation
- Botswana water security sanitation situation
- Key findings
- MAR assessment
- Conclusions and Recommendations
- Subsequent Activities

WATER SUPPLY SITUATION IN BOTSWANA



Area	**581,871 sq.km**
Population	2,359,609 persons in 2022 census

BOTSWANA WATER AND SANITATION SITUATION

- Approximately 80% of Botswana population have access to at least basic sanitation services while 10% of the population has no form of sanitation facilities and hence practice unsanitary hygienic processes.

- The remaining 12% of the population either has access to shared or unimproved sanitation facilities.

- Botswana has however reduced open defecation from 54% of population to 10% within a 30 years period.

BOTSWANA WATER SECURITY SANITATION SITUATION

- The total renewable water resources available to the country are in the order of 12.2 kilometres per year, of which the total internal renewable water resources are estimated at only 2.4 kilometres per year.
- The internal renewable surface water resources are estimated at only 0.8 kilometres per year.
- The renewable water resources are scarce like in Botswana with only 1064.74 cubic meters per capita water availability.
- The total water demand in the country currently stands at 272 million cubic meters per year. The demand is expected to increase to 340 million cubic meters per year by 2035.
- Approximately 10% of the total treated wastewater generated in country is being utilized for non-potable use.
- The current water supply status is estimated at 225 million cubic meters in a year with an average water loss from our supply systems standing at 35%.
- The main water sources are groundwater, surface water and wastewater.

BOTSWANA WATER SECURITY SANITATION SITUATION

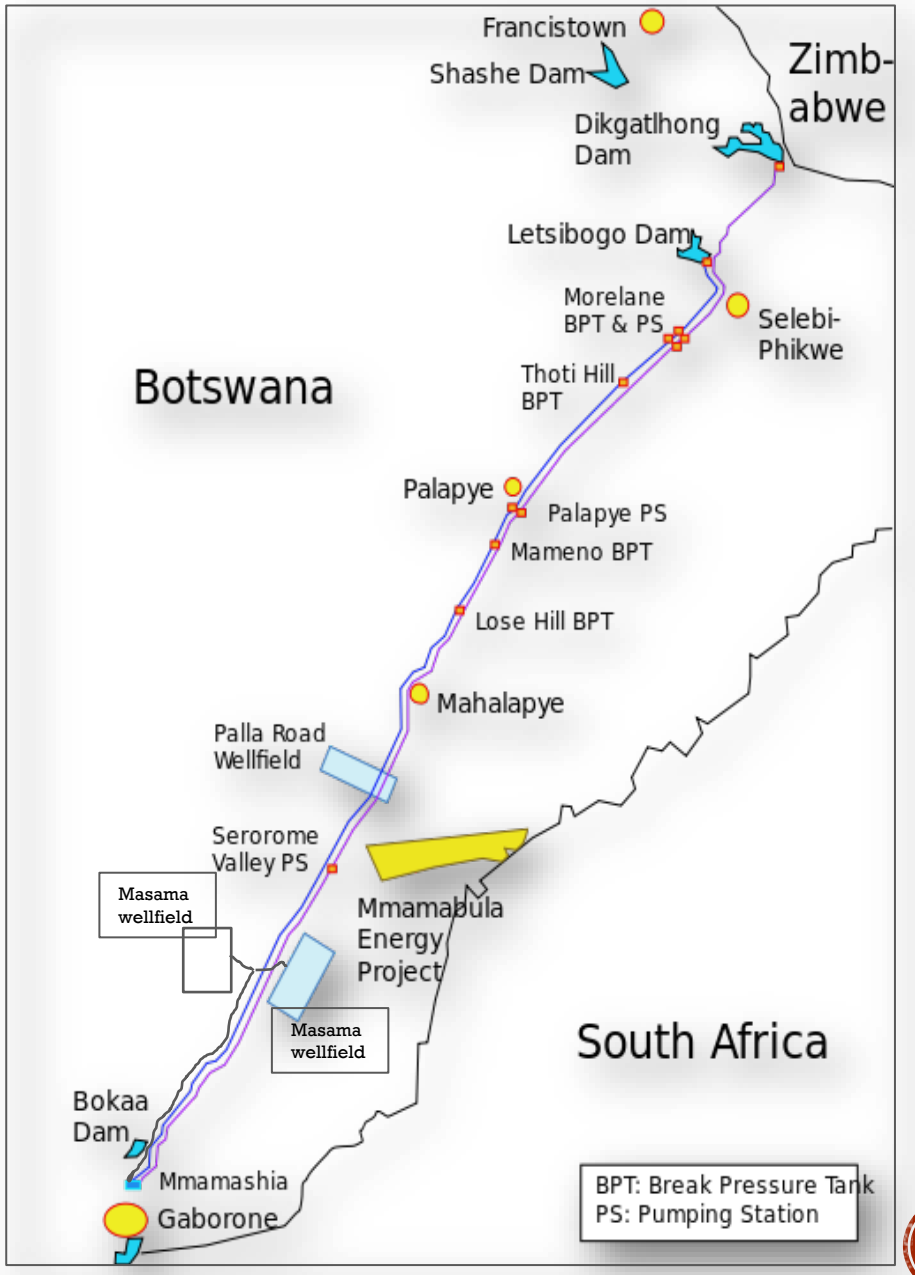
- The four main river basins account for 95% of surface runoffs in Botswana. All the ten (10) major dams in Botswana are located in the Limpopo basin and have a combined capacity of 1104 million cubic meters.
- There are 374 small/medium dams in Botswana and these are used for agricultural water supplies. Out of the 374, only 310 are operational, with a combined capacity of 31 million cubic meters (i.e. About 3% of the total dam storage capacity in Botswana).
- The estimated total sustainable yield is 96 million cubic meters/annum from developed and potential wellfields/aquifers).
- In 2016, groundwater use stood at 28 million cubic meters/annum, which is about 30% of the sustainable supply in 2016.
- There are currently about 46 812 boreholes drilled and registered in the country, with 11487 for government departments and 35 325 boreholes for farmers and the private sector use
- It is estimated that 60 % of the population dependent on groundwater, but the rate is seemingly going down with water supply from the North South Water Carrier (NSC).

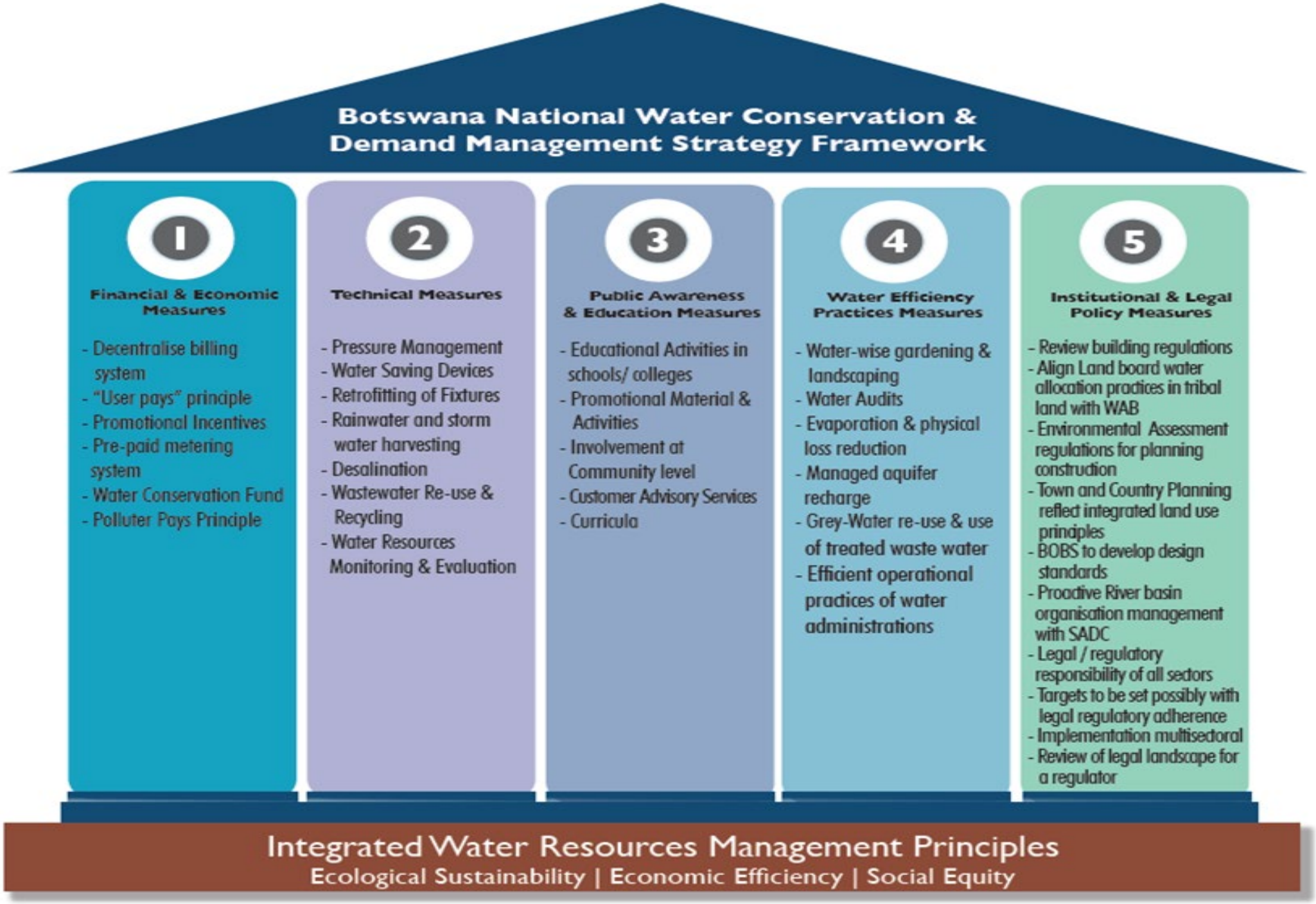
INTERVENTIONS TO ENSURING SAFE WATER AND SANITATION FOR ALL

- Institutional and Legal Reforms
- Water and Sanitation infrastructure
- Water Conservation and Water Demand Management
- Capacity Building

Infrastructure Development

- 30% of Development Budget on Water and Sanitation Infrastructure the past 2 years.
- More than 40 water and sanitation projects under implementation
- The North South Carrier (NSC) transfers 90ML/day water from the North to the South of the Country (about 400 km)
- The Second NSC under construction at a cost of P5.5 billion or US$415 million to increase water from the scheme to 200 ML/day
- To address the issue of vast geographical spread of infrastructure, operations are controlled remotely through telemetry and Scada

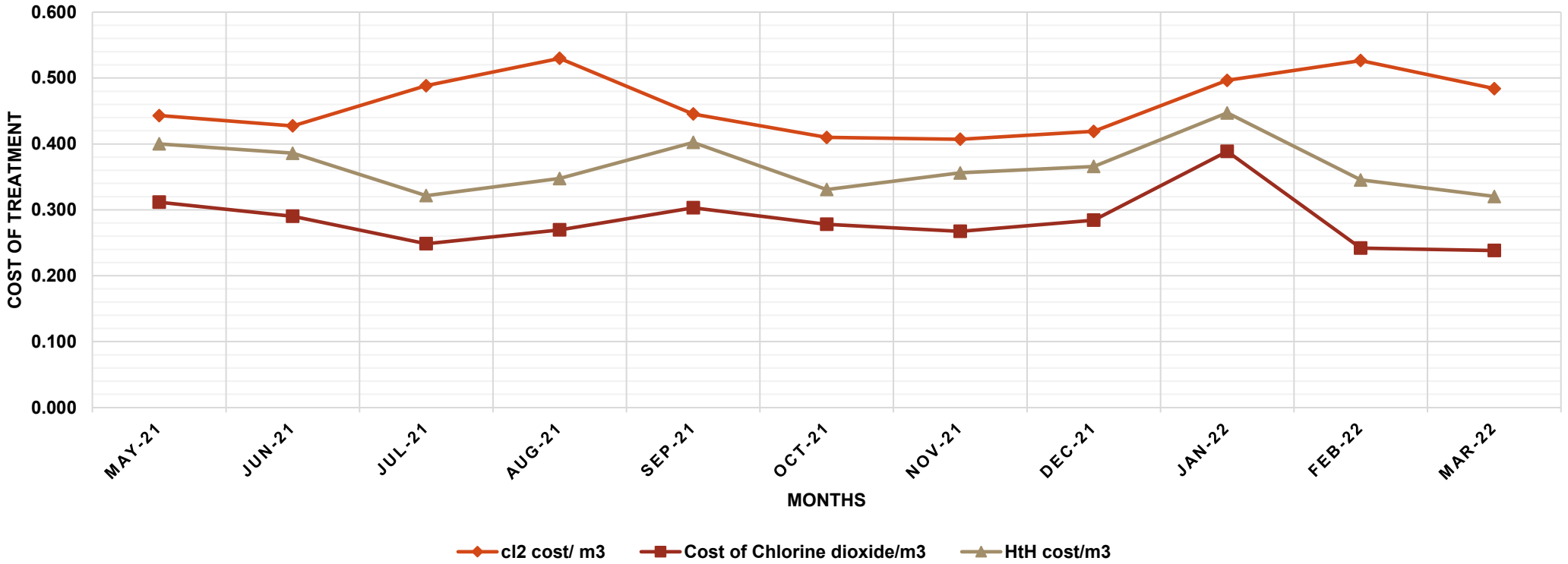



Botswana National Water Conservation & Demand Management Strategy Framework
1
Financial & Economic Measures
- Decentralise billing system
- "User pays" principle
- Promotional Incentives
- Pre-paid metering system
- Water Conservation Fund
- Polluter Pays Principle
2
Technical Measures
- Pressure Management
- Water Saving Devices
- Retrofitting of Fixtures
- Rainwater and storm water harvesting
- Desalination
- Wastewater Re-use & Recycling
- Water Resources Monitoring & Evaluation
3
Public Awareness & Education Measures
- Educational Activities in schools/ colleges
- Promotional Material & Activities
- Involvement at Community level
- Customer Advisory Services
- Curricula
4
Water Efficiency Practices Measures
- Water-wise gardening & landscaping
- Water Audits
- Evaporation & physical loss reduction
- Managed aquifer recharge
- Grey-Water re-use & use of treated waste water
- Efficient operational practices of water administrations
5
Institutional & Legal Policy Measures
- Review building regulations
- Align Land board water allocation practices in tribal land with WAB
- Environmental Assessment regulations for planning construction
- Town and Country Planning reflect integrated land use principles
- BOBS to develop design standards
- Proactive River basin organisation management with SADC
- Legal / regulatory responsibility of all sectors
- Targets to be set possibly with legal regulatory adherence
- Implementation multisectoral
- Review of legal landscape for a regulator
Integrated Water Resources Management Principles
Ecological Sustainability | Economic Efficiency | Social Equity

INNOVATIONS -

- Automated Device Management System is being installed to manage all devices at Water Utilities Corporation including both Post or Pre-Paid.
  - Smart water meters successfully piloted and will be implemented from August 2023 as an outsourced service
  - Conventional meters presents challenges of high water bills, and stucking
- Water quality issues
  - Comparison on disinfection methods - the use of chlorine gas, chlorine dioxide, and calcium hypochlorite
- Pilot study for Managed Aquifer Recharge (MAR)

DISINFECTION METHODS - COST OF TREATMENT COMPARISON PLOT



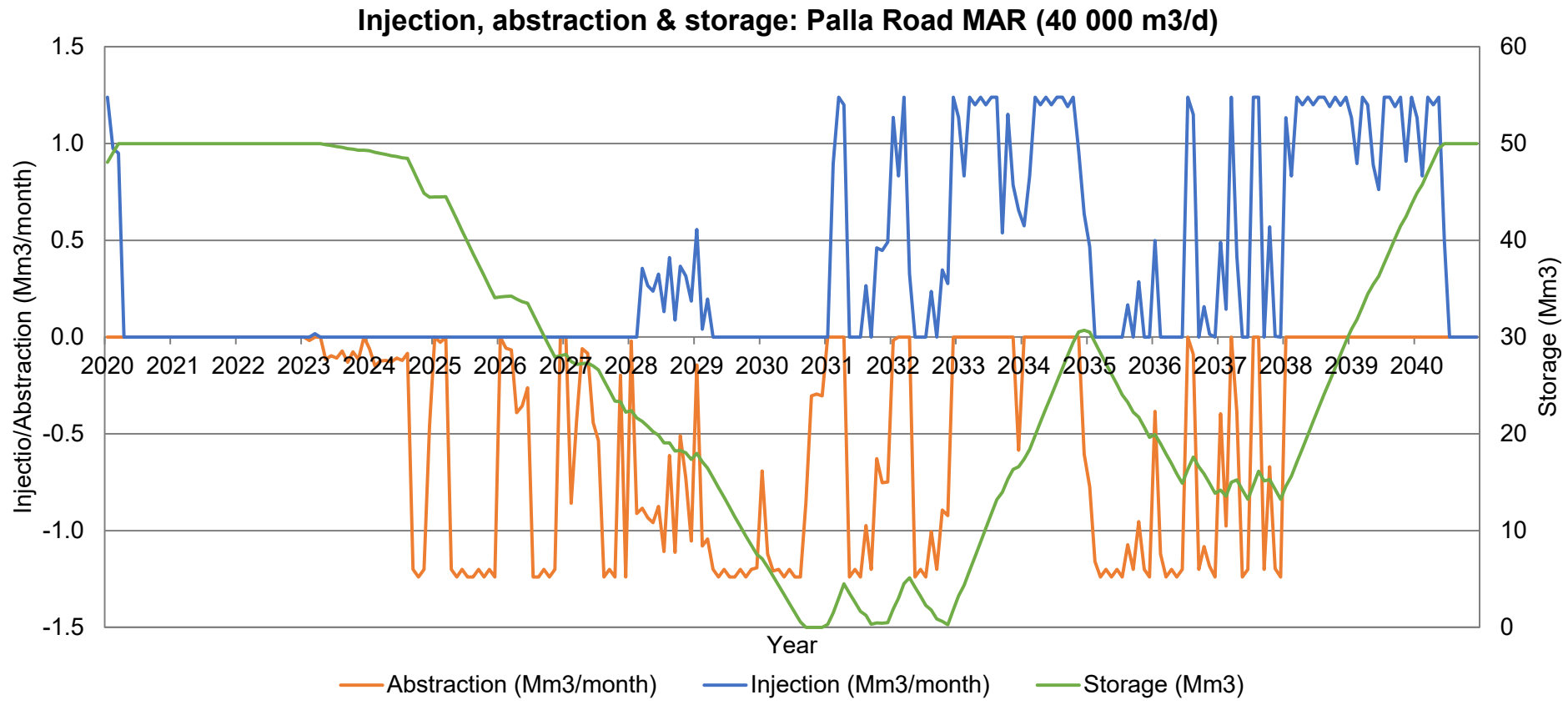
- Although the capital cost of installation of chlorine dioxide generator unit is more than that of a chlorine dosing system,
- the need for booster stations when using gas and calcium hypochlorite far exceeds that of using the single chlorine dioxide generator.
- Chlorine dioxide method is observed to be most economic and efficient as it only needs one unit or dosing point for the whole system

Comparison	Chlorine dioxide	Chlorine gas	Calcium hypochlorite (HtH)
Reaction to Biofilms	Highly Reactive and Penetrative Effective on Cryptosporidium and Giardia	Largely ineffective - will not penetrate Ineffective against Cryptosporidium and Giardia	Largely ineffective - will not penetrate Ineffective against Cryptosporidium and Giardia
Taste & Odour	Slight	Produces chemical smell and taste	Produces chemical smell and taste
Effective pH range and pH dependency	4 – 10 Effective over a lager pH range	6 - 7.5 Highly dependent on pH	6 - 7.5 Highly dependent on pH
Reaction in Water	Does not Hydrolyse and is not easily lost in water Single dosing and a large area are disinfected 100 Km distance range	Hydrolyses and easily dissipate in water Require boosting along the distribution scheme	Hydrolyses and easily dissipate in water. Require boosting along the distribution scheme
Reaction to Organic Load	Resists Neutralisation and does not form trihalomethanes (THM's)	Readily Neutralised forming trihalomethanes (THM'S)	Readily Neutralised forming trihalomethanes (THM'S)

MANAGED AQUIFER RECHARGE

- To investigate the feasibility MAR at Palla road wellfield using borehole injection to improve ground water sustainability (storage systems and additional yields)
  - Improve resilience of the NSC
  - Build capacity on groundwater management and artificial recharge
  - Compare MAR with other solutions of water supply and security
- The Ntane Sandstone aquifer in the Palla Road wellfield is suitable for MAR by means of borehole injection considering e.g. hydrochemistry and low risk of losing water
- A MAR-scheme can reduce surface water losses from dam due to evaporation and spill over with 26.4 Mm^3 between 2020-2040

STOCHASTIC TIME SERIES ANALYSIS




Thank You!