Case Studies

6 CLEAN WATER AND SANITATION

Standards for Clean Water and Sanitation

Case study n°1

Wastewater treatment and reuse using a constructed wetland system at institutional level

Country: Botswana

Level: National and Local

SDG Addressed: SDG 6 – Clean Water and Sanitation

Summary

The objective of this case study is to demonstrate how standards can be used for waste water treatment and re-use. This supports the achievement of the SDG target 6.3 on improving water quality by reducing pollution, eliminating dumping and minimizing the release of hazardous chemicals and materials. The government of Botswana involved the Department of Water Affairs Headquarters, which used national standards based on international standards, to treat wastewater discharged from its own headquarters.

Wastewater reuse promotes water conservation & demand management which is one of Botswana's priorities for additional water resources. The demonstration project on wastewater treatment and reuse acts as a leverage towards improving wastewater re-use by various stakeholders. This includes public knowledge on safety and hygiene on handling wastewater.

Wastewater reuse at institutional level closes the water cycle loop. This reduces pressure on fresh water usage as well as wastewater discharge into natural water resources, increasing water efficiency and preventing pollution.

Background

Botswana is faced with water shortages due to its limited water resources. The situation is exacerbated by low rainfalls, high evaporation rates, poor water quality that is caused by the salinity of underground water, and water wastage especially in institutions such as schools. The country has reached its full potential in terms of surface water development (construction of dams). All Botswana's perennial rivers are shared with neighbouring countries. These rivers are Okavango, Zambezi, Orange-Senque and Shashe – Limpopo. As an economy in transition, Botswana requires water for economic growth in domestic, energy, agriculture, tourism, manufacturing and the mining sectors hence wastewater reuse is an alternative.

Strategy

Effluent produced by the constructed wetland system is assessed for quality in accordance with the national water quality standards. These are the drinking water quality specifications (BOS32: 2015), wastewater discharge requirements (BOS 93: 2012) and the water quality for irrigation specifications (BOS 463:2011). These standards were developed in Botswana by the Water Quality Technical Committee through the Botswana Bureau of Standards.

The collection of samples from the wetland system is carried out in accordance with water quality sampling standards (BOS ISO 5667) which provide guidance on sampling wastewaters, sampling techniques, sample handling and preservation and guidance on design of sampling programmes. Sampling, handling of samples in the field, their preservation and transportation to the laboratory for testing are also guided by the BOS ISO/IEC 17025 for the Competence of Testing and Calibration Laboratories.

The first trial diverted wastewater into a constructed wetland ecosystem for treatment. This is a process where solids are removed from wastewater using septic tanks and the liquid is passed through a reed bed system that consists of four beds running in parallel and receiving the same load. Three of the beds contain different types of reeds that remove nutrients such as phosphates and nitrates while the fourth contains only sand and is used as a control.

Results and impact

The constructed wetland system was found to be effective in treating wastewater for non-portable uses such as irrigation, construction and dust suppression. It was highlighted that different plant species in the reed beds have different affinities for nutrients in wastewater. However, constructed wetland system was not effective in pathogen removal in wastewater hence coupling the system with disinfection reduced the micro–organisms to acceptable levels suitable for non- potable re- use option. In conclusion, the system when coupled with membrane filtration can treat wastewater to the acceptable water quality standards.

Challenges and lessons learned

The operation and maintenance of the constructed wetland system requires funding and skilled manpower, to avoid constant breakdowns and blockages due to lack of preventive maintenance plans. Constant breakdowns and blockages of the system disrupts water flows, and this affects the systematic effluent sampling and quality monitoring. Low up-take of wastewater re-use by the various stakeholders due to social, cultural and religious beliefs is a challenge. Extensive research is required on wastewater re-use to determine technologies that can improve wastewater quality for the intended use, establish the consequences on cumulative pollution over extended use, as well as energy and nutrient recovery.

Potential for Replication

Treatment of wastewater using a constructed wetland can be replicated by various institutions in Botswana to treat wastewater on site for reuse for non-potable uses.

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Case study n°3

Moving from the MDG Water Supply Infrastructure Service Delivery Indicator to a Sustainable Water Supply Delivery Indicator in Support of the SDG process

Country: South Africa

Level: National

SDG Addressed: SDG 6 – Clean Water and Sanitation

Summary

The objective of the case study is to show how South African standards – (SABS 241), which are based on the WHO Guidelines for drinking water quality - have been used to develop revised indictors that track both the provision of infrastructure and the sustainability of the services for the provision of water supply. This allowed the shift from indicators supporting the Millennium Development Goals to indicators supporting the Sustainable Development Goals. This is directly in support of SDG 6 "achieve universal and equitable access to safe and affordable drinking water for all" The agencies involved were Department of Water and Sanitation and the South African Department for Statistics.

The approach chosen by the Department of Water and Sanitation was to critically review their monitoring and evaluation processes, specifically with regards to distinguishing between monitoring water services facility implementation (the infrastructure provided) and the sustainable operation of the facility (which is based on the stipulated basic service delivery supply standard of a minimum flow rate of 10 litres per minute and available when needed at 98% assurance of supply). A new indicator was developed known as "Stability of Supply", which involved the Statistics South Africa General Household Survey (GHSs) instrument (2009) that monitored the impact.

Background

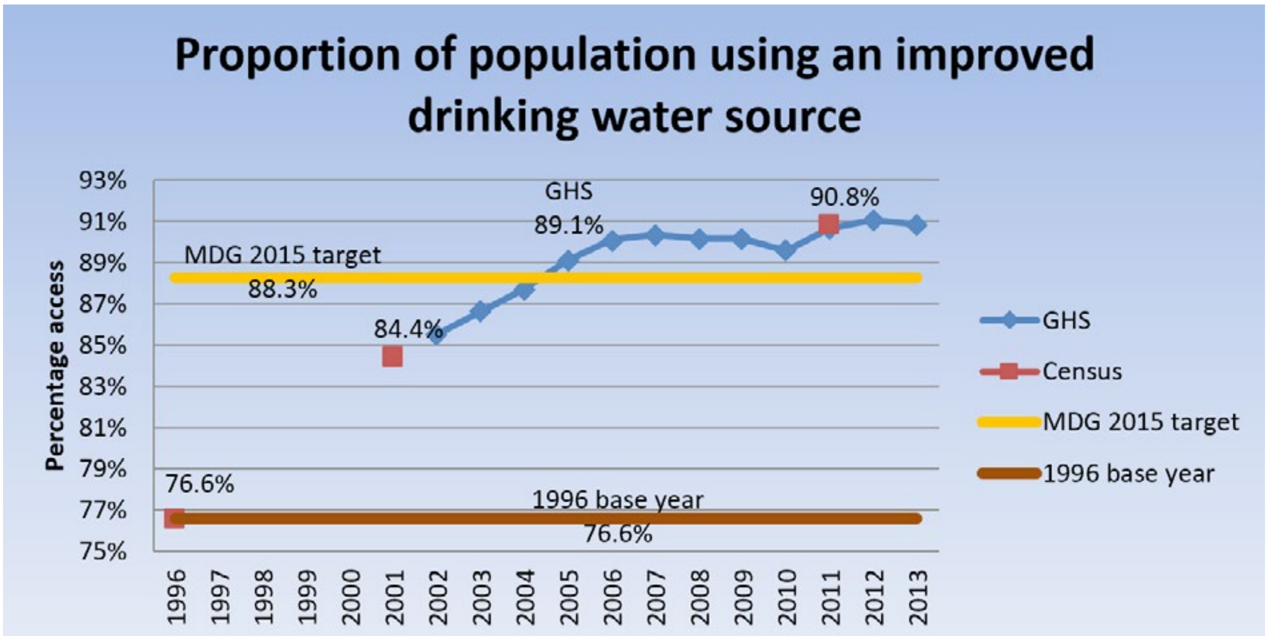
Water Service delivery in South Africa started to "flat line" in 2006 - 2007, and to understand why no progress was being made in addressing the backlogs, improved service delivery indicators had to be developed. The full suite of revised indictors would effectively track both the provision of infrastructure and sustainability of the service.

Strategy

National standards and measures to conserve water, the Water Services Act 1997 and the Strategic Framework for Water Services 2003, set out standards (SABS 241) which are in accordance with the WHO, Guidelines for drinking water quality, fourth edition. One of the main principles was to ensure that water services will be available at least 350 days of the year without interruptions of longer than 48 hours per incident.

To address the sustainable operation of the infrastructure DWS developed a new indicator called "Stability of Supply", which consisted of questions based on delivery of water services. Once the responses were received they were analysed and trends were monitored in subsequent GHS surveys (post 2009). The GHS survey instrument covers 30 000 Households. To obtain a more accurate benchmark the questions were also included in the 2011 National Census.

See drinking service delivery trend graph below:



Results and impact

The percentage of households which had stable municipal water supply was 76.3% and access to a basic tap water supply (within 200m of Household) was 83.8%. Based on the results DWS developed a new composite indicator called "Reliability of Supply" with regards to access to basic water services provision. The method of computation was to multiply "Stability of Supply" (76.3%) by "Access to Basic Water Supply" (83.8%). The Reliability of Supply Indicator for South Africa was 64%. The "Access to Basic Water Supply" indicator correlates directly with the SDG definition of Access to Basic Water Supply (with a distance filter of 200m, not 100m). This implies that although 95% of the infrastructure for basic services had been provided, only 64% was operational. (It seemed that 10% of the schemes had become dysfunctional and most of the financial expenditure continued to be directed to new schemes and not the rehabilitation and upkeep of existing schemes – which explained the flat lining trend in the graph).

Results of the worrying service delivery trends were presented to Government, explaining the dynamics of why service delivery had slowed to virtually zero. In 2014 a national election took place and these results directly influenced government policy. The latest Government Medium Term Strategic Framework (2014 to 2019) has 12 key outcomes, and outcome 9, states that "90% of all Households must have access to a sustainable and reliable water supply by 2019".

Challenges and lessons learned

Proving the necessity of incorporating the new indictors into the national framework was a challenge especially while using a survey instrument to refine and measure the correct indicators in order to explain virtually zero service delivery which made an impact on the Government policy.

Potential for Replication

This methodology is replicable in all environments and other contexts (electricity for example).

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Case study n°4

Quality standard and assessment for village water supply systems (QSVS)

Country: Thailand

Level: National

SDG Addressed: SDG 6 – Clean Water and Sanitation

Summary

The objective of the case study is to show how Thai Quality Standard on assessing village water supply systems (QSVS) - based on WHO Drinking Water Quality Guidelines – were used to develop a self-assessment tool.

The new tool allows the collection of structural and non-structural components of village water supply systems that address problems and causes of water supply system function and performance, directly supporting the achievement of SDG target 6.1 "achieve universal and equitable access to safe and affordable drinking water for all" by ensuring that people of Thailand receive good quality and safe water for consumption."

The agencies involved were the Department of Health, Department of Groundwater Resources, in collaboration with Provincial Water Work Authorities and others. This new tool identifies problems and causes to find proper solutions to improve water supply efficiency and performance in a community. As a result, people in the rural areas can have good water quality and supply systems with affordable prices.

The self-assessment tool allows Local Administrative Organizations to understand the impact level of quality standards in water supply systems. These guidelines improve the quality of each component to provide clean water to customers efficiently.

Background

Thailand has a population of 66 million, more than 60% rely on village water supply systems which are operated by communities or local governments. More than fifteen years ago, Department of Water Resources decentralized the village water supply systems to local administrative organizations. The first strategy of the National Water Resources Strategy Plan is to improve village water supply systems which corresponds to SDG 6.1 target of achieving universal and equitable access to safe and affordable drinking water for all.

Strategy

To address the problems, the department has set-up a working group comprising of representatives from water supply agencies such as: Department of Health, Department of Groundwater Resources and Provincial Water Work Authority. They drafted the Quality Standard on assessing village water supply systems which is based on WHO Drinking Water Quality Guidelines.

Through consensus, the final draft was presented at a workshop on 23rd August 2018. There were more than 120 participants who were representatives from, government and non-governmental organizations: Department of Local Administration, Department of Health, Public Works Department, Water Supply Association of Thailand, Local government among others attending the workshop to share their views, comments and suggestions.

Results and impact

The village water supply system assessment form comprises of 86 questions designed to collect information on five major categories: Raw water source, Water treatment unit and water distribution, Operation and maintenance, Water supply quantity pressure and quality and Management.

There are two types of evaluation forms:

- Water supply from surface water
- Water supply from ground water

Each category was weighted by experts using the AHP (Analytic Hierarchy process) method. The calculation uses a weighting score method for all categories and evaluates the scoring on an excel sheet. The results showed the categories and their overall scores. Finally, the outcomes were expressed in five levels: A: very good, B: good, C: moderate, D: poor and E: very poor.

The QSVS can be used by more than 7,500 LAOs comprising of 75,000 villages in Thailand.

Challenges and lessons learned

The Self-assessment tool should be simple for local community personnel to understand and use in a context of nationwide application. The draft assessment form for village water supply systems was tested in 220 villages in 42 provinces throughout Thailand. The draft was later edited for the ease of understanding by local communities.

The final draft will be submitted for the approval by Director General of DWR in September 2018. The Quality Standard and assessment for Village water supply systems (QSVS) will then be distributed to local governments.

The lesson learned is that it is important to create partnerships and welcome technical and practical knowledge from local communities and national ministries in the creation of standards. Their comments and suggestions are valuable.

Potential for Replication

The quality standard and self-assessment approach can be replicated in other locations by adjusting the evaluation form related to their water supply system needs.

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Case study n°5

National implementation of WSPs: A regulatory tool strengthening water resource management and surveying water quality

Country: Italy

Level: National

SDG Addressed: SDG 6 – Clean Water and Sanitation

Summary

The objective of the case study is to demonstrate how international standards such as the EN 15975-2 standard (Safety of drinking water supply - Guidelines for risk management and critical events) and ISO 14000 have been used to develop national regulations for mandatory Water Safety Plans to improve prevention and response to water quality and quantity issues.

This new approach built on a previous voluntary approach that had proved ineffective to concretely facilitate the achievement of SDGs 3 and 6. The national adoption of Water Safety Plans (WSPs) represent a fundamental tool to reach SDGs n.3 (Good health and well-being), n.6 (Clean Water and Sanitation) and n.13 (Climate Action).

Risk analysis in the water and sanitation sector, including the WSPs approach, is a key strategy to strengthen environmental health with focus on access and quality of drinking water. The actual Italian policy on WSP implementation started in 2014, when the first pilot led to the publication of the first national guidelines for WSPs implementation.

The Ministerial Decree of 14th June 2017, EU Directive 2015/1787, introduced the implementation of WSPs based on general principles established according to international standards such as the EN 15975-2 standard (Safety of drinking water supply - Guidelines for risk management and critical events) and specifically on National Implementation Guidelines of WSPs.

The WSP implementation is mandatory for water suppliers through a seven-year regulatory process. The first phase (already started) is focused on training activities and the definition of procedures for WSP implementation and approval. The second five-years phase concerns application and approval of WSPs to Regional and National Authorities.

Background

Availability of water resources of adequate quality, is a fragile issue due to ongoing climate changes and post-industrial developments in Italy. Despite a general compliance of water supply performance to EU rules, in the summer of 2017, 6/20 regions called for a "state of emergency" due to water scarcity, and health issues related to water quality in different Regions (e.g. thallium in Tuscany, perfluoroalkyl compounds in Veneto).

To cope with this scenario, Italy has strengthened and integrated strategic solutions for the water sector, including the compulsory implementation of WSPs.

Strategy

The following standards were used to address the problem:

- The EN 15975-2 standard supports the integrated prevention and control approach, extended to the entire drinking water supply chain, proposed by the WHO with the introduction of WSPs. It includes 5 basic phases: description of the drinking water system, identification of all potential hazards and hazard events that affect the system, assessment of related risks, risk control and verification of the approach.

- The ISO 14000 series of standards are adopted as a basis for the management of environmental systems. It is important to identify the common points of the environmental and health risk assessment processes, to best optimize the application of the WSP approach to water systems.

Results and impact

Until now, the development of water safety plans in Italy has been a voluntary choice of water suppliers. The various experimental application on national territory demonstrated the efficacy of WSP as the best effective tool assuring safety and clean drinking water distribution as well as better management of water catchment and supply. The mandatory application of WSPs results to:

- A higher level of health protection through: the prevention of water contamination, increase of tap water uses by consumer due to the increased level of assurance;

- Efficacy of adapting to climate change affects availability, quality of water resources and supply due to strengthening the resilience of water systems to extreme weather events – droughts and flooding;

- Improvement of long term tap water access due to rationalization of resources and interventions driven by risk assessment results.

Challenges and lessons learned

The Italian panorama of drinking water suppliers is heterogeneous. There are many small and very small managers, to whom the application of water safety plans is a challenge in terms of human and economic resources. By voluntary application, the following lessons were learned:

- Systematize and integrate existing practices, experiences, procedures, because most of the WSP elements are already in place.

- The WSP must be system-specific to be effective.

- The implementation of WSP is a continuous, dynamic and incremental process.

- Risk analysis must be based on evidence.

- The WSP should be accepted and shared by all representatives of the management board and by all team members.

Potential for Replication

Due to the flexibility of the WSP model we feel it is a universal approach for prevention and response to water quality and quantity issues. Indeed, WSP implementation is already spread worldwide, and its diffusion can concretely facilitate the achievement of SDGs 3 and 6.

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