BOREHOLES FOR DOMESTIC WATER SUPPLY IN LESOTHO

TECHNOLOGY DESCRIPTION

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In regions of water scarcity small-scale collection infrastructure can contribute greatly to the volume of freshwater available for human use. This is especially true in the southern lowlands and Senqu river valley where the little rainfall received is usually very intense and often seasonal. This technology entails two broad categories: i) Collecting rainfall from ground surfaces utilizing "micro-catchments" to divert or slow runoff so that it can be stored before it enters watercourses; and ii) Collecting flows from natural watercourses i.e. floodwater harvesting by constructing an earthen or other structure to dam the watercourse and form "small reservoirs." Micro-catchments are often used to enhance agricultural water management. Small reservoirs are typically used in areas with seasonal rainfall to ensure that adequate water is available during the dry season.

CURRENT TECHNOLOGY READINESS LEVEL (TRL) OR COMMERCIAL READINESS INDEX (CRI)

The TRL for boreholes in Lesotho is relatively advanced, reflecting the country's extensive experience and ongoing efforts in groundwater extraction for domestic water supply. Borehole technology in Lesotho is at a mature stage (TRL 7-8), with successful demonstrations in operational environments and nearing full-scale deployment. This includes well-established practices for drilling, casing, and pump installation. Ongoing projects aim to expand and improve borehole infrastructure, ensuring reliable access to groundwater. The CRI reflects the maturity and market adoption of this technology (CRI 5-6). The technology is in the market expansion phase i.e. while the technology is well-established and widely used, there is still room for further market penetration and optimization.

CLIMATE RATIONALE OF THE TECHNOLOGY

Recent projections for future scenarios indicate increasing frequency and intensity of drought and other extreme weather events (LMS, 2018)[1]. Thus, deep boreholes penetrating at least one impermeable layer generally have greater resilience to drought (Cooley and Gleick, 2009)[2]. The rationale for their use is rooted in their ability to access deep groundwater reserves, which are less susceptible to the immediate impacts of drought compared to surface water sources (MacAllister et al., 2020)[3]. In many communities in southern lowlands and Senqu River Valley (SRV) of Lesotho groundwater is the only perennial source of water supply but a more nuanced understanding of drought is needed to formulate a proper response.

[1] Lesotho Meteorological Service. 2018. Lesotho Extreme climate Indices: Climate Hind-cast and Future projections.

[2] Cooley, H. and P.H. Gleick. 2009. Urban water-use efficiencies: Lessons from United States cities (pp. 101-122). Island Press: Washington, DC, USA.

[3] MacAllister, D. J., A.M. MacDonald, S. Kebede, S. Godfrey, and R. Calow. 2020. Comparative performance of rural water supplies during drought. Nature communications 11(1):1099

AMBITION OF THE TECHNOLOGY

SCALE FOR IMPLEMENTATION AND TIME-LINE

The long-term target is to initially drill three monitoring boreholes in each of the three main hydrometric catchments of Lesotho especially targeting drought prone areas. The entry point thereafter is to rehabilitate or revive 100 percent of the existing community boreholes and increase them 10-fold by drilling at least 64 new boreholes proportionally skewed towards the drought prone southern lowlands and SRV reaching at 459, 281 people in the southern lowland SRV. The timeline for realizing boreholes for domestic water supply covers the period 2025-2035 in line with national and development policies. These are also aligned to Sustainable Development Goal 6.

The project will roll out in three phases starting with the Planning phase (1-2 years) - Water needs assessment of the community; identify potential sites for drilling; assess groundwater availability and quality; designs for the borehole, including depth, casing, and pump specifications; potential environmental impacts and plan mitigation measures. Then the implementation phase of **Drilling and Construction phase (2-5 years) -** Drill the borehole to the required depth, ensuring proper alignment and stability; install casing and screens; install pipelines to distribute water from the borehole to storage tanks and distribution points; install storage tanks to ensure a steady supply of water; and ending with the **Testing phase (1 - 12 months) -** Conduct pump tests to determine the borehole's yield and water quality; test the water for contaminants. The operation and maintenance phase is continuous and there is need to train local operators on the proper use and maintenance of the borehole system; continuously monitor water quality and system performance.

AMBITION FOR TECHNOLOGY READINESS LEVEL OR COMMERCIAL READINESS INDEX

The ambition is to advance the TRL by maintaining and advancing the boreholes to TRL 9 by implementing sustainable groundwater management practices to ensure long-term viability in order to prevent over-exploitation and ensure the sustainability of water resources. Technical skills and knowledge among local professionals and communities will be enhanced in order to improve the efficiency and effectiveness of borehole system. Furthermore, the ambition is to move towards higher CRI stages (8-9) by expanding borehole infrastructure to reach more remote and underserved areas and increase access to reliable water sources and improve water security.

EXPECTED IMPACTS OF THE TECHNOLOGY

Implementing boreholes as a drought intervention for domestic water supply can have significant impacts on water accessibility, quality, and sustainability since they provide a reliable source of water during droughts, especially in rural and arid regions where other water sources may be scarce or unreliable. The potential impacts are:

- **Reliability and Accessibility** - Boreholes equipped with handpumps have proven to be the most reliable water source during droughts they consistently recovered quickly after use, unlike springs and hand-dug wells which contribute to daily water consumption.

- **Water Quality and Health** - Boreholes generally maintain better water quality compared to other sources, with lower contamination levels during drought cessation periods.
- **Sustainability and Management Challenges** - The sustainability of borehole projects is influenced by factors such as community engagement, maintenance practices, and availability of spare parts hence these factors were critical for the long-term success of borehole projects.

POLICY ACTIONS FOR TECHNOLOGY IMPLEMENTATION

EXISTING POLICIES IN RELATION TO THE TECHNOLOGY

Water and Sanitation Policy (2007) promotes proper management and sustainable use of water resources, including provision of sanitation services, so as to maximize socioeconomic benefits while not compromising the integrity of the natural ecosystem.

Soil and Water Conservation Policy (2021) protects land and water resources by conserving the natural resource base, while maximizing the potential for sustainable land management, using appropriate land management techniques.

National Drought Contingency Plan 2018/2019 aimed at minimizing the negative impact of drought on all vulnerable groups, especially people with disability, women and children.

Draft Irrigation Policy (2021) promotes social and economic well-being of people through irrigated agriculture development on maximum arable land while ensuring equity, sustainability, technical and economic feasibility, and social acceptability without causing any negative impact on the environment.

Water Resources Management Policy (2017) seeks to ensure sustainable development of water as a resource, adequate supply of potable water even in times of drought, and proper assessment and protection of available water resources.

National Climate Change Policy 2017 – 2027 (2017) ensures that all stakeholders address climate change impacts and their causes through the identification, mainstreaming and implementation of appropriate adaptation and mitigation measures, while promoting sustainable development.

PROPOSED POLICIES TO ENHANCE TECHNOLOGY IMPLEMENTATION

- Protocol for prioritizing areas/sites for installation of boreholes.
- Guidelines for approval of permits for extraction of groundwater resources.
- Revise policies/laws to control drilling of boreholes affecting vulnerable aquifers.

COSTS RELATED TO THE IMPLEMENTATION OF POLICIES

Research on ground water availability/quality: Estimated cost is USD22.25 million.

Institutional Capacity Building: Estimated cost is USD 5.0 million.

Awareness Raising and Behaviour Change Campaigns: Estimated cost of about USD 4.0 million

Incentives and Subsidies for Drilling Equipment: Estimated cost of about USD 15 million.

Development of Protocols: Total estimated cost of about USD 6 million.

Monitoring: Estimated cost is USD 6.0 million for water monitoring and water quality standards infrastructure and technology.

The total estimated cost is **USD.58.25 million**

USEFUL INFORMATION

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LINKS TO TNA REPORTS

https://tech-action.unepccc.org/country/lesotho/