SECTION A:	**QUALIFICATION DETAILS**																		
QUALIFICATION DEVELOPER (S)	Ministry of Employment, Labour Productivity and Skills Development																		
TITLE	Certificate IV in Borehole Mechanics and Water Management																**NCQF LEVEL**	4	
FIELD	Manufacturing Engineering Technology		**SUB-FIELD**		Borehole Mechanics and water management												**CREDIT VALUE**	60	
New Qualification							√	Review of Existing Qualification											
SUB-FRAMEWORK	General Education						TVET			√	Higher Education								
QUALIFICATION TYPE	Certificate	I		II		III		IV	√	V		Diploma		Bachelor					
	Bachelor Honours			Post Graduate Certificate								Post Graduate Diploma							
	Masters											Doctorate/ PhD							
RATIONALE AND PURPOSE OF THE QUALIFICATION																			

Rationale

The Botswana Vision 2036 states that development of the human capital and the informal sector and the micro and small enterprises (MSES) are essential in achieving the VISION 2036 pillars, in particular Sustainable Economic Development and Human and Social Development. Although Botswana has been fortunate to experience unprecedented economic growth since independence, this has not generated enough jobs to reduce unemployment. The most severely hit group amongst the unemployed is the youth, who account for about 51.7 % of the total unemployed, with the 15-19 age group most affected.

The Botswana Education and Training Sector Strategic Plan (ETSSP 2015-2020) marks a significant milestone in our collective efforts as a nation to bring about a more diversified, knowledge-based economy. Through a planned and careful development of human capital, the ETSSP seeks to refocus our education and training towards fulfillment of social and economic aspirations identified in our Revised National Policy on Education (RNPE) 1994, the National Development Plan 11, Vision 2036 and as well as the Millennium Development Goals. In particular, the ETSSP is intended to strengthen the match between qualifications and Labour market requirements, thereby ensuring that education and training outputs are more closely aligned to socio economic development needs of the country. In line with this strategic goal, the Human Resource Development Council (HRDC 2016) report on top occupations in demand has identified mechanics inclusive of heavy plant, borehole

and water management, hydraulics, diesel and auto electrical as some of the priority skills for Transport & Logistics and Mining Mineral Energy & Water Resources Sectors.

Since there is a high-water demand experienced in the country for different uses such as farming (arable and pastoral), businesses (hotels, schools) the Borehole and Water Management curricular would produce personnel who will support constant and reliable water supply. As such the Borehole Mechanic graduates are vital in the country to design, construct and operate boreholes in order to achieve safe drinking water.

PURPOSE:

The purpose of this qualification is to produce semi-skilled personnel with knowledge, skills and competence to:

- Perform basic functions of information technology and communication skills.
- Apply appropriate methods to borehole design, construction and operation.
- Use borehole information including pumping test analysis to develop sustainable borehole designs and appropriate remediation strategies.
- Conduct field tests on boreholes and perform borehole installation.

ENTRY REQUIREMENTS (including access and inclusion)

Minimum entry requirement for this qualification is a:

NCQF level 3, Certificate III (General Education or TVET) or equivalent.

Recognition of Prior Learning (RPL):

There will be provision for access through Recognition of Prior Learning (RPL) and Credit Accumulation and Transfer (CAT) in accordance with the RPL and CAT National Policies.

(Note: Please use Arial 11 font for completing the template)

SECTION B	QUALIFICATION SPECIFICATION
GRADUATE PROFILE (LEARNING OUTCOMES)	**ASSESSMENT CRITERIA**
1. Organize and manipulate data using ICT	**1.1.** Read and analyse data from a prepared database **1.2.** Enter and manipulate data using ICT tools. **1.3.** Display data electronically using charts. **1.4.** Manipulate and present information through the selection of appropriate spread sheet tools.
2. Demonstrate awareness of the basic entrepreneurial concepts associated with business establishment in Botswana.	**2.1.** Relate the basic entrepreneurial concepts that inform the establishment of a venture. This includes support structures or policies available for entrepreneurs in Botswana. **2.2.** Identify entrepreneurship or business opportunities in a field of interest making use of brainstorming and environmental and scanning techniques. **2.3.** Consider the various investment strategies and risks associated with your identified business.
3. Demonstrate knowledge, skill and competence to engage in vocationally relevant tasks, be it in an organization or vocational context.	**3.1** Apply negotiation and communication skills prior to and during work-based learning. **3.2** Perform assigned vocation-related tasks to the required standards. **3.3** Apply effective fundamental and core skills throughout the duration of the work-based learning program. **3.4** Adhere to health and safety requirements at all times. **3.5** Apply problem solving skills as and when problems are encountered during work process. **3.6** Contribute effectively to teamwork initiatives within the work environment. **3.7** Evaluate the work-based learning experience to determine its benefits and/or limitations.
4. Apply knowledge on engineering science	**4.1.** Calculate reactions on simply supported beams **4.2.** Demonstrate knowledge on simple machines

	4.3. calculate work done, energy and power **4.4.** Calculate temperature and quantity of heat energy **4.5.** Identify types of thermal expansion **4.6.** Demonstrate knowledge on power transmission calculations **4.7.** Perform some electrical calculations
5. Design drawings for engineers	**5.1** Produce orthographic projection of engineering drawing **5.2** Demonstrate knowledge on standard conventions and fastenings **5.3** Produce assembled drawings for borehole equipment/components **5.4** Produce sectioned engineering drawings **5.5** Produce electrical circuit diagrams
6. Apply knowledge fuel injection system	**6.1.** Demonstrate knowledge of the principles and operation of diesel fuel system **6.2.** Identify fuel system components **6.3.** Fit fuel system components **6.4.** Conduct post operation functions
7. Demonstrate knowledge on engine cooling system	**7.1.** Demonstrate knowledge of the principles and operation of diesel fuel system **7.2.** Identify fuel system components **7.3.** Fit fuel system components **7.4.** Conduct post operation functions
8. Demonstrate knowledge on engine lubrication system	**8.1.** Identify different types of engine cooling systems **8.2.** Explain operating principle of different types of engine cooling systems **8.3.** Diagnose engine cooling system faults **8.4.** Remove and refit engine cooling system components
9. Apply knowledge on pressure charging system	**9.1.** Identify different types of engine lubrication system **9.2.** Describe the operating principles of lubrication systems **9.3.** Diagnose faults on lubrication system

10. Assemble engine components under supervision	**10.1.** Dismantle the engine component as per the manufacturing specification **10.2.** Inspect engine components for any defects **10.3.** Prepare for assembly of mechanical components under supervision **10.4.** Assemble engine components under supervision **10.5.** Test and store completed assemblies under supervision
11. Apply mechanical principles for power transmission	**11.1.** Explain different types of power transmissions **11.2.** Discuss principles of mechanical power transmission **11.3.** Design mechanical power transmission system **11.4.** Identify causes of mechanical power transmission problems
12. Demonstrate knowledge on hydraulics and pumps	**12.1.** Identify different types of water pumps **12.2.** Illustrate working principles of different types of water pumps **12.3.** Identify and repair faults on water pumps **12.4.** Calculate water flow and total head
13. Demonstrate knowledge on groundwater	**13.1** Identify different types of aquifers **13.2** Discus major ground resources in Botswana **13.3** Identify different types of wells **13.4** Demonstrate knowledge on well hydraulics
14. Perform basic construction	**14.1** Determine factors affecting design of a structure **14.2** Prepare a good mix and mix the constituents in the right proportion **14.3** Apply knowledge on various walling systems **14.4** Apply knowledge on floor construction **14.5** Apply knowledge on concrete mixtures
15. Demonstrate knowledge on water quality monitoring and preventative measures in water supply reticulation systems	**15.1** Describe causes and effects of variation in water quality in water reticulation system **15.2** Apply knowledge on water sampling procedures **15.3** Determine tests carried out on water samples **15.4** Describe measures for preventing deterioration in water quality **15.5** Demonstrate knowledge on accredited water quality standards.
16. Develop a Borehole	**16.1** Demonstrate knowledge on borehole siting

	16.2 Illustrate on borehole drilling methods **16.3** Design and construction of borehole. **16.4** Demonstrate knowledge on database/record keeping for boreholes.
17. Install and maintain pumps	**17.1** Install a progressive cavity pump in a borehole using galvanized steel piping Show and awareness of the potential hazards that are prevalent in borehole and WellPoint installation and the safety precautions that must be applied. **17.2** Construct a well point and install a pump with all the necessary piping and valves **17.3** Install submersible centrifugal pump in a borehole utilizing high density polyethylene piping and fittings **17.4** Install a progressive cavity pump in borehole using galvanized steel piping **17.5** Service and maintain a wide range of boreholes well point pumps **17.6** Complete all necessary documentation
18. Demonstrate knowledge on water quality and treatment	**18.1** Understand the common parameters used for water quality **18.2** Demonstrate knowledge on sampling procedure in different sources either for biological or chemical parameters **18.3** Identify sources and effects of pollution and learn some of the control measures **18.4** Observe a source contaminated from a known pollutant

Note: Please use Arial 11 font for completing the template)

SECTION C	QUALIFICATION STRUCTURE				
COMPONENT	**TITLE**	**Credits Per Relevant NCQF Level**			**Total (Per** Subject/ Course/ Module/ Units)
		Level [ ]	**Level [4]**	**Level [ ]**	
FUNDAMENTAL COMPONENT Subjects/ Courses/ Modules/Units	Entrepreneurship		**4**		**2**
	Information and Communications Technology (ICT)		**4**		**2**
CORE COMPONENT Subjects/Courses/ Modules/Units	Groundwater		**4**		**3**
	Power Sources		**4**		**7**
	Engineering Mathematics and Science		**4**		**3**
	Technical Drawing		**4**		**4**
	Water Quality and Treatment		**4**		**2**
	Installation		**4**		**3**
	Borehole Systems		**4**		**2**
	Work Based Learning/Attachment		**4**		**32**
ELECTIVE/ OPTIONAL COMPONENT Subjects/Courses/ Modules/Units	**N/A**				

Note: Please use Arial 11 font for completing the template)

SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL	
TOTAL CREDITS PER NCQF LEVEL	
NCQF Level	**Credit Value**
Fundamental components	**4**
Core components	**56**
Elective components	
TOTAL CREDITS	**60**
Rules of Combination: **(Please Indicate combinations for the different constituent components of the qualification)**	
To be awarded the qualification learners are required to obtain a minimum of 60 credits inclusive of 04 credits for fundamental, 24 credits core and 32 credits for industrial attachment.	

(Note: Please use Arial 11 font for completing the template)

ASSESSMENT ARRANGEMENTS

ASSESSMENT ARRANGEMENTS

All assessments, formative and summative, leading/contributing to the award of credits or a qualification should be based on learning outcomes and/or sub-outcomes.

Formative assessment

Formative assessment or continuous assessment contributing towards the award of credits should be based on course outcomes. The contribution of formative assessment to the final grade shall be **60%.**

Summative assessment

Learners shall undergo assessment including written and practical and simulated projects. The final examination for each course contributes **40%** of the final mark for that course.

MODERATION ARRANGEMENTS

Internal and external moderators to be engaged will be BQA accredited subject specialists in relevant fields with relevant industry experience and academic qualifications. Both internal and external moderation shall be done in accordance with applicable policies and regulations.

RECOGNITION OF PRIOR LEARNING

Learners may submit evidence of prior learning and current competence and/or undergo appropriate forms of RPL assessment for the award of credits towards the qualification in accordance with applicable RPL policies and relevant national-level policy and legislative framework. Implementation of RPL shall also be consistent with requirements, if any, prescribed for the field or sub-field of study by relevant national, regional or international professional bodies.

CREDIT ACCUMULATION AND TRANSFER

Candidates may submit evidence of credits accumulated in related qualification in order to be credited for the qualification they are applying for.

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

Horizontal Articulation

The holder of this qualification may articulate horizontally to qualifications like:

- Certificate IV in Wastewater management
- Certificate IV Heavy plant mechanics
- Certificate IV Mechanical engineering

Vertical Articulation

The holder of this qualification may progress to

- Certificate V in Borehole Mechanics and water management
- Certificate V in water engineering

EMPLOYMENT PATHWAYS

On completion the candidates can either get employed or become a self-employed Entrepreneur in any one of the following fields:

Wage Employment

1. Plant operator
2. Private fleets and Garages
3. Workshop assistance
4. Water Supply assistance

b) Self Employment

1. Installation Company
2. Borehole maintenance

QUALIFICATION AWARD AND CERTIFICATION

Minimum standards of achievement for the award of the qualification

A candidate is required to achieve the stipulated minimum of 60 credits inclusive of 4 credits for total fundamental and 24 credits of core components and 32 credits Industrial Attachment to be awarded the qualification.

Certification

Candidates meeting prescribed requirements will be awarded **Certificate IV in Borehole Mechanics and Water Management** Certificate in accordance with standards prescribed for the award of the qualification and applicable policies.

REGIONAL AND INTERNATIONAL COMPARABILITY

1. **Kenya Water Institute (KEWI) certificate in Water Engineering (NQF level 4 worth 190 credits**). This qualification, which is tenable at Nairobi, Chiakang and Kituri Campus is intended to develop knowledge, skills and competencies in:
   - Problem solving,
   - Collection and analysis of data
   - Management of environment and water resources,
   - Groundwater assessment survey planning and design of water supply, wastewater and irrigation,
   - Sinking and equipping boreholes for groundwater abstraction,
   - Construction and installation of water supply wastewater and drainage system,
   - Maintenance of power sources and water abstraction equipment,
   - Communication in workplace.

Assessment strategies for this qualification include continuous assessment weighted 30% and final 70%. Each candidate is required to complete 420 hours of industrial attachment where the candidate is required to record daily activities assigned in a logbook. the candidate is also required to complete a trade project and business plan project. Educational and employment pathways for this qualification are not clearly indicated while the

2. **Maruleng training academy - Certificate in Water and Wastewater Treatment Process Control Supervision (NQF level 4 worth 166 credits).** This qualification is intended to develop knowledge, skills and competencies to
   - Compare water and wastewater works performance with legislative and workplace requirements at an operational level.
   - Interpret and apply legislation relevant to the operation of water and wastewater treatment works.
   - Apply communication and leadership skills at the working environment.
   - Demonstrate of administration required on a wastewater treatment works.
   - Use the System International (SI) and appropriate formulae to perform calculations needed to operate water or wastewater treatment plant

This qualification will prepare learners to function independently on water or wastewater treatment works. A person acquiring this qualification will be able to operate and control specific processes at water or wastewater treatment works within the context of legislation and work policies and procedures. This qualification is aimed at people who are expected to make decisions relating to the amount of chemicals dosed, volumes of water treated and pumped. The qualification will provide learners with knowledge and skills to be able to lead a small team or group on a plant as well as to conduct administrative tasks in order to meet organizational objectives.

This qualification forms the foundation for progression to higher-level qualifications at NQF Level 5 in the learning pathway. It focuses on the full development of the learner and further mobility.
Although assessment for this qualification has not been stated, the learning qualifications reflect that both knowledge based and performance-based assessment are applicable candidates are required to achieve a minimum of 136 credits inclusive of fundamentals units worth 36 credits, core units weighted 87 credits and electives worth 36 Credits. Holders for these qualifications may pursue other qualifications in cognate areas, for multi skilling purposes, including but not limited to range of water or wastewater operations including careers other related sectors such as pollution control, wet industries, electricity generation, environmental qualifications.

Employment pathways for the qualification holders provide the flexibility to pursue different careers in fields related to the water sector. The level of flexibility within the range of electives will allow the individual to follow a career in a range of water or wastewater operations including careers other related sectors such as pollution control, wet industries, electricity generation, environmental qualifications. The qualifications noted above are generally comparable in terms of structure and some exit outcomes. The differences noted include but not fact that the SAQA qualifications is of water and wastewater processes and control and it addresses issues of legislation more than the practical work. While KENYA qualification is about water engineering and covers a lot on practical issues of abstracting groundwater and the distribution system.

Comparability and articulation of the proposed qualification with the ones examined

This qualification that is designed for Botswana commonly known as Borehole Mechanic does not appear in other countries, but since it has got something to do with water issues, that are why it had to be compared with water engineering and water and wastewater processes and control.

Therefore, this qualification designed for Botswana compares very well with the foreign qualifications examined in that it emphasizes the same or similar competencies and the altitude and that it follows a structure typical of similar types and levels of qualifications. What sets this qualification apart from the ones studied is that it offers mostly the maintenance of boreholes and borehole equipment including construction, hydro geo physics and general installation of boreholes using all different types of power source , water reticulation and distribution system.

REVIEW PERIOD

This qualification shall be reviewed every 5 years.

(Note: Please use Arial 11 font for completing the template)