SECTION A:	QUALIFICATION DETAILS		
QUALIFICATION DEVELOPER (S)	Department of Teacher Training and Technical Education		
TITLE	Diploma in Water Engineering	**NCQF LEVEL**	6
STRANDS (where applicable)	N/A.		
FIELD	Manufacturing, Engineering and Technology	**CREDIT VALUE**	380
SUB FIELD	Engineering and Engineering Trades		

New Qualification	✓	Legacy Qualification		Renewal Qualification	
				Registration Code	

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 qualification Diploma in Water Engineering was developed in response to the need established by the Human Resource Development Council Report (HRDC 2016-2021) of Top Occupations in Demand, which identified Water Engineering conditioning Technicians as one of the occupations in high demand in Botswana.

In addition, the study carried out by ETSSP (2014) reveals that there is poor articulation of skills with labour market demands, an outdated curriculum and low utilisation rates. In this manner, the industry complains about graduates who have little or no exposure to the industry. This qualification will address the issue of skills mismatch and equip graduates with the practical skills needed in the water

industry. It will enable graduates to have exposure and skills in water supply, treatment and distribution.

Furthermore, the qualification provides a wide coverage and suppleness to match the needs of the industry, learners, employers and entrepreneurs. It gives learners key skills essential to function effectively and competitively as Water Engineering Technicians. This is espoused in the National Vision 2036 and contributes to transforming Botswana from a resource-based economy to a knowledge-based economy.

This qualification has been developed in line with the Botswana Government's Vision 2036, which acknowledges Technical and Vocational Education Training (TVET) as one of the key contributors to economic growth and employment creation (page 17) and NDP11 (page 71)

The Vision further emphasises implementation of curriculum which is aligned to the needs of the economy, business, science, mathematics and technology (page 20).

Additionally, it will improve the health of communities and contribute towards the improvement and management of the environment and supply of clean water.

Qualification is another way of establishing a positive image for improved perception of the TVET sector. It increases enrollment and, at the same time, addresses the alignment of TVET programmes. Institutions will create demand for qualified, productive and competitive human resources as stated in the Education Training Strategic & Sector Plan (ETSSP), Pg 98.

PURPOSE: (itemise exit level outcomes)

The purpose of this qualification is to produce graduates with advanced technical knowledge, skills and competence to:

1. Provide technological skills required in problem solving involving collection and analyses of data, and implementation of solutions accurately and efficiently.
2. Conserve and manage the environment and water resources for sustainability.
3. Construct and install water supply, irrigation and drainage systems as per the requirements
4. Perform operation and maintenances of the components of the water supply, wastewater, solid waste, irrigation and drainage systems.
5. Provide support services to Engineers in all aspects of water systems, design of treatment plants and reticulation/collection systems.
6. Maintain project records by using computer programme files.

MINIMUM ENTRY REQUIREMENTS (including access and inclusion)

- Certificate IV, NCQF Level 4(General Education or TVET Intermediate Certificate)
- Applicants who do not meet minimum entry will be absorbed through RPL and CAT according to the ETP's policies aligned to National RPL and CAT policies

SECTION B	QUALIFICATION SPECIFICATION
GRADUATE PROFILE (LEARNING OUTCOMES)	**ASSESSMENT CRITERIA**
1 Carry out operation and maintenance of the water treatment plant, supply and distribution system and related infrastructure components for efficient operation and good water quality.	1.1 Carry out water treatment processes according to the set standards 1.2 Perform routine monitoring of water treatment plants, supply and distribution systems to ensure efficiency in operation 1.3 Execute maintenance of water treatment plants, supply and distribution system as per the maintenance standards of the water engineering industry 1.4 Operate water treatment plants, supply and distribution system using quality procedures in accordance with the code of practice and work procedures 1.5 Conserve and protect water resources to sustain the environment
2 Apply engineering mathematics skills to design water engineering systems	2.1 Perform calculations to solve problems within the wastewater engineering field 2.2 Employ engineering mathematical concepts and principles to design wastewater systems 2.3 Perform design calculations on various wastewater systems, including hydraulic calculations of pipe flows, sizes and slopes for design purposes
3 Use engineering software to design and develop engineering drawings as per the standards	3.1 Examine the symbols associated with environmental engineering systems to produce engineering drawings 3.2 Produce engineering components in pictorial and orthographic projection to analyse designs 3.3 Employ the skill to use wastewater engineering software to produce drawings as per the requirements
4. Execute health and safety measures to ensure a health and safety compliant environment	4.1 Adhere to health and safety regulations in the workplace to minimise risks and accidents

	4.2 Apply and monitor occupational, health and safety regulations, codes and practices in the workplace to ensure best safety practices 4.3 Report injuries and accidents in the workplace to comply with health and safety reporting procedures
5. Offer support services to engineers for the design of water treatment plants, design and construction of water supply systems, using applicable standards, codes of practice and legislation	5.1 Provide all support services to engineers for the design treatment of water systems, design and construction of pipelines. 5.2 Lay pipelines for the water reticulation system while adhering to set standards. 5.3 Provide all support services to engineers for design and identify alternative water harvesting technologies and conservation solutions 5.4 Conduct enforcement of bylaws as per the standards (professionally)
6 Apply professional skills (ethics) in the Water Engineering discipline	6.1 Enforce water management statutes as per set standards. 6.2 Employ the code of ethics in the water industry for professional and ethical responsibility. 6.3 Employ knowledge and understanding of current information, theories and models, techniques and practices in all of the major business disciplines.
7. Carry out quality measurements in the Water Engineering Discipline to ensure compliance with set standards	7.1 Develop specific water quality sampling protocols to ensure consistency in sampling. 7.2 Perform different water quality parameter tests to ensure adherence to standards. 7.3 Conduct standard tests, measurements, experiments, and interpret the results to improve processes.
8. Execute professional skills applicable in the Water Engineering discipline	8.1 Employ ICT skills in water engineering to execute the assigned tasks. 8.2 Communicate effectively and efficiently (both oral and verbal) in the water engineering industry. 8.3 Apply entrepreneurship and financial management practical skills in a business set-up. 8.4 Comprehend and write effective reports and design documentation, impact assessment reports and make effective presentations.

	8.5 Employ research, project management skills and ethics in an environmental engineering discipline to carry out an integrated project.

SECTION C	QUALIFICATION STRUCTURE				
COMPONENT	TITLE	Credits Per Relevant NCQF Level			Total Credits
		Level [ ]	Level [5]	Level [6]	
FUNDAMENTAL COMPONENT Subjects/ Courses/ Modules/Units	Introduction to Computing		8		**8**
	Communication skills		8		**8**
	Occupational Health & Safety		6		**6**
	Introduction to Research Methods			8	**8**
	Entrepreneurship			8	**8**
	Engineering Ethics			8	**8**
CORE COMPONENT Subjects/Courses/ Modules/Units	Engineering Mathematics		18	18	**36**
	Engineering Drawing		6		**6**
	Chemistry		14		14
	AutoCAD for Civil Engineering		10		**10**
	Geotechnical Engineering		14		**14**
	Workshop Processes and Practice		14		**14**

	Introduction to Surveying		14		**14**
	Biology		14		**14**
	Fundamentals of Fluid Mechanics and Hydraulics			7	**7**
	Surface and Groundwater Hydrology			13	13
	Construction Technology and Sewage Construction			12	12
	Water Treatment			12	12
	Water Conservation and Systems Management			11	11
	Pipeline and network Construction			14	14
	Water Analysis			8	8
	Irrigation Engineering			12	12
	Pump System Design			15	15
	Computer Applications in Water Engineering			10	10
	Integrated Project			30	30
	Work Placement			60	60
STRANDS/ SPECIALIZATION	Subjects/ Courses/ Modules/Units	**Credits Per Relevant NCQF Level**			**Total Credits**
		Level [ ]	**Level [ ]**	**Level [ ]**	

1.	N/A				
2.	N/A				
Electives	N/A				

SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL	
TOTAL CREDITS PER NCQF LEVEL	
NCQF Level	**Credit Value**
Level 5	**120**
Level 6	**260**
TOTAL CREDITS	**380**

Rules of Combination:

(Please Indicate combinations for the different constituent components of the qualification)

Fundamentals NCQF 5= 30
Fundamental NCQF 6 = 16

Core NCQF 5 = 90
Core NCQF 6=244

Total Credits 380

NCQF Level 5 and 6 fundamental modules add up to 46 credits. Credits for NCQF Level 6 for core and fundamental add up to 334. The total credits for the qualification are 380.

ASSESSMENT ARRANGEMENTS

Documentation
All necessary documents, including: qualification document, alignment matrices, assessment instruments, and Assessment criteria/rubrics, should be available.

Formative (60%)
The contribution of formative assessment to the final grading shall be 60%

Summative Assessment (40%)
The contribution of summative assessment to the final grade shall be 40%

Assessment shall be carried out by BQA-registered and accredited Assessors

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. The moderators should be holders of a bachelor's degree in civil/water/Wastewater Engineering, with relevant/similar qualifications, and industrial experience will be an added advantage.

RECOGNITION OF PRIOR LEARNING

Recognition of Prior Learning (RPL) will be considered for the award of credits according to applicable RPL policies. Candidates 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 applicable national, regional or international professional bodies.

CREDIT ACCUMULATION AND TRANSFER

Credit Accumulation and Transfer will be considered for the award of the credits according to applicable RPL policies. The qualification may be achieved in part or in whole through the recognition of the amount of learning in a qualification or part qualification (credit) based on the acknowledgement of studies already completed. The formal arrangement of credit transfer is negotiated between ETPs based on the comparability of qualifications.

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

Horizontal Articulation (related qualifications of similar level that graduates may consider)

- Diploma in Geomatics
- Diploma in Civil and Building Engineering
- Diploma in Mechanical Engineering
- Diploma in Environmental Engineering

- Vertical Articulation (qualifications to which the holder may progress to)
- Bachelor of Science in Geomatics

- Bachelor of Engineering in Civil Engineering
- Bachelor of Engineering in Mechanical Engineering
- Bachelor of Engineering in Water and Environmental Engineering

Employment Pathways

- On successful completion of this qualification, the holder may be absorbed in the job market as:
- Wastewater Technician
- Sanitation Technician
- Water Engineering Technician
- Water Quality Analyst

QUALIFICATION AWARD AND CERTIFICATION

Qualification Award

Candidate meeting the required minimum of 380 credits will be awarded a Diploma in Water Engineering in accordance with the qualification composition rules and applicable policies.

Certification

There will be certification upon the awarding of the Diploma in Water Engineering qualification.

SUMMARY OF REGIONAL AND INTERNATIONAL COMPARABILITY

Introduction

Diploma in Water Engineering is a three-year qualification which aims to produce a Water Engineering Technician graduate with the knowledge and skills that meet the needs of the industry. The developed qualification has two entry levels, which are for holders of NCQF Level IV (BGSCE) and NCQF Level V (Artisans). The qualification has been benchmarked with other qualifications from New Zealand (Wintec) and Australia (TAFE NSW), and there are no qualifications to benchmark with regionally. Wintec is at NQF level 5(entry NQF level 4- artisans) and TAFE NSW is at NQF Level 5, and the minimum entry is for NQF level 4 holders (artisans), and there are no qualifications to benchmark with regionally.

The developed qualification NCQF maximum level is ten (10), as well as for Wintec, while for TAFE Queensland is level 12, but the content and the depth are equivalent.

Subject Benchmark

The qualification has captured all Graduate Attributes required by ECSA, which include problem solving, application of scientific and engineering knowledge, engineering design, and others. All six ECSA knowledge areas and their minimum credits have been covered. It has also adhered to international standards such as ISO 13.060, which deals with water quality.

Naming

The name of the developed qualification is Diploma in Water Engineering. In contrast, the benchmarked qualifications are Diploma in Water Treatment with strands in Drinking-water and Wastewater (New Zealand - Wintec) and Diploma of Water Industry Operations for Australia - TAFE-NSW. The names of the benchmarked qualifications are different from the developed qualification, but they produce a technician with similar competencies.

Duration and Level
The duration of the qualification for TAFE NSW is between 1-2 years, whereas for Unite – New Zealand Wintec - is 2 years and the developed qualification is 3 years. The developed qualification has two entry levels which are for the holders of NCQF Level 4 qualification (BGCSE entry level is year 1) and NQF Level 5 qualification (Certificate V entry level at year two).

Exit Outcomes
There are some similarities in exit outcomes, such as (in summary) managing water treatment plant, managing risks, compliance or adherence to law, adhering to health and safety standards, maintenance of water plant, and analysis for water level. The exit outcomes or competencies for Australia-NSW also have specialities (electives) of treatment, trade waste, source, networks, irrigation, hydrometric monitoring, hydrographic survey, control centre operations, and asset management. The New Zealand-Wintec qualification has components or aspects of drinking water and wastewater.

Modules
The developed and the benchmarked qualification share some similar modules that cover content of ICT, occupational health and safety, mathematics, research project, water treatment, chemistry, biology, civil engineering technology(construction) and others.

Differences

Naming
The minor difference is the naming of modules, for example: The developed qualification - Water Treatment, TAFE NSW - water treatment processes and Wintec: Drinking Water treatment.

Comparability and articulation

The students of the developed qualification can articulate horizontally (NQF Level 6) or transfer to institutions offering similar qualifications. Horizontal articulation qualifications include but are not limited to Diploma in Water Engineering, Diploma in Environmental Engineering, Diploma in Wastewater and Water Engineering, Diploma in Water Treatment (with strands in Drinking-water, and Wastewater), and Diploma in Water Industry Operations.

Students can articulate vertically to NQF Level 7 (bachelor's degree) since the benchmarked institutions offer a degree qualification of Bachelor of Science in Water Engineering. Other Vertical articulation qualifications include a bachelor's degree in water operations, a bachelor's degree in water and Wastewater Engineering and a bachelor's degree in environmental engineering.

The graduates of the developed qualification can work locally, regionally, and internationally as Wastewater Technician, Sanitation Technician, Wastewater Reticulation Technician, Water Engineering Technician and Water Quality Analyst.

Employers for Water Engineering Technicians include engineering consultancies, privately owned water companies, state-owned water companies, regulatory bodies, the Environment Agency, and others.

REVIEW PERIOD

The qualification will be reviewed every five (5) years or as and when required, depending on the changing needs of the market.

For Official Use Only:

CODE (ID)			
REGISTRATION STATUS	**BQA DECISION NO.**	**REGISTRATION START DATE**	**REGISTRATION END DATE**
LAST DATE FOR ENROLMENT		**LAST DATE FOR ACHIEVEMENT**	