BQA NCQF QUALIFICATION TEMPLATE

SECTION A:	QUALIFICATION DETAILS																	
QUALIFICATION DEVELOPER (S)	Department of Teacher Training &Technical Education																	
TITLE	Diploma in Wastewater Engineering											**NCQF LEVEL**	6					
STRANDS (where applicable)	1. 2. N/A 3. 4.																	
FIELD	Manufacturing, Engineering and Technology											**CREDIT VALUE**	370					
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:

Wastewater Engineering has been identified as one of the occupations in high demand in Botswana and beyond (HRDC Occupation Code No. 2149). This is based on the Labour Market Analysis conducted by the HRDC. The qualification Diploma in Wastewater Engineering was developed as a response to the need established by the Human Resource Development Council Report (HRDC

2019) On Top Occupations in Demand, which identified Wastewater Engineering conditioning Technicians as one of the occupations in high demand in Botswana.

Botswana lacks Wastewater & Sanitation Technicians, which creates a gap in the Water-based industry. The industry has most often complained that entrants in the job market have little or no exposure to basic industry requirements of sewerage reticulation, treatment and disposal - industry and generic knowledge of sewerage reticulation, and therefore fail to make a success in the sewerage reticulation, treatment, and disposal remediation industry. Central to the rationale of this qualification is the development of a culture of professionalism and a deeper understanding of sewerage reticulation, treatment and disposal of wastewater engineering. To provide skills specific to operation and maintenance of wastewater treatment, reticulation, solid waste management and waste disposal. The qualification will improve the health of communities and contribute towards the improvement and management of the environment and control of environmental pollution.

The 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.

Furthermore, the qualification provides 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 sewerage reticulation, treatment and disposal Technicians in the sewerage reticulation, treatment and disposal - industry. This is espoused in the National Vision 2036 and contributes to transforming Botswana from a resource-based economy to a Knowledge-Based one.

PURPOSE: (itemise exit level outcomes)

The purpose of this qualification is to produce wastewater engineering technicians with advanced technical knowledge, skills and competencies to:

- Treat wastewater and maintain treatment plants, reticulation systems and solid waste disposal systems.
- Conserve the environment and maintain public health to ensure public protection.
- Inspect wastewater systems and treatment plants for compliance with the standards that govern their operation.

- Provide support services to engineers in all aspects of wastewater system design of treatment plants and reticulation/collection systems.

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 Apply engineering mathematics skills to design wastewater engineering systems.	3.1 Perform calculations to solve problems within the wastewater engineering field. 3.2 Employ engineering mathematical concepts and principles to design wastewater systems. 3.3 Perform design calculations on various wastewater systems, including hydraulic calculations of pipe flows, sizes and slopes for design purposes.
2 Use engineering software to design and develop engineering drawings as per the standards.	2.1 Examine the symbols associated with environmental engineering systems to produce engineering drawings. 2.2 Produce engineering components in pictorial and orthographic projection to analyse designs.

	2.3 Use wastewater engineering software to produce drawings as per the requirements.
3 Carryout operation, maintenance and repair of wastewater treatment plant, collection systems and related components.	3.1 Carry out wastewater treatment and monitor processes according to the set standards. 3.2 Maintain and repair wastewater treatment plants and collection systems, including stabilisation pond systems, to ensure effective operation. 3.3 Perform sewer construction involving setting out of alignment and grade, excavation and protection of trenches, dewatering, pipe laying and jointing, backfilling and sewer testing.
4 Apply professional skills in wastewater engineering.	4.1 Use ICT skills in wastewater engineering to execute the assigned tasks. 4.2 Communicate effectively and efficiently (both orally and verbally) in the wastewater engineering industry. 4.3 Apply practical entrepreneurial skills to a business setup. 4.4 Design documentation, impact assessment reports, and make effective presentations. 4.5 Employ research, project management skills and ethics in an environmental engineering discipline to carry out an integrated project.
5 Execute health and safety measures to ensure a health and safety-compliant environment.	5.1 Adhere to health and safety policies in the workplace. 5.2 Apply and monitor occupational, health and safety regulations, codes and practices in the workplace to ensure best safety practices. 5.3 Report injuries and accidents in the workplace in compliance with health and safety reporting procedures.

6 Offer support services to engineers to design wastewater treatment plants, collection systems, and related components using applicable standards, codes of practice, and legislation.	6.1 Provide support services to engineers for the design of wastewater treatment plants. 6.2 Provide support services to engineers to design wastewater collection systems and related components. 6.3 Provide support services to engineers for the construction of wastewater collection pipelines and related components.
7 Apply professional skills (ethics) in wastewater engineering to ensure the integrity of the discipline.	7.1 Enforce wastewater management statutes as per set standards. 7.2 Employ a code of ethics in the wastewater industry for professional and ethical responsibility. 7.3 Employ knowledge and understanding of current information, theories and models, techniques and practices in all the major business disciplines.
8 Carry out quality measurements in the Wastewater Engineering Discipline to ensure compliance with standards.	8.1 Develop wastewater quality sampling protocols to ensure consistency in sampling. 8.2 Perform different wastewater quality parameter tests to ensure adherence to standards. 8.3 Conduct standard tests, measurements, and experiments and interpret the results to improve processes.

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 and 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**
	Chemistry		14		**14**
	Advanced Hydraulics			8	**8**
	Biology		14		14
	AutoCAD for Civil Engineering		10		**10**
	Engineering Drawing		6		**6**
	Geotechnical Engineering		14		**14**

	Workshop Processes and Practice		14		**14**
	Introduction to Surveying		14		**14**
	Fundamentals of Fluid Mechanics			7	**7**
	Surface & Groundwater Hydrology			9	**9**
	Construction Technology and Sewerage Construction			12	**12**
	Environmental Pollution and Sanitation			9	**9**
	Wastewater Collection & Systems Management			9	**9**
	Water Analysis			8	**8**
	Wastewater Treatment & Disposal			15	**15**
	Wastewater Re-use Technologies			10	**10**
	Pumps System Design			15	**15**
	Computer Applications in Waste 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	134
Level 6	236
TOTAL CREDITS	**370**

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

Fundamental component = 46 credits (NCQF 5= 30, NCQF 6 = 16)

Core component = 324 credits (NCQF 5 = 90, NCQF 6=234)

Total Credits 370

The candidate must pass all core modules and fundamentals modules.

There are no electives for this qualification.

ASSESSMENT ARRANGEMENTS

Documentation

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

Formative Assessment

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

Summative Assessment

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

The internal and external moderators to be engaged will be BQA accredited subject specialists with relevant industry experience and academic qualifications.

RECOGNITION OF PRIOR LEARNING

Recognition of Prior Learning, RPL, will be considered for awarding credits towards the qualification according to applicable RPL policies.

CREDIT ACCUMULATION AND TRANSFER

Credit Accumulation and Transfer, CAT will be considered for the transfer of the credits towards the qualification according to applicable CAT policies.

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 Water Engineering
- Diploma in Environmental Engineering

Vertical Articulation (qualifications at a higher level 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
- Wastewater Reticulation Technician

QUALIFICATION AWARD AND CERTIFICATION

Qualification Award

Candidates who meet the required minimum of 370 credits will be awarded Diploma in Wastewater Engineering in accordance with the qualification composition rules and applicable policies.

Certification Award

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

SUMMARY OF REGIONAL AND INTERNATIONAL COMPARABILITY

Introduction

The Diploma in Wastewater Engineering is a three-year (National Credit Qualification Framework: NCQF Level 6) qualification that aims to produce a competent Wastewater Engineering Technician. It has been benchmarked with other qualifications from TAFE NSW (Australia) and Algonquin College (Canada).

The developed qualification entry levels are NCQF Level 4(minimum) and NCQF Level 5 for Artisans. TAFE NSW is at NQF Level 5 and the minimum entry is for NQF level 4 holders (artisans). Algonquin College's entry level is for secondary school diploma holders. The developed qualification NCQF maximum level is ten (10), while for TAFE NSW it is level 12, whereas for Algonquin College it is not stated. The content and depth of the developed and benchmarked qualifications are equivalent.

Subject Benchmark

The Diploma in Wastewater Engineering qualification is aligned to ECSA R-02-STA-PE/PT/PCE/PN and Dublin Accord. Botswana Engineering Technologists and Engineers are regulated by the Engineers Registration Board (ERB), which is ERB is aligned with ECSA.

Additionally, Reference was made to the ECSA document E-02-PN of 26 November 2015 to ensure that the 11 attributes mentioned are adequately addressed. In articulating the Learning Outcomes against the Graduate Attributes, reference was made to The International Engineering Alliance Graduates Attributes and Professional Competencies of 1 September 2021 to ensure that the graduate attributes are pegged at the appropriate level.

Furthermore, the developed qualification is aligned with ISO 13.060.00, which focuses on issues of protection against pollution, related installation and equipment and others which are also on the proposed qualification.

Naming

The developed qualification's title is Diploma in Wastewater Engineering, TAFE—NSW's is Diploma of Water Industry Operations, and Algonquin College's is Diploma in Water and Wastewater Engineering. The benchmarked qualifications' names are different from those of the developed qualification, but both produce Technicians with similar competencies to those produced by the proposed qualification.

Duration and Level

The duration of the qualification for TAFE- NSW and Algonquin College is two (2) years whereas for the developed qualification is three (3) years. The developed qualification has two entry levels which are at year 1(NCQF Level 4) and at year 2(NCQF Level 5). TAFE- NSW entry level is for graduates at NQF level 5(who have first year- Artisans/ Certificate V) whereas Algonquin College qualification entry is for college learnerswith Recognition of Prior Learning.

Learner exit outcomes

There are some similarities in exit outcomes such as (in summary) developing and managing a wastewater treatment plant, implementing wastewater policies, carrying out maintenance of the plant, conducting analysis, designing a wastewater treatment plant, designing a water supply pumping

system, pipe networks, and distributed networks. The exit outcomes or competencies for Australia also have specialities (electives) of treatment, trade waste, source, networks, irrigation, hydrometric monitoring, hydrographic survey, control centre operations, asset management.

Modules

The proposed and the benchmarked qualification share some similar modules as shown on the table below:

Proposed Qualification	**TAFE –NSW qualification**	**Algonquin College qualification**
Communication Skills		Communications I
Occupational Health & Safety	Health and Safety	Health and Safety
Engineering Mathematics I		Mathematics for Water and Wastewater
Biology	Biology	• Water and Wastewater Microbiology • Water and Wastewater Microbiology Lab
Chemistry	chemistry	• Water and Wastewater Chemistry • Water and Wastewater Chemistry lab
Construction Technology & Sewerage Construction	Civil engineering technology in the water industry	
Wastewater Collection & Systems Management		• Industrial Wastewater Management

Advanced Hydraulics	Hydraulic principles and application in the water industry	• Hydraulics for Water and Wastewater
Work placement		• Work Integrated Learning (Field Techniques)
Water Analysis		• Wastewater Treatment Laboratory
Wastewater Treatment & Disposal	Waste water treatment processes	• Wastewater Treatment • Solid Waste Disposal and Treatment
Computer Application in Wastewater Engineering		• Computer Applications in Water and Wastewater
Intergraded Research Project	Research project	

Assessment

Summative and formative assessment is being administered by both the proposed qualification and the benchmarked**.**

Qualification rules and minimum Standards for the award of the qualification

The proposed qualification and the benchmarked have stated that the candidate has to satisfy all the set minimum standards (such as all the modules should be passed) of the qualification in order to be awarded a diploma.

Differences

Naming of modules

There is a minor difference in the naming of modules for example: The developed qualification- has a module titled Wastewater Treatment & Disposal, while for the TAFE NSW a similar module is titled Waste water treatment processes and Algonquin College Wastewater Treatment.

Comparability and articulation

The learners 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, the Diploma in Water Engineering, Diploma in Environmental Engineering, Diploma in Wastewater and Water Engineering, and Diploma in Water Industry Operations.

Learners can articulate vertically to NQF Level 7(bachelor's degree) since the benchmarked institutions offer a Bachelor of Science in Water and Wastewater Engineering. Other Vertical articulation qualifications include a Bachelor's Degree in Water Operations and a Bachelor's Degree in Environmental Engineering.

The graduates of the developed qualification can work locally, regionally and internationally as Hydrographers, Trade waster operators, Water networks supervisors, Water source supervisors, Wastewater maintenance Technicians and Wastewater treatment plant coordinators.

Employers for Wastewater Engineering Technicians include Engineering consultancies, privately owned water companies, state owned water companies, regulatory bodies, the Environment agency, sewage water treatment plant, wastewater treatment plant and system.

REVIEW PERIOD

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

BQA NCQF QUALIFICATION TEMPLATE

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**	