

BQA NCQF Qualification Template

DNCQF.FDMD.GD04

Issue No.: 01

QUALIFICATION SPECIFICATION								SECTION A	
QUALIFICATION DEVELOPER		Botho University							
TITLE		Diploma in Water Science and Technology				NCQF LEVEL		6	
FIELD		Natural, Mathematical and Life Sciences		SUB-FIELD		Water Science and Technology			
New qualification		√		Review of existing qualification					
SUB-FRAMEWORK		General Education		TVET		Higher Education		√	
QUALIFICATION TYPE		Certificate		Diploma		√		Bachelor	
		Bachelor Honours		Master				Doctor	
CREDIT VALUE: 360									
RATIONALE AND PURPOSE OF THE QUALIFICATION									
Rationale for the qualification: Water resources pose a major environmental and development challenge. Water resources are increasingly scarce; the opportunities of additional water infrastructure are limited and the costs very high. The estimated combined sustainable yield of Botswana's well fields and storage dams are 165 Mm³ / annum or 216 L/person/day, based on the 2011 national population census estimate of 2,024,904. This is less than the current water demand of around 200 Mm³ / or 262L/person/day. New dams will relieve the situation by increasing the overall yield to 317 million m³ /a (415 L/person/day), but this will only offer temporary relief. More efficient water allocation, water conservation and use of shared water courses will be required to balance water supply and demand (Botswana Integrated Water Resources & Water Efficiency Plan, Vol 1., May 2013). The Botswana Integrated Water Resources Management and Water Efficiency (IWRM- WE) Plan represents our "long-term solution". The goal of this plan is to "Improve people's livelihoods and welfare and contribute to sustained economic growth, economic diversification, social justice and poverty eradication through efficient, equitable and sustainable water resources development and management." According to Botswana Integrated Water Resources & Water Efficiency Plan, (Vol 1., May 2013), the role									

of private sector in sustainable development, planning and management of Botswana's water resources is important for IWRM. Tertiary education institutions should offer IWRM and WDM training activities for graduates and professionals for IWRM and WDM. Training institutions will (in partnership with DWA/IWRM unit^T in some cases) develop curricula and training materials for target groups.

Human Resource Development Council (HRDC) of Botswana has published a document which provides a list of occupations that have been identified as being in high demand at a national level. Priority skills in each occupation have been identified and these includes both the core skills and soft skills (HRDC 2019, page 20). The proposed qualification will help to fill the skills gap in the fields of water chemists and chemical technicians. As per the HRDC document (2017) of Botswana, occupations such as Water Chemists (2113), Instrumentation Technicians (3119), Process Operators (3117) and Occupational Hygienists (2263) have been listed under demand at a national level. The qualification intends to train workplace-ready graduates who will be able to work as entry level employees in the water and chemical industry with less to no training upon employment.

An industrial survey was conducted to establish whether the proposed qualification is viable. The responses from the survey were positive with aspiration and conviction that the qualification was contemporary, needed, and sustainable. Both qualitative and quantitative methods of data collection were used in the study through face-to-face interviews and in-depth interviews. A purposive sampling method was used to select the population of the study, and representatives from both the public and private sector were involved as participants in the study to provide their input. Most of the high school students' participants engaged in the study stressed that they have a science background (94.5%). Only a minute share of the sample mentioned that they are not science students (3.1%). These findings gave us a strong standpoint as the right population was target and hence the conclusions of the results may possess an element of accuracy. It is further revealed that, that a 'Diploma in Water Science and Technology' qualification will be best offered and studied through campus learning/blended learning. This was 63.8% of the students' population and 67% of the employees' population. A Diploma in Water Science and Technology tends to be sufficient in preparing the graduates for the job market but nonetheless the industry made some recommendations that the qualification would even perform better if there were more practical sessions in the curriculum content to expose the students more to the hands-on experience. As employment and internship opportunities are key, it has been established that Water Science and

Technology qualification employment opportunities are sufficient in Botswana and in the SADC region. Further supporting this is the Ministry of Basic Education affirmation statement that “The proposal to start a diploma programme in Water Science and Technology is a vital step towards addressing the conversation of water. Graduates of this qualification will be well in demand in various industries and other organizations”.

Benchmarking with local, regional and institutions for similar qualification made the qualification developer to design this qualification with an inter-disciplinary field which combines environmental science, resources, conservation, distribution, and management in a holistic way.

It is to this effect that the Diploma in Water Science and Technology qualification is being developed, to achieve the vision by equipping the participants with the knowledge, skills and competencies of water management in line with the creation of knowledge-based economy in Botswana.

Purpose of the Qualification:

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

- Apply analytical to handle water quality related challenges in a dry land-locked country like Botswana.
- Operate water testing equipment, re-use methods, and to monitor water quality.
- Use the latest technologies and tools in water testing at their respective workstations.
- Work as water technicians or related industries.

ENTRY REQUIREMENTS (including access and inclusion)

- Certificate V, NCQF level 5 (General Education or TVET), or Certificate IV, NCQF level 4 with at least 20 credits at NCQF level 5.
- Applicants possessing a relevant certificate may also apply.
- Applicants that do not meet the above criteria but possess relevant industry experience may be considered through recognition of prior learning (RPL).

QUALIFICATION SPECIFICATION B		SECTION
GRADUATE PROFILE (LEARNING OUTCOMES)	ASSESSMENT CRITERIA	
At the end of this qualification, the learner will be able to:		
1. Demonstrate overall competency in solving water related problems faced by the industry and community through application of Science, Technology, Engineering and Mathematics (STEM) concepts.	1.1 Discuss STEM principles and concepts associated to water science & technology. 1.2 Evaluate a scenario / problem in relation to the water industry and community. 1.3 Apply the relevant principles and theory in solving the existing problem.	
2. Analyze and apply water treatment and sanitation techniques, monitoring and evaluation skills and planning tools necessary to develop sustainable solution for existing water related problems.	2.1 Apply acquired skills, techniques and modern tools for planning adhering to the contextual policies and feasibility 2.2 Justify the usage of a chosen analytical tool / method for diagnosis and correction. 2.3 Describe the performance of a given system or component through appropriate testing methods. 2.4 Discuss the policies related to the legal, safe sanitation approaches and environmental concerns within the industry for sustainable distribution. 2.5 Describe planning methods to effectively implement monitoring & evaluation techniques and to accommodate industry changes	
3. Identify and solve risks involved with human life by exposure to water	3.1 List various contaminants present in different sources of water.	

contaminants in surrounding environment.	3.2 Discuss methods to reduce / treat various contaminants. 3.3 Evaluate occupational safety and hazards associated in water industry.
4. Apply the concepts of water chemistry, water sciences, technology and environmental chemistry in analysis and design of potable water systems.	4.1 Design and develop a system required for effective utilization of water resource. 4.2 Incorporate sustainability in the formulated/ envisioned systems. 4.3 Apply water sciences including applied math, chemistry, microbiology and toxicology relevant to water and wastewater treatment
5. Provide practical solutions to water related challenges, sanitation and societal needs.	5.1 Identify different areas within water sciences & related technologies and know their functions. 5.2 Analyze, evaluate and incorporate solutions pertaining to the issues in water distribution and consumption and aquatic health 5.3 Apply environmental policies to have a positive impact on community. 5.4 Discuss methods of source water quality-sampling, analysis, reporting and protection
6. Display professional behavior while addressing specific issues with stakeholders in the water industry.	6.1 Develop approaches to enhance and assure quality within a specific water industry. 6.2 Work in a team to solve the issues. 6.3 Explain the details of applicable human resource issues and assets 6.4 Communicate to the stakeholders through verbal and non-verbal communication.

Mapping of Exit Learning Outcomes of the qualification with NCQF's knowledge, skills and competency:

	Exit Learning Outcomes	Knowledge	Skills	Competence
	EL-01	X	X	X
	EL-02	X	X	X
	EL-03	X		X
	EL-04		X	X
	EL-05	X	X	
	EL-06	X	X	X

QUALIFICATION STRUCTURE			SECTION C	
FUNDAMENTAL COMPONENT Subjects / Units / Modules / Courses	Title	Level	Credits	
	Computer Literacy	5	10	
	General Chemistry	5	10	
	Chemistry Practical	5	10	
	Occupational Health and Safety	5	10	
	Physics	6	10	
	Physics Lab	6	10	
CORE COMPONENT Subjects / Units / Modules / Units	Basic Mathematics	5	20	
	Introduction to Financial Accounting	5	10	
	Toxicology	6	20	
	Water Microbiology	6	20	
	Science of Water Chemistry	6	20	
	Water Chemistry Practical	6	20	
	Catchment and Aquatic Ecosystems Health	6	20	
	Economics of Water Management	6	20	
	Water Treatment and Sanitation	6	20	
	Environmental Assessment and Monitoring	6	10	
	Environmental Chemistry	6	20	
	Environmental Chemistry Practical	6	20	
	Water Policy and Planning	6	10	
	Project Work	6	40	
ELECTIVE COMPONENT Subjects / Units / Modules / Courses				
	Geographical Information System OR Water Resource Mapping	6	10	
	Community Water Development OR Community Engagement and Capacity Building	6	10	
	Urban Water Design OR Water Sustainability and Development	6	10	

Rules of combinations, Credit distribution (where applicable):

The credit combination for this qualification is: **60** Credits from fundamental components, **270** credits from Core components and **30 credits** from electives; in total: **360** Credits.

Credit distribution:

Level and Credits	Compulsory	Elective
Level – 5 Credits 70	70 Credits	----
Level - 6 Credits 290	260 Credits	30 Credits
Total credits: 360 Credits	330 Credits	30 Credits

ASSESSMENT & MODERATION ARRANGEMENTS

This qualification is assessed and moderated as follows:

Integrated Assessment:

Because assessment practices must be open, transparent, fair, valid, reliable and ensure that no learner is disadvantaged in any way whatsoever, an integrated assessment approach is incorporated into the qualification. Both formative and summative assessment processes are monitored during the programme and to determine competence at the end of the qualification.

Summative assessment:

Integrated assessment, focusing on the achievement of the exit-level outcomes, will be done by means of a written examination at the end of the module.

Project: Students must do a project and submit their project work at the end of the qualification.

Formative assessment:

Learners are continuously assessed through:

- Practical test
- Class assignments
- Presentations
- Informal class tests
- Formal modular tests

Pass requirements:

A learner passes a module, if he/she obtains a final mark of 50% or more in the module. The final mark is constituted of the formative assessments (40%) and the summative assessment (60%). A learner qualifies for the **Diploma in Water Science and Technology** on NQCF level 6 when he/she passes all the required modules individually. The final mark for the qualification is calculated by averaging the marks obtained in the various modules.

Moderation:

Moderation of assessments focuses on:

- a) Ensuring the assessment is aligned to the module objectives and the learning outcomes.
- b) Ensuring assessment is consistent on all levels within the institution and does not show any bias or academic disregard and that it is immune to all forms of prejudice.
- c) Ensuring the level of assessment appropriately matches to students' level of study. This ensures that the assessments remain viable, relevant and provide an accurate judgement of a student's achievements and level of knowledge.
- d) Maintaining consistency in the marking process

Pre-assessment Moderation:

This moderation is carried before assessment tasks are given to students. All submitted sets of question papers & marking keys are shared with the moderators. Each assessment pack should be moderated by two Moderators where possible. The question paper moderation report should be filled in for each question paper. Moderator report will be shared with question paper setter so that moderator feedback will be taken into account when finalizing the question paper.

Post-assessment moderation or moderation of marking:

Moderation of completed assessment tasks is categorized as post-assessment moderation. It is carried out after assessment tasks have been marked. The set of answer scripts and marking keys are shared with the moderators. At least 10% of the answer scripts in a module should be moderated during post assessment moderation. Head of Department assigns moderation tasks to moderator. External moderators are from both the industry and other accredited Education and Training Providers (Local and international experts).

RECOGNITION OF PRIOR LEARNING (if applicable)

A clear framework through which students can accumulate learning credits and transfer such credits towards appropriate qualifications helps to validate and recognize learning gained through formal and informal means, provides flexibility to students, and allows students to progress relatively seamlessly through their lifelong learning journey.

Candidates may apply for recognition of prior learning whether such learning has been gained through formal programmes of study, through workplace learning, or through any other formal or informal means. Any candidate applying for recognition of prior learning (RPL) or Credit Accumulation and Transfer (CAT) will be expected to provide evidence of such learning that must be relevant, sufficient, valid, verifiable, and authentic. In addition, the candidate may be interviewed by a member of staff or have to take a formal test, which may include a live demonstration of skills and competencies, to assess competence. RPL Policy will be in line with BQA's RPL Policy.

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

Learning Pathway:

Vertical:

After completing the Diploma in Water Science & Technology, students can proceed to the following qualifications:

- Bachelor's degree in Water Science & Technology
- Bachelor's degree in Water and Wastewater Technology

- Bachelor's degree in Water Treatment and Distribution System (at Des Moines Area Community College/USA)
- Bachelor's degree in Water Engineering Technology (at Okanagan College / Canada)

Horizontal:

Students can do the following Diploma qualification:

- Diploma in Water Management
- Diploma in Water and Wastewater Technology
- Diploma in Water Treatment Technology

Employment Pathway:

This qualification will produce diploma holders suitable to work as water chemists or technicians in various water business industries such as:

- Water treatment plant
- Water distribution pump houses
- Health care
- Water testing lab
- Water supply and Sanitation
- Water resource planning

QUALIFICATION AWARD AND CERTIFICATION

The learner will be awarded '**Diploma in Water Science and Technology**' after attaining **360** credits as specified in the rules of combination and credit distribution. This qualification does not have exit awards. Therefore, if the candidate does not meet the prescribed minimum standards of the qualification, the learner will exit with a transcript.

REGIONAL AND INTERNATIONAL COMPARABILITY

This qualification was compared with various universities / Institutions, running similar / related qualification in Water Resource Management. The following universities / Institutions and their qualifications were used for bench marking.

Regional:

- Tshwane University of Technology (Pretoria, South Africa), Diploma in Water Science and Technology.

International:

- Thompson Rivers University (Vancouver, Canada), Diploma in Water Treatment Technology

Diploma in Water Science and Technology: Tshwane University of Technology (TUT) (South Africa):

The qualification provided by TUT and the proposed qualification have similar learning outcomes. The domains covered and the total number of credits (360) are the same. They share many common modules such as Physics, Chemistry, Water Microbiology and Water treatment. The assessment methods are common, and both the qualifications have project work for students. The entry requirements and progression pathways are also similar. The only difference is TUT has 162 credits at Level 5 & 198 credits at Level 6, whereas the proposed qualification has 60 credits & 300 credits at Level 6.

Diploma in Water Treatment Technology, Thompson Rivers University (TRU), Vancouver, Canada:

The entry requirements exit learning outcomes, and the assessment techniques are similar for both the qualifications. They share many common modules such as Water Microbiology, Toxicology and Water treatment. Though the module names are different in some cases: in TRU safety and communication (*Occupational Health and Safety*): Applied Math's and Science (*Mathematics, Physics and Chemistry*) the learning outcomes are similar. The only difference is the credit type: 20 courses of 3 credits each in TRU, whereas 360 credits in total for the proposed qualification. For detailed comparison please check the benchmarking document.

REVIEW PERIOD

5 Years