BQA NCQF QUALIFICATION TEMPLATE

SECTION A:	QUALIFICATION DETAILS		
QUALIFICATION DEVELOPER (S)	Botswana International University of Science and Technology		
TITLE	Bachelor of Science (Honours) in Ecosystem Science and Sustainability	**NCQF LEVEL**	8
STRANDS (where applicable)	N/A		
FIELD	Natural, Mathematical and Life Sciences	**CREDIT VALUE**	132
SUB FIELD	Social Sciences/Environment Management sciences		

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

PURPOSE: (itemise exit level outcomes)

On a global scale, humans are rapidly and extensively changing ecosystems. This has resulted in a substantial and largely irreversible loss in the diversity of life and natural resources on Earth (Ripple et. al. 2017). Botswana and most other countries in Africa are resource-based economies, wherein human welfare is dependent on living and non-living natural capital such as mineral resources and provision of healthy ecosystem services. Secondary to mining, Botswana receives revenues from tourism industry and agriculture, particularly the cattle export (Lesego 2010; Modungwa 2018). While the economic development has contributed to improved human well-being, however, this has also led to loss of an array of valuable monetary and non-monetary natural capital stocks and to degradation of flows of benefits from natural ecosystems (Raudsepp-Hearne et. al. 2010). Unless addressed, the current development path and strategies do not prevent degradation of ecosystems that may lead to unexpected changes to complex non-linear interactions threatening the resilience of the same ecosystems that can alter the access to sustainable production of essential provisions such as food, fresh water, forest products, fibre, and basic commodities necessary for human survival. These consequences initially have high impact on marginalized society especially those in the rural areas, and sequentially to the urban population. Less direct consequences of degradation are services such as natural pollination, clean air, extreme weather mitigation, biodiversity, option values, human mental and physical well-being.

To attain sustainable development and resource use in all sectors which is emphasized in the National Development Plan 11 of Botswana (NDP 11 2017), there is a need to adapt a comprehensive strategy in managing natural resources towards sustained development and that Ecosystem approach is the best option. Currently however, there is no specialized manpower in Botswana that could tackle this enormous challenge and implement the country's National Framework on Sustainable Development (HRDC, Botswana). This specialized manpower should address the current challenges on strengthening human well-being and capabilities to understand fundamental requirements for sustainable development; avert environmental and social disaster; create and implement evidence-based instrument (scientific perspective) on decision making and policy formulation; and promote and secure the global environmental commons. Therefore, there is a need to develop highly skilled manpower to play a major role for a sustainable development of the economy that can only be achieved with thorough sustainable management of natural resources.

Environmental problems as result of human actions can be resolved by human intervention. The perspective of social-ecological interactions must therefore be integral part of ecosystem science and sustainability seeking transdisciplinary solutions to integrate the processes between science and associated social actors and institutions.

To achieve sustainable development across all economic sectors, including the use untaggable natural resources, there is a need to adapt a comprehensive strategy in managing natural resources towards sustained development and that ecosystem approach is the best option. Currently however, there is no specialized manpower in Botswana that could tackle this enormous challenge. This specialized manpower should address the current challenges on strengthening human well-being and capabilities to understand fundamental requirements for sustainable development; avert environmental and social disaster; create and implement evidence-based instrument (scientific perspective) on decision making and policy formulation; and promote and secure the global environmental commons. Therefore, there is a need to produce highly skilled manpower to play a major role for a sustainable development of the economy that can only be achieved with thorough sustainable management of natural resources. This qualification will meet the demands in Botswana, SADC and worldwide for high level skilled manpower necessary for natural resources and ecosystem management and sustainable development.

PURPOSE: (itemise exit level outcomes)

Purpose of this qualification is to produce learners with highly specialised knowledge, skills, and competences to:

1. Integrate the latest Science and high impact technologies into real-world decision making and public policy, with the goal of managing our planet's resources – the air, water, land, and biological diversity upon which all life depends.
2. Analyse and process complex information on ecosystem interactions, its effect of human societies on ecosystem processes and their long-term sustainability and solving the ever-growing environmental challenges.
3. Analyse and identify sustainable approaches to environmental issues and challenges at local, regional, national, and global scales.
4. Use various concept in sustainability science, systems analysis, information management, natural resources ecology and measurements for enhancing perspectives of sustainability at

different scales and geographic locations including sustainable urban development and green cities.

MINIMUM ENTRY REQUIREMENTS (including access and inclusion)

- NCQF level 7 (Bachelor's Degree) in the same or a similar field of study.
- Applicants who do not meet the above criteria but possess relevant industry experience may be considered through Recognition of Prior Learning (RPL) and Credit Accumulation and Transfer (CAT) policies for access. This consideration will be done following guidelines of the education and trainings providers (ETP) which are aligned with BQA/ National policies.

SECTION B	**QUALIFICATION SPECIFICATION**
GRADUATE PROFILE (LEARNING OUTCOMES)	**ASSESSMENT CRITERIA**
1. Demonstrate an understanding and integration of the contemporary theories, principles and concepts of the earth system pathways and their interactions with each other.	1.1 Incorporate the theories, principles, and concepts of the five sphere of earth system pathways (atmosphere, biosphere, hydrosphere, lithosphere and anthroposphere) in explaining natural phenomena and processes during assessment and evaluation to clienteles and stakeholders. 1.2 Illustrate and validate to the stakeholders the interactions between different spheres in relation to ecosystem functions and sustainability.
2. Demonstrate an understanding on the complex theories and hypothesis of the	2.1 Illustrate and validate to the stakeholders and clientele the interaction of living

origin, evolution and diversity of living organisms and its interaction in the ecosystems.	organisms in the ecosystem through the specialized knowledge of life, the theories of origin and evolution of life and the current body of knowledge on ecosystem functions and processes. 2.2 Demonstrate to the stakeholders and clientele the impact of human activities on biodiversity and the importance of biodiversity on sustaining ecosystem health and productivity.
3. Demonstrate grounded understanding of contemporary theories, principles and concepts on ecosystems processes, its interaction, the flow of energy and nutrient cycling, and the maintenance and sustainability of biomes.	3.1 Illustrate and validate to the stakeholders and clientele the principles and interaction between the physical environment and different ecosystem process. 3.2 Illustrate and explain to stakeholders and clientele how human intervention influence ecosystem processes and the feedback mechanisms among the components of the ecosystems.
4. Apply various concept in sustainability science, systems analysis, information management, natural resources ecology and measurements for enhancing perspectives of sustainability at different scales and geographic locations including sustainable urban development and green cities.	4.1 Utilize the multidisciplinary approach in planning appropriate developmental strategies that will enhance efficient use of resource utilization and sustainability. 4.2 Create and implement comprehensive and strategic land-use development plans.
5. Evaluate the influence of the current economic development tract on	5.1 Assess the impacts of different economic activities and natural resource utilization.

ecosystem processes and sustainable resource utilization.	5.2 Propose strategies to manage and sustain ecosystems, societies, and biosphere. 5.3 Implement the strategies that are sustainable and economically sound.
6. Conduct research related to ecosystem and sustainable development in compliance with legislated & ethical research principles.	6.1 Identify and synthesize problems related to ecosystems and sustainable development. 6.2 Implement sound research techniques in formulating hypotheses; objectives; methodologies for research and development programs in resource utilization, ecosystem maintenance and sustainable development. 6.3 Gather and interpret reliable data using appropriate scientific tools. 6.4 Formulate up to date and practical recommendations based on research results. 6.5 Prepare and package comprehensive report.
7. Conduct audit on waste management, pollution status, and natural resource degradation	8.1 Conduct base-line analysis of the status of the environment. 8.2 Quantify the factors influencing the current environmental scenario. 8.3 Propose mitigation measures to alleviate current and future environmental problems. 8.4 Implement localized sustainable mitigation strategies.

9 Integrate the latest science into real-world decision-making and public policy for the realization of sustainable development	9.1 Apply the economics of pollution and management, and its implication to environmental policy and regulation. 9.2 Assess the environmental cost and benefits of economic development. 9.3 Utilize the theoretical and empirical methods in estimating of cost associated with compliance of environmental rules and provision and its associated environmental benefits.

SECTION C	**QUALIFICATION STRUCTURE**				
COMPONENT	**TITLE**	**Credits Per Relevant NCQF Level**			**Total Credits**
		Level [7]	**Level [8]**	**Level [9]**	
FUNDAMENTAL COMPONENT Subjects/ Courses/ Modules/Units	Computational Statistics and Research Methods for Ecosystem Science		**12**		**12**

CORE COMPONENT Subjects/Courses/ Modules/Units	The Climate System: Analysis and Prediction		**12**		**12**
	Ecosystem and Watershed		**12**		**12**
	Pedology and Land Evaluation		**12**		**12**
	Environmental Governance and Sustainable Development		**12**		**12**
	Terrestrial Ecosystem Ecology		**12**		**12**
	Research 1		**18**		**12**
	Research 2		**18**		**12**
STRANDS/ SPECIALIZATION	Subjects/ Courses/ Modules/Units	**Credits Per Relevant NCQF Level**			**Total Credits**
		Level [7]	**Level [8]**	**Level [9]**	
1.	**N/A**				

2.					
Electives	**List of Elective Modules (Choose 2)**				
	Satellite Meteorology		**12**		**12**
	Atmospheric Thermodynamics		**12**		**12**
	Soil Biogeochemistry		**12**		**12**
	Palaeoenvironments		**12**		**12**
	Land Degradation and Pollution Control		**12**		**12**
	Waste Management and Circular Economy		**12**		**12**
	Sustainable Watershed Management		**12**		**12**
	Hydrological Modelling		**12**		**12**
	Environmental Change: Society and human dimensions		**12**		**12**

	GIS for Environmental Applications		**12**		**12**
	Environmental Remote Sensing		**12**		**12**
	Water Quality		**12**		**12**
	Ecosystem Modelling		**12**		**12**
	Economic of Resource Utilisation and Management		**12**		**12**

SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL	
TOTAL CREDITS PER NCQF LEVEL	
NCQF Level	**Credit Value**
8	**132**
TOTAL CREDITS	

Rules of Combination:

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

Rules of combination:

Fundamental Modules: Level 8 = 12 Credits

Core Modules Level 8 = 96 Credits

Electives (2) Level 8 =24 Credits

Total **Level 8 = 132 Credits**

ASSESSMENT ARRANGEMENTS

Formative assessment

Formative assessment or continuous assessment (CA) contributing towards the award of credits should be based on course outcomes. This can include tests, assignments, and projects as well as simulated and real work settings. The contribution of formative assessment to the final grade shall be **40%.**

Summative assessment

Candidates may undergo assessment including written and practical and simulated projects. The final examination for each course contributes **60%** of the final mark for that course.

MODERATION ARRANGEMENTS

In addition, there will be internal and external moderation for the qualification. Assessors and moderators must be BQA registered and accredited. Both internal and external moderation will be done in-line with the moderation policy of the Institution.

RECOGNITION OF PRIOR LEARNING

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 relevant national, regional, or international professional bodies.

CREDIT ACCUMULATION AND TRANSFER

CAT shall be applicable to gain credits as per ETP CAT policy which is aligned with BQA/ National policy.

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

Horizontal Articulation

Post-Graduate Diploma (NCQF Level 8)

- Post-Graduate Diploma Environmental Planning and Sustainable Development
- Post-Graduate Diploma Land use planning
- Post-Graduate Diploma Ecohydrology
- Post-Graduate Diploma Integrated Water-resources Management
- Post-Graduate Diploma Climate Change and Mitigation
- Post-Graduate Diploma GIS and remote sensing of the environment
- Post-Graduate Diploma Integrated Waste Management

Post-Graduate Certificate (NCQF Level 8)

- Post-Graduate Certificate GIS and remote sensing application
- Post-Graduate Certificate EIA
- Post-Graduate Certificate Environmental Compliance and Audit

Vertical articulation

Master of Science (NCQF level 9) in

- Master of Science in Environmental Science
- Master of Science in Earth Sciences
- Master of Science in Resource Utilization and Management
- Master of Science in Ecosystem Science
- Master of Science in Land Use Planning and Development
- Master of Science in Atmospheric Science
- Master of Science in Hydrology and Water Resource Management
- Master of Science in Ecosystem Science and Sustainability

Employment pathway

Graduates will be able to pursue careers in various sectors such, agriculture, as water resources, mining industry, energy, commerce, meteorology, health as well as in relevant government departments. Specific career paths include:

- Environmental Consultants
- Resource Valuation and Development Experts
- Environmental Impact Assessment (EIA) practitioners
- Water Resource Planners
- Geo-Environmental Scientists and Researchers
- Specialist Environmental Advisors
- Academics
- Technicians and Research Associates
- Natural resource specialist

QUALIFICATION AWARD AND CERTIFICATION

Qualification Award. To obtain the Bachelor of Science Honours (Ecosystem Science and Sustainability) the student must obtain a minimum of 120 credits and satisfy all the rules of combination as indicated above.

Certification - Candidates meeting prescribed requirements will be awarded a certificate.

SUMMARY OF REGIONAL AND INTERNATIONAL COMPARABILITY

Based on the bench marking for the BSc Ecosystem Science and Sustainability, there was no university locally and regionally that was found offering the degree. The qualifications bench-marked in the application are those offered by the Colorado State University in the USA and a related degree program on Bachelor of Science degree in Wildlife, Sustainability, & Ecosystem Sciences, Tarleton State University, USA. Although the qualifications examined generally follow similar structures and standards, there are differences, though not significant, in that the modules are not offered at identical levels of the degree, module credits are not the same from different universities and the duration of

the qualifications does not match. The proposed qualification has, therefore, generally, compares well with all the qualifications studied since the exit outcomes cover similar scope and depth and are aligned to exit-level descriptors typical of this level and type of qualification as well as competencies required for registration and accreditation with professional bodies such as the Colorado Commission on Higher Education (CCHE) and the Southern Association of Colleges and Schools Commission on Colleges (SACSCOC).

The degree, Bachelor of Science Honours in Ecosystem Science and Sustainability will focus on the study of ecosystem and sustainability of resource use particularly applicable to Botswana and other African countries. The degree program will produce professionals that are capable integrate the latest science into real-world decision-making and public policy, with the ultimate goal of managing our planet's natural resources – the air, water, land, and biological diversity upon which all life depends – sustainably into the future. They will be equipped to analyze and process complex information on the ecosystem interactions the effect of human societies on ecosystem processes and their long-term sustainability and solving the ever-growing environmental challenges.

The strengths of the proposed program are to produce professionals that could make a difference in the real world ready to address challenges of global change, environmental and resource conservation, and sustainability. This is possible because of the interdisciplinary science approach that will allow graduates to have specialized knowledge, skills, and competencies.

Graduates of the developed qualification are employable as environmental consultant, wildlife biologist, ecosystem scientist, specialist environmental advisor, water resource planners etc just like graduates of qualifications it was benchmarked from. Graduates of the developed qualification can also articulate into MSc in Environmental Science, MSc in Earth Science, MSc in Ecosystem, and others.

REVIEW PERIOD
River period shall be 5 years.

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**	