SECTION A:	*QUALIFICATION DETAILS*																		
QUALIFICATION DEVELOPER (S)	University of Botswana																		
TITLE	Bachelor of Science in Geology														*NCQF LEVEL*		7		
FIELD	Natural, Mathematical, and Life Sciences			*SUB-FIELD*		Geology									*CREDIT VALUE*		520		
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:

Botswana is endowed with mineral resources that require development, to aid in economic development and impove the quality of life. The mining sector contributes a significant share to the national GDP (>50%; NDP11, 2017-2023), which is critical. One objective of Vision 2036 is that education, training, and skills development systems must embrace science, innovation, and new technologies. Botswana is relatively unexplored and needs infusion of new scientific knowledge and technical skills to conduct primary geological investigations, revising

existing old geological maps, and geological reports, which are the primary mineral exploration documents. This is recognized by the Human Resource Development Council (HRDC), which placed geoscientists at the top within the Mining, Minerals, Energy and Water Sector as the priority skills needed in the economy (HRDC, Priority and Employment trends for 2016-2018).

Geology is a critical discipline for sustaining the mining industry and establishing new mines, thus creating employment opportunities in other professions. This geology qualification provides an opportunity to promote a curriculum that emphasizes scientific and critical thinking, inquiry, innovation, science for social development and developing generic skills for observation, problem-solving, effective communication, and analysis. The curriculum combines a sound mix of skills that emphasize the importance of the applied competencies within a scientific context (Vision, 2036).

This BSc qualification provides clear statements of the qualification outcomes to employers and makes explicit the competencies that can be expected of the graduates. The programmes of learning which make this qualification have specified exit level outcomes which can be directly related to the aspirations of learners seeking careers in science and technology and to the range of competencies required in different employment sectors.

PURPOSE:

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

1. Apply a coherent body of knowledge, skills, and competencies to understand the underlying concepts and principles of earth sciences, with the ability to critically interrogate conventional formulation of problems, hypotheses, methods, and solutions independently in a creative way.

2. Design and safely carry out geological surveys or laboratory experiments and be able to communicate the results ethically and professionally.

3. Demonstrate a high level of cognitive and generic skills, including problem-solving, written, and oral communication.

ENTRY REQUIREMENTS (including access and inclusion)
(i) Certificate IV, NCQF Level 4 (GE/ TVET) or equivalent. (ii) RPL and CAT shall apply in the admission of learners according to ETP policies aligned with national/ BQA policies.

SECTION B	*QUALIFICATION SPECIFICATION*
GRADUATE PROFILE (LEARNING OUTCOMES)	*ASSESSMENT CRITERIA*
BSc graduates in the discipline should: 1. Demonstrate specialised knowledge and understanding of fundamental and contemporary theories, principles, and geology/earth science concepts.	1.1 Demonstrate competency and knowledge of principles and concepts underpinning geology in the form of correct explanations of the concepts and principles. 1.2 Apply the principles and concepts correctly in conducting geological investigations. 1.3 Identify the range and limits of applicability of the core concepts and principles 1.4 Demonstrate logical thinking, identify flawed and erroneous reasoning, and implement corrective measures. 1.5 Apply the underlying concepts and principles outside of the context they were first studied, including where appropriate, in an employment context or work situation.

2. Acknowledge that geoscientific knowledge and understanding are changeable.	2.1 Collect and record data accurately, truthfully, and appropriately and correctly apply correct scientific vocabulary, data gathering methods, analyses, and reporting. 2.2 Demonstrate current knowledge in the discipline by keeping abreast of the latest literature, including studies done in the region. 2.3 Engage and comment upon aspects of current research in their discipline. 2.4 Appreciative of the uncertainty, ambiguity, and limits of knowledge and how it influences analyses and interpretations.
3 Access, evaluate and synthesise geoscientific information and literature, generate geoscientific information and show key scientific reasoning skills to solve geoscientific problems.	3.1 Apply methods and techniques to review, consolidate, extend, and apply their knowledge and understanding to initiate and carry out projects. 3.2 Critically evaluate arguments and assumptions (incomplete) to judge and frame appropriate questions to achieve a solution or identify a range of solutions. 3.3 Communicate information ideas, problems solutions to both specialist and non-specialist audiences.

	3.4 Manage own learning, making use of scholarly reviews and primary sources, e.g. Journal articles or original material appropriate to the discipline. 3.5 Identify, assess and source datasets appropriate to user requirements and determine their quality and fit for purpose in geoscience survey projects.
4 Communicate advanced scientific knowledge in writing, orally and using visual, symbolic and/or other forms of representation in managing geology projects and geoscientific data to both specialist and non-specialists.	4.1 Apply scientific language correctly to produce clear and understandable written reports that follow appropriate scientific conventions and standards. 4.2 Apply appropriate referencing conventions, avoid plagiarism, and respect intellectual property. 4.3 Integrate knowledge from various disciplines or models of enquiry in solving geoscientific problems for societal benefit. 4.4 Produce and present professional reports and communicate them clearly to a broad spectrum of audiences using correct, clear, and unambiguous language.
5 Work effectively as a member of a team or group in scientific projects or geological investigations.	5.1 Design, Plan and execute detailed field geoscience surveys using correct procedures and methods.

	5.2 Conduct reconnaissance surveys based on GIS, remote sensing, google earth images, and geophysical data sources. 5.3 Contribute effectively to project teams and offer professional advice in geoscience projects. 5.4 Apply organisational skills to manage work teams and provide leadership.
6 Apply scientific knowledge, skill, and ways of thinking to societal problems, considering professional, ethical and cultural considerations.	6.1 Apply appropriate environmental awareness in project management. 6.2 Show understanding and quick uptake of local community issues (in survey area) and be ready to offer mediation, negotiations, and conflict resolution. 6.3 Design, Plan and put in place remedial actions to safeguard the environment against pollution and degradation during drilling in mineral exploration surveys.
7 Possess management capacities and transferrable skills that are necessary for employment and assume initiative and personal responsibility for others and the team.	7.1 Manage, show initiative and personal responsibility to the discipline (geosciences), to the team and professional life. 7.2 Demonstrate understanding in decision-making in complex and unpredictable contexts as a professional geoscientist.

	7.3 Develop an adaptable and flexible approach to management, study, and professional growth in work, in the team and in society

SECTION C		QUALIFICATION STRUCTURE				
COMPONENT	TITLE	Credits Per Relevant NCQF Level				Total (Per Subject/ Course/ Module/ Units)
		Level [5]	Level [6]	Level [7]	Level [8]	
FUNDAMENTAL COMPONENT Subjects/ Courses/ Modules/Units	Communication and Academic Literacy Skills (Science)	12				12
	Computing Skills Fundamentals I	8				8
	Academic and Professional Communication (Science)		12			12
	Computing Skills Fundamentals II		8			8
CORE	General Chemistry I	16				16

COMPONENT	Introduction to Geology I	12				12

Subjects/Courses/ Modules/Units	Introduction to Geology II		12			12
	Introductory Mathematics I	12				12
	Geometrical Optics and Mechanics, Vibrations and Waves	16				16
	General Chemistry II		16			16
	Introductory Mathematics II		12			12
	Electricity, Magnetism and Elements of Modern Physics	12				12
	Structural Geology		12			12
	Hydrogeology I		12			12
	Basic Mineralogy		12			12
	Introduction to Sedimentology and Stratigraphy		12			12
	Basic Statistics		12			12

	Engineering Mathematics I		12			12
	Optical Mineralogy		12			12
	Remote Sensing Applied to Geology		12			12
	Petrography		12			12
	Engineering Mathematics II			12		12
	Field Mapping			12		12
	Igneous Petrology			12		12
	Sedimentary Petrology			12		12
	Ore Geology			12		12
	Exploration Geophysics I			12		12
	Computer Application in Geosciences			12		12
	Metamorphic Petrology			12		12

	Exploration Geophysics II			12		12
	Introduction to Geochemistry			12		12
	Advanced Structural Geology			12		12
	Hydrogeology II			12		12
	Economic Geology			12		12
	Environmental Geology			12		12
	Research Project I for Single Major				16	16
	Geotectonics			8		8
	Regional Geology of Southern Africa			8		8
	Engineering Geology			12		12
	Mineral Exploration			12		12
	Research Project II for Single Major				16	16

ELECTIVE/ OPTIONAL COMPONENT Subjects/Courses/ Modules/Units	Research Methods in Geosciences			8		8

SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL	
TOTAL CREDITS PER NCQF LEVEL	
NCQF Level	Credit Value
5	104
6	168
7	216
8	32
TOTAL CREDITS	520

Rules of Combination:

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

To attain the Bachelor of Science (Geology) qualification, learners must fulfil the requisite learning outcomes in core, fundamentals, options/ electives, and general education courses as indicated in the section above and summarised below.

Single Major Geology:

- Core 456
- Fundamentals 56
- Options/Electives 8

Total 520

ASSESSMENT ARRANGEMENTS

- The assessment will include a formative evaluation (tests, quizzes, and practical and written assignments) and a summative evaluation in the form of a final examination.
- The distribution between formative and summative assessment is 1:1.
- The assessors will be registered and accredited by the Botswana Qualification Authority (BQA).

MODERATION ARRANGEMENTS

- There will be a provision for internal moderation arrangements governed by the University of Botswana policies of Departmental Quality Assurance Committees.
- The moderators will be registered and accredited by the Botswana Qualification Authority (BQA).

RECOGNITION OF PRIOR LEARNING

Recognition of Prior Learning (RPL):

Formal prior learning: Prior accredited learning of a learner at levels below in relevant domains which constitute credit-bearing units or modules should be recognised if evidence can be produced that shows that the Learner has achieved, at a satisfactory level, the outcomes and associated assessment criteria specified for the Bachelor of Science in geology and, if appropriate, allow the recognition of prior learning for the achievement of the qualification in part or in full based on prevailing policies on recognition of RPL.

CREDIT ACCUMULATION AND TRANSFER

CAT will be applicable for the award of credits to contribute to the award of the qualification.

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

The knowledge and skills acquired studying geology serve as an excellent foundation for various careers, including opportunities for further studies. Pathways to employment include mining, manufacturing, mineral prospecting, groundwater, engineering geology and geotechnical engineering, space agencies, academia, research, and the

army. A graduate with a BSc degree in geology can work as a Geologist, Hydrogeologist, Geotechnical Engineer, Engineering Geologist, Exploration Geologist, Mining Geologist, etc.

Horizontal:

- Bachelor of Science in Applied Geophysics
- Bachelor of Science in Geo-Archaeology
- BSc Hydrology
- Bachelor of Science in Engineering

Geology Vertical:

- MSc Master of Science in Geology,
- Master of Science in Hydrogeology
- Master of Science in Geophysics
- Master of Science in Engineering Geology

A BSc geology degree equips the learner with knowledge and skill to practice and consult in various fields professionally in the following areas:

1. Mineral Exploration and resource evaluation and development
2. Water resources evaluation and development
3. Mapping/Survey geologist
4. Geotechnical Engineering and Environmental Investigations,
5. Geospatial and Geographic Information Systems
6. Academia, Research and Development

Some of the professions are as follows:

• Archaeologist

• Environmental Analyst

• Environmental Policy Officer

- Environmental Scientist
- Environmental Technician
- Geologist
- Geophysicist
- Geoscience Technician
- Geoscientist
- Hydrogeologist
- Hydrologist
- Museum Curator
- Natural Resources Manager
- Natural Resources Planner
- Palaeontologist
- Remote Sensing Technician
- Research Assistant
- Seismologist

QUALIFICATION AWARD AND CERTIFICATION

Qualification Award

If the Learner meets the minimum credits requirements of 480 credits made up of 360 core credits and 120 credits of Electives and Optional courses, as governed by the university's policies, he/she will be issued with a Bachelor of Science in Geology degree.

Certification

There will be the issuance of a certificate and an official transcript at the award.

REGIONAL AND INTERNATIONAL COMPARABILITY

Summary of Similarities and Differences Observed

The geology qualification is a 4-year Professional Degree which was compared with the Bachelor of Science in Geology in three universities in South Africa and one in the UK as follows.
Similarities and differences have been compared below with respect to entry-level, exit level, total credits, main exit levels, courses offered and assessment strategies.

Similarities:

(i) Compatibility was done with three universities in South Africa, which offer BSc Degrees in Geology in over three years of full-time study. Although the B.Sc. Degree at UB is a four-year programme; its first year concentrates more on foundation courses as entry-level is Ordinary Level or equivalent. However, with the exception of its first year, the structure of the UB B.Sc programme is similar to the benchmarked universities. The UB second-, third- and fourth-year courses are comparable with the first-, second-and fourth-year courses offered at the benchmarked universities, respectively.

(ii) The B.Sc. degrees offered at UB and South African universities are at NQF Level 7. However, the Bachelor's degree at Oxford University has no such system.

(iii) Main exit outcomes are more or less similar.

(iv) As is visible from the table below, assessments are formative for in-class tests and other assignments and summative for final examinations.

(v) Employments pathways are almost similar.

Differences:

The minimum number of credits for a B.Sc. degree in the South African universities benchmarked vary from 420 to 440. However, our UB BSc (Geology) is worth 520 credits. This is because UB's first-year courses are mostly foundation courses, which are prerequisites for upper-level courses. The SA universities benchmarked offer Honors degrees with an additional one-year with around 120 Credits.

(a) University of Pretoria's BSc Geology is worth 440 Credits, NQF Level 7

(b) University of Capetown Geology is worth 420 Credits, NQF Level 7

(c) University of Johannesburg BSc Geology is worth 440 credits at NQF Level 7.

The Bachelor's Degree at the University of Oxford is a three-year degree programme. The fourth-year is mainly research and is equivalent to M.Sc. The major difference between the Oxford and UB geology programmes is that the former concentrates more on the solid earth.
The BSc Degree is– 520 Credits, Level 7. This would be equivalent to the BSc honours degree at universities in South Africa and in countries. The proposed qualification generally compares well with the three programmes or qualifications studied in terms of content scope and learning hours to be achieved before assessment. What sets this qualification apart from the ones studied is that it is anchored on hands-on experiential learning with two field winter courses based on the competency qualifications framework.
Review Period
The qualification will be reviewed every 5 years.