SECTION A:	QUALIFICATION DETAILS																
QUALIFICATION DEVELOPER (S)	Botswana International University of Science and Technology/Faculty of Science/ Department of Earth and Environmental Sciences																
TITLE	Master of Science in Geological Sciences													NCQF LEVEL	9		
STRANDS (where applicable)	1. Petrology-Geochemistry-and-Ore Geology 2.Hydrogeology-Geophysics-Environmental Geoscience 3.Sedimentology-Stratigraphy-Petroleum Geology																
FIELD	Natural, Mathematical and Life Sciences		SUB-FIELD	Earth Sciences										CREDIT VALUE	248		
New Qualification		✓	*Legacy 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's mineral resource potential, especially large coal reserves and base metals (e.g., copper, nickel, silver, cobalt, and zinc) continues to be promising[1] and therefore prompts our local universities to equip learners with knowledge and skills that can match the requirements of potential employers in the industry and facilitate economic growth of the country. Although minerals remain an important sector of the economy of

Botswana, there is a desire to transform the economy from minerals to knowledge-based and enhance the country's global competitiveness in line with the aspirations of Vision 2036 and the Education and Training Sector Strategy Plan direction. In addition to these existing realities, there is growing demand for geoscientist graduates to fill positions of geologists, hydrogeologists, and geophysicists in the mining and mineral sector as identified in the latest priority skills report of the Human Resource Development Council (2023/2024). This presents an opportunity for universities to develop strategic plans to train a new generation of geoscientists required to discover world-class ore deposits under increasingly challenging, uncertain, and complex environments.

The Master of Science degree in Geological Sciences qualification is designed to empower graduates with advanced theoretical knowledge and a practical foundation in geological sciences that can provide direct results to the economy. The qualification comprises both coursework and research components and is comparable with regional and international qualifications.

PURPOSE: (itemise exit level outcomes)

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

1. Conduct independent investigations and scholarly inquiries in geoscience.
2. Assess information from diverse sources and identify connections between various issues and concepts.
3. Analyze diverse geoscience data sets for economic decision-making.
4. Examine geoscience data sets for hazard identification and problem-solving.
5. Apply a range of sedimentology and stratigraphy techniques and principles to analyze geoscience data sets for mining activities and policy formulation.

MINIMUM ENTRY REQUIREMENTS (including access and inclusion)

- Applicants should have a Bachelor of Science degree in Geology (NCQF level 7) or equivalent from a recognised university.
- Applicants with relevant research and work experience will be considered through RPL policy.

SECTION B	***QUALIFICATION SPECIFICATION***
GRADUATE PROFILE (LEARNING OUTCOMES)	***ASSESSMENT CRITERIA***
ELO-1 Develop advanced research skills and methodologies necessary for conducting independent investigations and scholarly inquiries in geoscience.	1.1 Conduct independent research projects that adhere to scientific standards and ethical principles. 1.2 Design working strategies to mitigate and rehabilitate mine-related environmental problems. 1.3 Demonstrate the ability to compile and summarize essential literature information for a piece of research. 1.4 Develop a research strategy and a sound written proposal for an original research project. 1.5 Present and disseminate research results to specialist and non-specialist audiences.
ELO-2 Analyze and evaluate different sources of information and use the new information to structure and formulate professional arguments.	2.1 Demonstrate extensive knowledge in evaluating mineral deposits. 2.2 Evaluate the different medium and long-term impacts of mining activities on the environment and ecosystem health. 2.3 Examine information obtained from the field and combine it with other related data to answer geological questions. 2.4 Evaluate analytical data based on a profound knowledge of the method used and all potential sources of error and express the results in meaningful diagrams.
ELO 3 Demonstrate critical thinking skills in assessing information from diverse sources and identify connection between various issues and concepts.	3.1. Identify opportunities and potential risks associated with geological and environmental projects. 3.2. Apply new ideas and methods to solve geological or environmental problem. 3.3. Identify strengths and limitations of different models of geological processes.

	3.4. Demonstrate an ability to prepare georeferenced geologic maps, which can be readily integrated with other data related to geoscientific research.
Petrology-geochemistry and ore geology strand. **ELO-4** Demonstrate a deep understanding of theoretical principles, concepts, and methodologies in petrology-geochemistry-and-ore geology settings. **ELO-5** Demonstrate a deep understanding of the physical and chemical properties of rocks in relation to their formation, minerals deposits and potential hazards. **ELO-6** Apply a range of geochemical techniques and principles to locate geological deposits for economic value and mining activities.	4.1 Apply best practices and methodologies to locate geological anomalies of mineral deposits. 4.2 Interpret field observations to identify potential economic mineral deposits. 4.3 Identify geological settings favourable to raw material accumulation. 5.1 Identify the characteristics of ore-forming processes mechanisms. 5.2 Assess geological hazards associated with different rock formations. 5.3 Assess the impacts environmental and social factors in mineral exploration and mining activities. 6.1. Apply established geochemical techniques during mineral exploration projects. 6.2. Analyze rock samples using various laboratory techniques. 6.3. Interpret geochemical data to assess the potential economic value of geological deposits.
Hydrogeology-Geophysics-Environmental Geoscience strand. **EIO-7** Demonstrate a deep understanding of theoretical principles, concepts, and methodologies in hydrogeology-geophysics and environmental geoscience case studies.	7.1 Apply theoretical concepts such as groundwater flow, hydrological processes in water resources management. 7.2 Apply geophysical and remote sensing data to solve problems in the geosciences. 7.3 Apply various concepts and principles of sustainable resource utilization to efficient mining processes and effective waste management.

ELO-8 Apply a range of hydrogeological techniques and principles to analyze hydrogeological data sets for various uses. **ELO-9** Apply a range of geophysical techniques and principles to locate mineral deposits and solve environmental geoscience problems.	8.1 Apply appropriate geological techniques to identify major groundwater aquifers. 8.2 Apply research principles of hydrogeology and methods to quantify available underground water resources. 8.3 Analyze and interpret hydrogeological data sets effectively. 9.1 Interpret geophysical data sets to identify prospective exploration targets and prioritize exploration activities. 9.2 Apply geophysical methods for mineral and groundwater exploration. 9.3 Identify potential environmental and safety concerns using geophysical techniques.
Sedimentology-Stratigraphy-Petroleum Geology strand **ELO-10** Demonstrate a deep understanding of theoretical principles, concepts, and methodologies in sedimentology-stratigraphy and petroleum geology systems. **ELO-11** Evaluate geological systems and identify potential areas for exploration and extraction petroleum sources.	10 Demonstrating a deep understanding of the interplay between sedimentological processes and stratigraphic architecture in oil and gas formation. 10.1 Interpret geological data sets to identify prospective exploration targets and prioritize exploration activities. 10.2 Assess geological hazards and opportunities associated with petroleum systems or basin exploration projects. 11 Apply geophysical and geochemical methods to locate and characterised petroleum resources. 11.1 Identify the characteristics of petroleum-forming processes. 11.2 Interpret field observations to identify potential petroleum resources.

SECTION C	***QUALIFICATION STRUCTURE***				
COMPONENT	***TITLE***	***Credits Per Relevant NCQF Level***			***Total Credits***
		Level [8]	***Level [9]***	***Level [10]***	
FUNDAMENTAL COMPONENT *Subjects/ Courses/ Modules/Units*	Not applicable				
CORE COMPONENT *Subjects/Courses/ Modules/Units*	Advanced Field Methods in Geoscience		**9**		**12**
	Research Methods in Geoscience		**9**		**12**
	Dissertation of Master of Science degree in Geological Sciences		**9**		**120**
STRANDS/ SPECIALIZATION	*Subjects/ Courses/ Modules/Units*	***Credits Per Relevant NCQF Level***			***Total Credits***
		Level [8]	***Level [9]***	***Level [10]***	
1.	Advanced Ore Geology		**9**		**12**
	Advanced Mineral Exploration		**9**		**12**

	Analytical Geochemistry and data processing		**9**		**12**
	Mining and mineral processes and environmental problems		**9**		**12**
	Petrological, Geochemical and metallogenesis process.				**12**
2.	Applied Hydrogeology		**9**		**12**
	Hydro geochemistry		**9**		**12**
	Stable Isotope Hydrology		**9**		**12**
	Mining Geophysics		**9**		**12**
	Geophysical Data Processing and Interpretation		**9**		**12**
3.	Applied Sedimentology		**9**		**12**
	Basin Analysis		**9**		**12**
	Paleobiology and Paleoenvironments		**9**		**12**
	Petroleum systems		**9**		**12**
	Coal Geology		**9**		**12**
Electives	Hydro geophysics		**9**		**12**

	Skills for Employment and Entrepreneurship Development		**9**		**8**
	Note: One 8 credit module must be selected from department of Business Management and Entrepreneurship **together with** up to three 12 modules from a range of modules offered under different specialization.				

SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL	
TOTAL CREDITS PER NCQF LEVEL	
NCQF Level	***Credit Value***
9	**248**
TOTAL CREDITS	**248**

Rules of Combination:

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

This qualification consists of taught and research components.

Two core Modules =**24** credits

A combination of **five** 12 credit modules, t**hree** 12 credit optional modules and **one** 8 credit elective = **104** credits

Dissertation of Master of Science degree in Geological Sciences = 1**20** credits

Total credits=**248** credits

Two **(2)** core modules along with five **(5)** modules from an area of specialisation and four (**4**) electives, are normally studied during the first year of the program. The second year is fulfilled by a Dissertation of Master of Science degree in Geological Sciences.

ASSESSMENT ARRANGEMENTS

Assessment

Assessment activities, types (formative vs summative), methods, resources, and instructions are designed to cover the subject knowledge and skills developed throughout the qualification.

Assessment strategy

The assessment strategies for this qualification will consist of formative assessment and summative assessment. Each module will include the type of assessment and their weighting.

Formative assessment

Formative assessment or continuous assessment (C.A.) contributing towards the award of credits should be based on module outcomes. They include tests, case studies, problem-solving exercises, and field mapping exercises. The formative assessment constitutes 60% of the final module grade. A student who fails to score at least 50% in the formative assessment will not be admitted for the final examination and will be recorded as a fail.

Summative assessment

Summative assessment includes written examination, oral presentation, and dissertation. The final examination shall be internally and externally moderated before administered. The summative assessment contributes 40% of the final overall module mark. To pass a module, the student must achieve a minimum of 50% overall. A student who scores between 40 and 49% shall be eligible for one retake (i.e. supplementary examination) to be administered within 12 months from the first assessment.

MODERATION ARRANGEMENTS

Internal moderation

Internal moderation is designed to ensure the appropriateness of the assessment to learning outcomes and instructions/ questions are clearly stated. Examination scripts should be moderated internally all necessary documents including qualification documents, alignment matrices, assessment instruments and assessment criteria/rubrics should be available for this process.

External moderation

External moderation ensures that the assessment of students' work is conducted fairly and is comparable with other institutions offering a similar qualification. Only dissertations shall be subjected to external moderation or review following assessment and moderation policy and other applicable.

Criteria for selecting moderators.

Moderators should have expertise and experience in the specific field or discipline related to the Master of Science qualification. They should be accredited and registered by a body or individual acknowledged by the BQA.

RECOGNITION OF PRIOR LEARNING

Where the applicant demonstrated to have acquired enough competency in a module outside the formal learning programme a provision will be made in recognition of this. Awarding credits through RPL should be carried out by an appointed RPL assessor in conjunction with the head of the relevant academic department and RPL candidate. The RPL policy of the ETP which is aligned with the national RPL policy will be followed.

CREDIT ACCUMULATION AND TRANSFER

Credit Accumulation and Transfer (CAT) will be considered according to BIUST CAT policy.

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

Learning Pathways

Horizontal Progression:

Learners who progress through the program of study to completion may be awarded a degree in.

- Master of Science degree in Geology
- Master of Science degree in Geochemistry
- Master of Science degree in Hydrogeology
- Master of Science degree in Geophysics
- Master of Science degree in Sedimentology

Vertical Progression:

Learners may progress to doctoral level study of their choice in related areas such as geochemistry, hydrogeology, geophysics, petroleum geoscience etc.

Employment pathways

Based on the area of specialisation, graduates may take up positions as

- graduate geologist,
- junior hydrologist,
- Environmental Consultant,

- Geochemist,
- Geologist, etc.

QUALIFICATION AWARD AND CERTIFICATION

Minimum standards of achievement for the award of the qualification

For a candidate to be awarded this qualification they must have acquired a minimum of 248 credits as per the total credits indicated for this qualification.

Candidates meeting the prescribed requirements will be awarded the qualification of Master of Science in Geological Sciences in accordance with standards prescribed for the award of the qualification and applicable policies.

Certification

A certificate for the award of the degree of Master of Science in Geological Sciences will be given upon successful completion of the qualification.

SUMMARY OF REGIONAL AND INTERNATIONAL COMPARABILITY

Regionally it was compared with the qualification offered by the University of Witwatersrand (Wits) in South Africa. At the international level, it was compared with the one offered by the University of British Columbia in Canada and University College London in the UK.

Summary of Similarities Observed

Overall, there are some similarities in terms of Title of qualification, National Qualifications Framework Level (NQF), Credit Value and subjects covered.

1. The title of the developed qualification is like all the benchmarked qualifications.
2. The credit value of 248 and NQF Level 09 have a close similarity to credit value and duration with qualification developed at the University of Witwatersrand.
3. Subjects commonly covered in the benchmarked qualifications as part of this developed qualification include petrology, geochemistry, geophysics and hydrogeology. These subjects require both fieldwork and laboratory analysis for data collection and interpretation.

Summary of Differences Observed

What separates these qualifications are research fields and specific areas of specialization. Master of Science in Geological Sciences at University College London is flexible and has a wide range of specialization. The university has an option to enrol in the qualification full-time over one year or part-time over two years A minimum of 180 credits is required to be awarded a Master of Science degree in

Geoscience at University College. Master of Science in Geological Sciences at the University of British Columbia combines field-based studies, experimental research laboratory analyses and a minimum of 12 credits thesis. The qualification offered by the University of Witwatersrand has an option of Palaeontology as a specialization.

The developed qualification compares fairly with those offered regionally and internationally, thereby enhancing recognition of the value of this qualification and promoting the mobility of our graduates between educational progression and employment pathways. Graduates can choose to pursue a doctoral degree in Geological Sciences or related fields or enter a wide range of career opportunities at mining exploration companies, government geological surveys, universities and environmental consulting industries and work as Academic Researcher or Teachers, Environmental Consultant, Geochemist, Geologist.

REVIEW PERIOD

Reviewed every after five **(5)** years.