



NATIONAL OCCUPATIONAL STANDARD FOR HYDROLOGIST

APPROVING AUTHORITY

This National Occupational Standard has been prepared and published under the authority of the Zambia Qualifications Authority Board on [insert date when NOS was approved by the ZAQA Board].

ZAMBIA QUALIFICATIONS AUTHORITY

The Zambia Qualifications Authority Act No. 8 of 2024 was enacted by the Government of the Republic of Zambia to ***“continue the existence of the Zambia Qualifications Authority and redefine its functions; provide for the development and implementation of a national qualifications framework; provide for registration of qualifications on the national qualifications framework; provide for verification and evaluation of qualifications; constitute the board of the Zambia Qualifications Authority and redefine its functions; and provide for matters connected with, or incidental to, the foregoing”***. Among other functions, ZAQA is responsible for **determining national standards for any occupation**, through various sector specific National Occupational Standards Development Teams (NOSDTs).

REVISION OF NATIONAL OCCUPATIONAL STANDARDS

National Occupational Standards shall be revised every after **5 years**, or whenever necessary, by the issue of either amendments or of revised editions. It is important that users of National Occupational Standards (NOS) should ascertain that they are in possession of the latest amendments or editions.

NOS DEVELOPMENT TEAM RESPONSIBLE

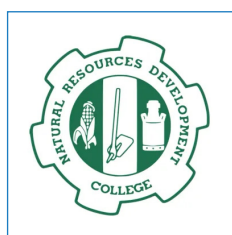
This National Occupational Standard was prepared by the Water National Occupational Standards Development Team, upon which the following organisations were represented:



Engineering Institution
of Zambia



Ministry of Water
development and
sanitation



Natural Resources
Development College



Zambia Environmental
Management Agency



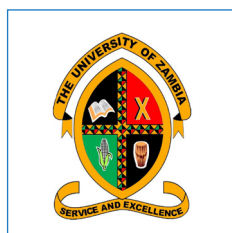
Ministry of Green
Economy



Quanta Horizon
Limited | Water
resource consulting



Surveyors Institute of
Zambia



University of Zambia



Water Resources
Management Authority
(WARMA)



Zambia Qualifications
Authority – Secretariat

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FOREWORD

The Zambia Qualifications Authority (ZAQA) is a statutory body under the Ministry of Higher Education established by ZAQA Act No. 8 of 2024 to ***“provide for the development and implementation of a national qualifications framework; provide measures to ensure that standards and registered qualifications are internationally comparable; and provide for matters connected with, or incidental to the foregoing”***.

Among other functions, ZAQA is responsible for *“determining national standards for any occupation”*, through various sector specific National Occupational Standards Development Teams (NOSDTs) of experts composed of representation from appropriate authorities, government departments, industry, academia, regulators, consumer associations and non-governmental organisations, etc.

This National Occupational Standard (NOS) has been developed by the WATER National Occupational Standards Development Team in accordance with the procedures and guidelines of ZAQA. All users should ensure that they have the latest edition of this publication as National Occupational Standards are revised from time to time.

This NOS shall be used by, among others, industry, employers, quality assurance bodies, awarding and professional bodies and education and training institutions, as a benchmark to identify training needs, develop job profiles/descriptions, develop curricula and learning programmes, in various sectors where the occupation exists. In the WATER sector, demonstration of competence against this NOS may be required in order to run a business or practice a craft or profession.

JUSTIFICATION

Hydrologist is one of the critical professions in the water industry which is common to various sectors. Water is critical resource for human survival, economic activities, and environmental sustainability. The roles of a Hydrologist in the water sector are essential for the sustainable management and development of water resources. Hydrologists brings expert analysis and solutions in the understanding, analysing, designing and managing water systems and hydraulic structures ensuring their effective use while mitigating risks associated with water scarcity, flooding, droughts and environmental degradation. The development of this National Occupational Standard will ensure relevance of the training to latest advancements in industry, resulting in adequately and appropriately skilled Hydrologists.

This National Occupational Standard highlights core knowledge, skills, competences and personal attributes that a Hydrologist must possess to be successful in their jobs.

ACRONYMS AND ABBREVIATIONS

CS	Core Skill
DNOS	Draft National Occupational Standard
GIS	Geographical Information System
GPS	Global Positioning System
Nbs	Nature-based solutions
NOS	National Occupational Standard
NOSDT	National Occupational Standards Development Team
OK	Organisational Knowledge
OSHE	Occupational Safety, Health and Environment
PC	Performance Criteria
PS	Professional Skill
QGIS	Quantum Geographic Information System
RPL	Recognition of Prior Learning
SSPs	Shared Socioeconomic Pathways
SWAT	Soil and Water Assessment Tool
TK	Technical Knowledge
WEAP	Water Evaluation And Planning Tool
WQM	Water Quality Management (WQM)
ZAQA	Zambia Qualifications Authority
ZQF	Zambia Qualifications Framework

GLOSSARY OF TERMS

For the purposes of this NOS, the following terms and definitions shall apply:

Core Skills/Generic Skills:	are a group of skills that are key to learning and working in today's world. These skills are typically needed in any work environment. In the context of the NOS, these include communication related skills that are applicable to most job roles.
Disability:	Physical or mental impairment that substantially limits one or more major life activities.
Function:	is an activity necessary for achieving the key purpose of the sector, occupation, or area of work, which can be carried out by a person or a group of persons. Functions are identified through functional analysis and form the basis of NOS.
Job Title:	defines a unique set of functions that together form a unique employment opportunity in an organisation.
Knowledge and Understanding:	are statements which together specify the technical, generic, professional and organisational specific knowledge that an individual needs in order to perform to the required standard.
National Occupational Standards (NOS):	are statements of the standards of performance individuals must achieve when carrying out functions in the workplace, together with specifications of the underpinning knowledge and understanding. They are precise descriptions of what an individual is expected to be able to do in his/her work role.
National Occupational Standards (NOS) Code:	is a unique reference code that identifies a NOS.
National Occupational Standards Development Team (NOSDT):	means an established group of national stakeholders/experts responsible for the development of National Occupational Standards within a specific economic sector or occupation.
Occupation:	is a set of job roles, which perform similar/related set of functions in an industry.
Organisational Context:	includes the way the organisation is structured and how it operates, including the extent of operative knowledge that managers have in their relevant areas of responsibility.

Performance Criteria:	are statements that together specify the standard of performance required when carrying out a task.
Scope:	is the set of statements specifying the range of variables that an individual may have to deal with in carrying out the function which have a critical impact on the quality of performance required.
Sector:	is a conglomeration of different business operations having similar businesses and interests. It may also be defined as a distinct subset of the economy whose components share similar characteristics and interests.
Sub Sector:	is derived from a further breakdown based on the characteristics and interests of its components.
Technical Knowledge:	is the specific knowledge needed to accomplish specific designated responsibilities.
Unit Title:	gives a clear overall statement about what the incumbent should be able to do.

1.0 OVERVIEW

This is an introductory section providing a brief summary and specific information or commentary about the content of the NOS and the targeted sector and occupation to help the user judge whether it is relevant to them.

NOS Code	DNOS.HD.01
Occupation	Hydrologist
Job Title	Hydrologist
Job Description	A Hydrologist is a specialist in the occurrence, circulation and distribution of the water resources of the earth .
Job Purpose	To conduct hydrological studies; collect, process and interpret data about hydrological and climatic processes as well as predicting the frequency of occurrence and most likely quantities involved in the extreme cases of flood and drought to support the design of hydraulic structures, irrigation water requirements and watershed management.
ZQF Level	7
Sector	Water
Sub sector	• Water Supply and Sanitation • Water Resource Development and Management
Other Economic Sector(s) in which the Occupation is Practiced	Agriculture, Education, Construction, Manufacturing, Hydropower design and management, Mining, Consultancy etc.
Other Similar Jobs that can be Performed in the Occupation	Dam Engineer, Irrigation Engineer, Environmental Engineer, Water Resources Specialist, Project Engineer, Research Engineer, Water Supply Engineer, River Catchment Manager, Flood Engineer, Lecturer, Consultant etc.

Minimum Educational Job Entry Qualification(s)	BSc/ BEng. in Hydrology/ Natural Resources Management/Earth Science/Environmental Science/ Water Engineering/Civil/Environmental Engineering or equivalent.
Practicing License Requirements (if any)	Membership with the Engineering Institution of Zambia.
Training/RPL (Suggested)	1. Hydrological Modelling and Simulations (SWAT, WEAP, HEC-RAS, HEC-HMS, etc.) 2. GIS and Remote Sensing (QGIS, ArcGIS, Earth Map etc.) 3. Data Science with Python & MATLAB 4. Project Management 5. First Aid Training 6. National Occupational Safety and Health 7. Leadership and Ethics 8. Environmental Standards and Legislation
Minimum Job Entry Age	23 years
Prior Experience (Recommended)	Should have at least six months traineeship working with a qualified registered Hydrologist or related.
Performance Criteria	As described in the Units under Section 4

2.0 SCOPE

This NOS specifies the fundamental knowledge and understanding, skills and competences, and personal attributes that Hydrologists must possess to be successful in their jobs.

3.0 PERSONAL ATTRIBUTES (VALUES, ETHICS AND ATTITUDES)

This job requires ability to plan and prioritise; ability to work in a team; physique to sustain strenuous conditions; attention to detail; high technological exposure to handle various GIS, remote sensing and hydrological modelling software, equipment, tools, and materials; sensitivity towards safety for self, others, and work environment; be well versed with tasks, functions, standards, specifications, codes of practice, and safety norms applicable to operations; be accountable and results oriented, excellent technical report writing skills, scientific paper writing, and presentations etc.

4.0 UNITS AND ELEMENTS

This National Occupational Standard is divided into 8 Units representing the tasks that a jobholder should undertake in his/her day-to-day work. Each unit is further broken down into elements depicting the number of activities to be carried out for the successful execution of a particular task.

UNIT 1 [This Unit covers the skills and knowledge required by a Hydrologist in planning for watershed systems]

Unit No.	01
Unit Title	Watershed Planning
Description	This unit describes the skills and knowledge required by a Hydrologist to conduct watershed planning for hydrological related projects.
Scope	This Unit covers the following: • Watershed Definition. • Data collection. • Watershed planning process. • Stakeholder and Community Engagement. • Policy, legal and institutional framework for water resources in Zambia
Performance Criteria (PC) with respect to the Scope	
Element	Performance Criteria (PC)
Watershed Definition	To be competent, the individual must be able to: PC1. Identify and delineate the watershed area based on hydrological features. PC2. Use geographic information systems (GIS) and topographic maps for accurate boundary definition.
Data collection.	To be competent, the individual must be able to: PC3. Identify and know the available metrological, social, economic and hydrological data as well as how to collect the data PC4. Be familiar with the applicable data sources (government agencies, NGOs, private sector) at National, Provincial, District and Local levels

Unit No.	01
Watershed Planning Process	To be competent, the individual must be able to: - PC5. Identify problems and opportunities from past and existing watershed activities. - PC6. Identify the main characteristics of the problems and opportunities identified. - PC7. Establish objectives and constraints associated with the objectives. - PC8. Formulate strategies and methods for action. - PC9. Identify alternative watershed management practices within budget, regulation and time constraints. - PC10. Identify alternative watershed management measures within limits of constraints. - PC11. Appraise and evaluate the environmental, social and economic impacts of the alternative watershed management practices. - PC12. Rank or prioritize the alternative watershed management practices and recommend the practices (projects) when a recommendation is requested. - PC13. Document the watershed plan detailing the specific steps, timelines, responsibilities, and resources needed for implementation.
Stakeholder and Community Engagement.	To be competent, the individual must be able to: - PC14. Conduct stakeholder mapping (stakeholder maps, stakeholder matrix etc.) - PC15. Involve local communities, government institutions, and other relevant stakeholders to understand their perspectives and gather local knowledge and incorporate in watershed planning.
Policy, Legal and Institutional Framework for Water Resources	To be competent, the individual must be able to: PC16. Incorporate the policy, legal, and institutional framework for managing its water resources in watershed planning.

Unit No.	01
Knowledge and Understanding (K)	
A. Organisational Context (knowledge of the company/ organisation and its processes)	The individual on the job must demonstrate knowledge and understanding of company: OK1. Organizational structure, including key departments (such as environmental compliance, project management, engineering, and community relations) and their functions. OK2. Mission and vision of the organization in the hydrological context. OK3. Organization's standard operating procedures for project execution, data collection, and reporting. OK4. Environmental assessments, data management, and compliance with regulatory frameworks OK5. Organization's climate change policies, goals, and commitments.
B. Technical Knowledge	The individual on the job must demonstrate knowledge and understanding of: TK1. The hydrological cycle and its processes. TK2. Watershed/catchment delineation on based on hydrological features. TK3. Geographic information systems (GIS)and remote sensing tools like QGIS, ArcGIS, Google Earth etc. TK4. Project management. TK5. Watershed Best Management Practices TK6. Nature-Based Solutions (Nbs) TK7. Data visualization tools like Microsoft Excel, Python, MATLAB, etc. TK8. Project costing; preparing bills of quantities. TK9. Data collections tools and methods
C. Regulatory Context (Knowledge of rules and regulations)	The individual on the job must demonstrate knowledge and understanding of: RK1. Laws and Regulations on Environmental and Water Resources Managements

Unit No.	01
Skills (S)	
A. Core Skills/ Generic Skills	Writing Skills The individual on the job must be able to: CS1. Prepare and provide concise technical and scientific reports, instructions, and simplified sketches to co-workers and policymakers.
	Reading Skills The individual on the job must be able to: CS2. Read English and be able to, or have the means to, give simple instructions in the local language used in respective project areas. CS3. Read and interpret sketches, drawings or instructions provided for the required work.
	Oral Communication (Listening and Speaking skills) The individual on the job must be able to: CS4. Explain information clearly and concisely to co-workers, community members and other stakeholders. CS5. Respond appropriately to any queries relevant to work planning and performance.
B. Professional Skills	Decision-Making The individual on the job must be able to: PS1. Follow organisation rule –based decision-making process. PS2. Take decision with systematic course of actions and/or response. PS3. Demonstrate high ethical standards. PS4. Disclosure all Conflicts of Interest related to proposed projects

Unit No.	01
B. Professional Skills	Plan and Organise
	The individual on the job should be able to: PS5. Plan and organise work to meet targets within deadline, budget and other constraints.
	Customer Centricity
	The individual on the job should be able to: PS6. Regularly engage with stakeholders, including local communities, governmental agencies, and NGOs, to understand their specific needs, concerns, and expectations regarding water resources and environmental management.
	Problem Solving
	The individual on the job should be able to: PS7. Recognise problems and provide cost-effective solutions PS8. Resolve any conflicts within the team
	Analytical Thinking
	The individual on the job should be able to: PS9. Apply research, knowledge, observations, testing and data to select course of action to perform tasks.
	Critical Thinking
	The individual on the job should be able to: PS10. Evaluate existing data to identify trends and anomalies PS11. Observe and predict opportunities, threats, and solutions.

UNIT 2 [This Unit covers the skills and knowledge required by a Hydrologist for Water Resources Management]

Unit No.	02
Unit Title	Water Resources Management
Description	This Unit describes the skills and knowledge required to manage water resources
Scope	This Unit covers the following: • Data Collection • Hydrological Modelling • Water Resources Assessment • Water Quality Management (WQM)
Performance Criteria (PC) with respect to the Scope	
Element	Performance Criteria (PC)
Data Collection	To be competent, the individual must be able to: PC1. Collect hydrological data (precipitation, Streamflow, groundwater levels etc) using appropriate methods and instruments. PC2. Process and analyze hydrological data using statistical and numerical techniques PC3. Interpret hydrological data to identify trends, patterns and anomalies.
Hydrological Modelling	To be competent, the individual must be able to: PC4. Develop and Calibrate hydrological models to simulate water flow, sediment transport and water quality processes. PC5. Apply hydrological models to assess the impact of climate change, land use change, and water management practices PC6. Use modelling tools to predict future water availability and water quality conditions.

UNIT 2 [This Unit covers the skills and knowledge required by a Hydrologist for Water Resources Management]

Unit No.	02
Water Resources Assessment	To be competent, the individual must be able to: - PC7. Evaluate the quantity and quality of water resources, including surface water and groundwater. - PC8. Assess the sustainability of water use and identify potential water shortages or surplus - PC9. Develop strategies to optimize water allocation and Use. - PC10. Conduct hydrological assessment to aid in the design of irrigation systems and hydraulic structures e.g. Bridge, culverts etc.
Water Quality management	To be competent, the individual must be able to: - PC11. Monitor water quality parameters, including physical, chemical and biological indicators. - PC12. Identify sources of water pollution and implement measures to reduce pollution. - PC13. Develop water quality management plans to improve water quality and protect aquatic ecosystems.
Knowledge and Understanding (K)	
Organisation-al Context (Knowledge of the company/ organisation and its processes)	The individual on the job must demonstrate knowledge and understanding of: - OK1. Organizational structure, including key departments (such as environmental compliance, project management, engineering, and community relations) and their functions. - OK2. Mission and vision of the organization in the hydrological context. - OK3. Organization's standard operating procedures for project execution, data collection, and reporting. - OK4. Environmental assessments, data management, and compliance with regulatory frameworks - OK5. Organization's climate change policies, goals, and commitments.

UNIT 2 [This Unit covers the skills and knowledge required by a Hydrologist for Water Resources Management]

Unit No.	02
Technical Knowledge	The individual on the job must demonstrate knowledge and understanding of: - TK1. Hydrological processes and principles - TK2. Water cycle and its components - TK3. Data collection and analysis methods - TK4. Geographical Information Systems and remote sensing - TK5. Water Quality assessment and management - TK6. Environmental impact assessment - TK7. Hydrological and Hydraulic modelling tools - TK8. Water resources management policies and regulations
Skills (S)	
Core Skills/ Generic Skills	Writing Skills
	The individual on the job must be able to: - CS1. write in English (at least working level) and be able to or have the means to give simple instructions in the local language used at the site - CS2. prepare and provide clear and simple instructions, details and sketches to co-workers
	Reading Skills
	The individual on the job must be able to: - CS3. read English and be able to or have the means to give simple instructions in the local language used at the site - CS4. read and interpret sketches, drawings or instructions provided for the required work - CS5. read and interpret various safety and general signage, safety rules and tags, etc., provided at the workplace, including directions for exit routes during emergencies

UNIT 2 [This Unit covers the skills and knowledge required by a Hydrologist for Water Resources Management]

Unit No.	02
	Oral Communication (Listening and Speaking skills) The individual on the job must be able to: CS6. speak in English (at least working level) and be able to or have the means to give simple instructions in the local language used at the site CS7. listen attentively and interpret communication/ instructions from the supervisor and other co-workers CS8. convey information clearly and concisely to co-workers
Professional Skills	Decision Making
	The individual on the job must be able to: PS1. determine and report to the superior whether the working space is safe for working
	Plan and Organise
	The individual on the job should be able to: PS2. plan work and organise required resources in coordination with team members and superiors
	Problem Solving
	The individual on the job should be able to: PS3. resolve any conflicts within the team
	Analytical Thinking
	The individual on the job should be able to: PS4. analyse and convey to the superior and carry out remedial action
	Critical Thinking
	The individual on the job should be able to: PS5. identify and deal with or report violation of any safety norms which may lead to accidents

UNIT 3 [This Unit covers the skills and knowledge required by a Hydrologist for Flood management, forecasting and Control].

Unit No.	03
Unit Title	Flood Management, Forecasting and Control
Description	This Unit describes the skills and knowledge required for flood management, forecasting and control
Scope	This Unit covers the following: • Flood Risk Assessment • Flood forecasting and warning • Flood mitigation and Control • Post- Flood recovery and rehabilitation
Performance Criteria (PC) with respect to the Scope	
Element	Performance Criteria (PC)
Flood Risk assessment	To be competent, the individual must be able to: PC1. Conduct flood hazard assessments, including flood frequency analysis and inundation mapping PC2. Identify areas at risk of flooding and assess potential impacts on infrastructure, property, and human life. PC3. Evaluate the effectiveness of existing flood control measures.
Flood forecasting and warning	To be competent, the individual must be able to: PC4. Develop and implement flood forecasting systems to predict flood events and issue timely warnings PC5. Monitor hydrological conditions and weather forecasts to identify potential flood threats. PC6. Coordinate with emergency management agencies to disseminate flood warnings and alerts.

UNIT 3 [This Unit covers the skills and knowledge required by a Hydrologist for Flood management, forecasting and Control].

Unit No.	03
Flood mitigation and control	To be competent, the individual must be able to: PC7. Design and implement structural flood control measures, such as dams, levees, and channel improvements. PC8. Promote non-structural measures, including land use planning, floodplain management, and public awareness campaigns. PC9. Develop and implement emergency response plans for flood events.
Post – Flood recovery and rehabilitation	To be competent, the individual must be able to: PC10. Assess flood damages and losses. PC11. Develop and implement post-flood recovery and rehabilitation plans. PC12. Monitor the long-term impacts of floods and adjust flood management strategies as needed.
Knowledge and Understanding (K)	
Organisation-al Context (Knowledge of the company/ organisation and its processes)	The individual on the job must demonstrate knowledge and understanding of: OK1. Organizational structure, including key departments (such as environmental compliance, project management, engineering, and community relations) and their functions. OK2. Mission and vision of the organization in the hydrological context. OK3. Organization’s standard operating procedures for project execution, data collection, and reporting. OK4. Environmental assessments, data management, and compliance with regulatory frameworks OK5. Organization’s climate change policies, goals, and commitments.

UNIT 3 [This Unit covers the skills and knowledge required by a Hydrologist for Flood management, forecasting and Control].

Unit No.	03
Technical Knowledge	The individual on the job must demonstrate knowledge and understanding: TK1. Hydrological processes, particularly those related to flood events TK2. Hydrological modeling techniques for flood simulation TK3. Statistical methods for flood frequency analysis and risk assessment TK4. Hydraulic modeling for flood routing and inundation mapping TK5. Remote sensing and GIS for flood monitoring and assessment TK6. Emergency management principles and procedures TK7. Water resource management policies and regulations
Skills (S)	
Core Skills/ Generic Skills	Writing Skills
	The individual on the job must be able to: CS1. write in English (at least working level) and be able to or have the means to give simple instructions in the local language used at the site CS2. prepare and provide clear and simple instructions, details and sketches to co-workers
	Reading Skills
	The individual on the job must be able to: CS3. read English and be able to or have the means to give simple instructions in the local language used at the site CS4. read and interpret sketches, drawings or instructions provided for the required work CS5. read and interpret various safety and general signage, safety rules and tags, etc., provided at the workplace, including directions for exit routes during emergencies

UNIT 3 [This Unit covers the skills and knowledge required by a Hydrologist for Flood management, forecasting and Control].

Unit No.	03
Professional Skills	Oral Communication (Listening and Speaking skills)
	The individual on the job must be able to: CS6. speak in English (at least working level) and be able to or have the means to give simple instructions in the local language used at the site CS7. listen attentively and interpret communication/ instructions from the supervisor and other co-workers CS8. convey information clearly and concisely to co-workers
	Decision Making
	The individual on the job must be able to: PS1. determine and report to the superior whether the working space is safe for working
	Plan and Organise
	The individual on the job should be able to: PS2. plan work and organise required resources in coordination with team members and superiors
	Problem Solving
	The individual on the job should be able to: PS3. resolve any conflicts within the team
	Analytical Thinking
	The individual on the job should be able to: PS4. analyse and convey to the superior and carry out remedial action
	Critical Thinking
	The individual on the job should be able to: PS5. identify and deal with or report violation of any safety norms which may lead to accidents

UNIT 4 [This Unit covers the skills and knowledge required by a Hydrologist in planning for Environmental Protection].

Unit No.	04
Unit Title	Environmental Protection
Description	This Unit describes the skills and knowledge required for environmental protection
Scope	This Unit covers the following: • Water Quality Assessment • Water Pollution Control • Environmental Impact Assessment • Ecological Flow Assessment • Climate change Adaptation and Mitigation • Watershed Protection
Performance Criteria (PC) with respect to the Scope	
Element	Performance Criteria (PC)
Water Quality Assessment	To be competent, the individual must be able to: PC1. Monitor water quality parameters, including physical, chemical and biological indicators. PC2. Identify sources of water pollution, such as industrial, agricultural, and municipal discharges. PC3. Assess the impact of pollution on aquatic ecosystems and human health.
Water Pollution Control	To be competent, the individual must be able to: PC4. Develop and implement water pollution strategies, including wastewater treatment and non- source pollution control. PC5. Monitor the effectiveness of pollution control measures. PC6. Enforce water quality regulations and standards.

Unit No.	04
Environmental Impact Assessment	To be competent, the individual must be able to: • PC7. Assess the potential environmental impacts of development projects on the water resources. • PC8. Identify and mitigate adverse impacts on water quality and aquatic ecosystems • PC9. Develop environmental plans to minimize environmental degradation
Ecological Flow Assessment	To be competent, the individual must be able to: • PC10. Assess the ecological flow requirements of water bodies • PC11. Develop strategies to maintain healthy aquatic ecosystems • PC12. Implement measures to protect aquatic biodiversity
Climate Change Adaptation and Mitigation	To be competent, the individual must be able to: • PC13. Assess the impacts of climate change on water resources and ecosystems • PC14. Develop adaptation and mitigation strategies to reduce the vulnerability of water resources to climate change. • PC15. Promote sustainable water use practices and reduce greenhouse gas emissions.

Unit No.	04
Watershed Protection	To be competent, the individual must be able to: • PC16. Identify environmental problems in the watershed. • PC17. Identify the main characteristics of the problems. • PC18. Formulate soil and water conservation strategies for environmental protection. • PC19. Identify alternative environmental protection practices within budget, regulation and time constraints. • PC20. Appraise and evaluate the environmental, social and economic impacts of the alternative environmental protection practices. • PC20. Rank or prioritize the alternative environmental protection practices and recommend the practices (projects) when a recommendation is requested. • PC21. Document the environmental protection plan detailing the specific steps, timelines, responsibilities, and resources needed for implementation.
Knowledge and Understanding (K)	
Organisation-al Context (Knowledge of the company/ organisation and its processes)	The individual on the job must demonstrate knowledge and understanding of: • OK1. Organizational structure, including key departments (such as environmental compliance, project management, engineering, and community relations) and their functions. • OK2. Mission and vision of the organization in the hydrological context. • OK3. Organization's standard operating procedures for project execution, data collection, and reporting. • OK4. Environmental assessments, data management, and compliance with regulatory frameworks • OK5. Organization's climate change policies, goals, and commitments.

Unit No.	04
Technical Knowledge	The individual on the job must demonstrate knowledge and understanding: - TK1. Hydrological processes and their impact on water quality - TK2. Water quality standards and regulations - TK3. Water pollution control technologies - TK4. Ecological principles and aquatics ecosystems health - TK5. Environmental impact assessment methodologies - TK6. Climate change science and its implications for the water resources - TK7. Global Climate change models e.g. Shared Socioeconomic pathways (SSPs) etc. - TK8. Project management. - TK9. Environmental protection Best Management Practices - TK10. Nature-Based Solutions (Nbs) and structural measures(dams, drainage systems etc) - TK11. Data visualization tools like Microsoft Excel, Python, MATLAB, etc. - TK12. Project costing; preparing bills of quantities. - TK13. Data collections tools and methods
Skills (S)	
Core Skills/ Generic Skills	Writing Skills
	The individual on the job must be able to: - CS1. write in English (at least working level) and be able to or have the means to give simple instructions in the local language used at the site - CS2. prepare and provide clear and simple instructions, details and sketches to co-workers

Unit No.	04
	Reading Skills
	The individual on the job must be able to: CS3. read English and be able to or have the means to give simple instructions in the local language used at the site CS4. read and interpret sketches, drawings or instructions provided for the required work CS5. read and interpret various safety and general signage, safety rules and tags, etc., provided at the workplace, including directions for exit routes during emergencies
	Oral Communication (Listening and Speaking skills)
	The individual on the job must be able to: CS6. speak in English (at least working level) and be able to or have the means to give simple instructions in the local language used at the site CS7. listen attentively and interpret communication/ instructions from the supervisor and other co-workers CS8. convey information clearly and concisely to co-workers
Professional Skills	Decision Making
	The individual on the job must be able to: PS1. determine and report to the superior whether the working space is safe for working
	Plan and Organise
	The individual on the job should be able to: PS2. plan work and organise required resources in coordination with team members and superiors

Unit No.	04
	Problem Solving
	The individual on the job should be able to: PS3. resolve any conflicts within the team
	Analytical Thinking
	The individual on the job should be able to: PS4. analyse and convey to the superior and carry out remedial action
	Critical Thinking
	The individual on the job should be able to: PS5. identify and deal with or report violation of any safety norms which may lead to accidents

UNIT 5 [This unit outlines the knowledge, skills, and competencies required for a hydrologist to effectively contribute to groundwater exploration].

Unit No.	05
Unit Title	Groundwater Exploration
Description	This Unit describes the skills and knowledge required for groundwater exploration. Hydrologists play a critical role in identifying, assessing, and developing groundwater resources.
Scope	This Unit covers the following: • Groundwater resource assessment • Groundwater exploration techniques • Groundwater modelling • Groundwater quality assessment • Groundwater development
Performance Criteria (PC) with respect to the Scope	
Element	Performance Criteria (PC)
Groundwater resource assessment	To be competent, the individual must be able to: PC1. Conduct hydrogeological surveys to identify potential groundwater aquifers. PC2. Analyze geological and hydrological data to assess groundwater availability and quality. PC3. Evaluate the sustainability of groundwater extraction.
Groundwater exploration techniques	To be competent, the individual must be able to: PC4. Apply various groundwater exploration techniques, including geophysical surveys, drilling, and well logging. PC5. Interpret geophysical data to delineate aquifer boundaries and estimate aquifer parameters. PC6. Design and supervise drilling operations.

Unit No.	05
Groundwater modelling	To be competent, the individual must be able to: PC7. Develop and calibrate groundwater flow models to simulate groundwater flow and contaminant transport. PC8. Use modeling tools to predict groundwater levels and assess the impact of groundwater extraction. PC9. Design groundwater management plans based on modeling results.
Groundwater quality assessment	To be competent, the individual must be able to: PC10. Monitor groundwater quality parameters, including physical, chemical, and microbiological indicators. PC11. Identify sources of groundwater contamination and assess their impact on groundwater quality. PC12. Develop strategies to protect groundwater quality.
Groundwater Development	To be competent, the individual must be able to: PC13. Design and construct groundwater wells and pumping systems. PC14. Develop groundwater management plans to ensure sustainable groundwater use. PC15. Implement groundwater conservation and protection measures.
Knowledge and Understanding (K)	
Organisation-al Context (Knowledge of the company/ organisation and its processes)	The individual on the job must demonstrate knowledge and understanding of: OK1. Organizational structure, including key departments (such as environmental compliance, project management, engineering, and community relations) and their functions. OK2. Mission and vision of the organization in the hydrological context. OK3. Organization's standard operating procedures for project execution, data collection, and reporting. OK4. Environmental assessments, data management, and compliance with regulatory frameworks OK5. Organization's climate change policies, goals, and commitments.

Unit No.	05
Technical Knowledge	The individual on the job must demonstrate knowledge and understanding of: TK1. Hydrogeology and groundwater hydrology principles TK2. Geophysical exploration techniques TK3. Drilling and well construction methods TK4. Groundwater modeling techniques TK5. Water quality assessment and management TK6. Environmental impact assessment TK7. Water resource management policies and regulations
Skills (S)	
Core Skills/ Generic Skills	Writing Skills The individual on the job must be able to: CS1. write in English (at least working level) and be able to or have the means to give simple instructions in the local language used at the site CS2. prepare and provide clear and simple instructions, details and sketches to co-workers
	Reading Skills The individual on the job must be able to: CS3. read English and be able to or have the means to give simple instructions in the local language used at the site CS4. read and interpret sketches, drawings or instructions provided for the required work CS5. read and interpret various safety and general signage, safety rules and tags, etc., provided at the workplace, including directions for exit routes during emergencies

Unit No.	05
Core Skills/ Generic Skills	Oral Communication (Listening and Speaking skills) The individual on the job must be able to: CS6. speak in English (at least working level) and be able to or have the means to give simple instructions in the local language used at the site CS7. listen attentively and interpret communication/ instructions from the supervisor and other co-workers CS8. convey information clearly and concisely to co-workers
	Decision Making The individual on the job must be able to: PS1. determine and report to the superior whether the working space is safe for working
Professional Skills	Plan and Organise The individual on the job should be able to: PS2. plan work and organise required resources in coordination with team members and superiors
	Problem Solving The individual on the job should be able to: PS3. resolve any conflicts within the team
	Analytical Thinking The individual on the job should be able to: PS4. analyse and convey to the superior and carry out remedial action
	Critical Thinking The individual on the job should be able to: PS5. identify and deal with or report violation of any safety norms which may lead to accidents

UNIT 6 [This unit outlines the knowledge, skills, and competencies required for a Hydrologist to effectively contribute to hydropower development and management.].

Unit No.	06
Unit Title	Hydropower Development and Management
Description	This Unit describes the skills and knowledge required for hydropower development and management. Hydrologists play a critical role in assessing hydrological conditions, evaluating hydropower potential, and managing hydropower project.
Scope	This Unit covers the following: • Hydropower resource assessment • Hydropower project planning and design • Hydropower plant operations and maintenance • Environmental impact assessment and mitigation • Hydropower systems optimisation
Performance Criteria (PC) with respect to the Scope	
Element	Performance Criteria (PC)
Hydropower resource assessment	To be competent, the individual must be able to: PC1. Conduct hydrological and hydraulic assessments to evaluate the hydropower potential of rivers and streams. PC2. Assess the availability of water resources for hydropower generation. PC3. Evaluate the environmental and social impacts of hydropower development.
Hydropower project planning and design	To be competent, the individual must be able to: PC4. Contribute to the planning and design of hydropower projects, including dam design, reservoir operation, and power plant layout. PC5. Assess the hydrological and hydraulic requirements for hydropower generation. PC6. Develop water release schedules to optimize power generation and environmental flows.

Unit No.	06
Hydropower plant operations and maintenance	To be competent, the individual must be able to: PC7. Monitor hydrological conditions and adjust power plant operations to maximize energy production. PC8. Conduct regular inspections and maintenance of hydropower facilities. PC9. Implement measures to ensure the safety and reliability of hydropower operations.
Environmental impact assessment and mitigation	To be competent, the individual must be able to: PC10. Assess the environmental impacts of hydropower projects, including impacts on water quality, aquatic ecosystems, and downstream communities. PC11. Develop and implement mitigation measures to minimize environmental damage. PC12. Monitor environmental conditions and compliance with environmental regulations.
Hydropower systems optimisation	To be competent, the individual must be able to: PC13. Analyze historical hydrological data to identify opportunities for improving hydropower plant performance. PC14. Develop and implement strategies to optimize power generation and energy storage. PC15. Use advanced technologies, such as real-time monitoring and control systems, to enhance hydropower operations.

Unit No.	06
Knowledge and Understanding (K)	
Organisation-al Context (Knowledge of the company/ organisation and its processes)	The individual on the job must demonstrate knowledge and understanding of: OK1. Organizational structure, including key departments (such as environmental compliance, project management, engineering, and community relations) and their functions. OK2. Mission and vision of the organization in the hydrological context. OK3. Organization's standard operating procedures for project execution, data collection, and reporting. OK4. Environmental assessments, data management, and compliance with regulatory frameworks OK5. Organization's climate change policies, goals, and commitments.
Technical Knowledge	The individual on the job must demonstrate knowledge and understanding of: TK1. Hydrological and hydraulic principles TK2. Hydropower engineering and technology TK3. Water resource management TK4. Environmental impact assessment TK5. Climate change and its impact on hydropower TK6. Renewable energy policies and regulations
Skills (S)	
Core Skills/ Generic Skills	Writing Skills
	The individual on the job must be able to: CS1. write in English (at least working level) and be able to or have the means to give simple instructions in the local language used at the site CS2. prepare and provide clear and simple instructions, details and sketches to co-workers

Unit No.	06
	Reading Skills
	The individual on the job must be able to: CS3. read English and be able to or have the means to give simple instructions in the local language used at the site CS4. read and interpret sketches, drawings or instructions provided for the required work CS5. read and interpret various safety and general signage, safety rules and tags, etc., provided at the workplace, including directions for exit routes during emergencies
	Oral Communication (Listening and Speaking skills)
	The individual on the job must be able to: CS6. speak in English (at least working level) and be able to or have the means to give simple instructions in the local language used at the site CS7. listen attentively and interpret communication/ instructions from the supervisor and other co-workers CS8. convey information clearly and concisely to co-workers
Professional Skills	Decision Making
	The individual on the job must be able to: PS1. determine and report to the superior whether the working space is safe for working
	Plan and Organise
	The individual on the job should be able to: PS2. plan work and organise required resources in coordination with team members and superiors

Unit No.	06
	Problem Solving
	The individual on the job should be able to: PS3. resolve any conflicts within the team
	Analytical Thinking
	The individual on the job should be able to: PS4. analyse and convey to the superior and carry out remedial action
	Critical Thinking
	The individual on the job should be able to: PS5. identify and deal with or report violation of any safety norms which may lead to accidents

UNIT 7 [This unit outlines the knowledge, skills, and competencies required for a Hydrologist to effectively contribute to urban planning.]

Unit No.	07
Unit Title	Urban Planning
Description	This Unit describes the skills and knowledge required to Urban Planning. Hydrologists play a critical role in assessing urban hydrological processes, managing urban water resources, and mitigating urban flood risks.
Scope	This Unit covers the following: • Urban Hydrological assessment • Stormwater management • Urban Flood risk assessment and management • Urban Water Supply and Wastewater management • Environmental impact assessment

Unit No.	07
Performance Criteria (PC) with respect to the Scope	
Element	Performance Criteria (PC)
Urban Hydrological assessment	To be competent, the individual must be able to: PC1. Analyze urban hydrological processes, including rainfall-runoff, infiltration, and groundwater recharge. PC2. Assess the impact of urbanization on hydrological regimes, such as increased runoff and reduced infiltration. PC3. Evaluate the water balance of urban areas.
Stormwater management	To be competent, the individual must be able to: PC4. Design and implement stormwater management systems, such as detention basins, retention ponds, and green infrastructure. PC5. Assess the effectiveness of stormwater management practices in reducing flood risk and improving water quality. PC6. Develop stormwater management plans for urban areas.
Urban Flood risk assessment and management	To be competent, the individual must be able to: PC7. Conduct flood risk assessments for urban areas, including flood frequency analysis and inundation mapping. PC8. Develop flood mitigation strategies, such as flood control structures, floodplain management, and early warning systems. PC9. Implement flood emergency response plans.
Urban water supply and wastewater management	To be competent, the individual must be able to: PC10. Assess the water supply and wastewater treatment needs of urban areas. PC11. Develop sustainable water supply and wastewater management strategies. PC12. Implement water conservation measures to reduce water demand.

Unit No.	07
Environmental impact assessment	To be competent, the individual must be able to: PC13. Assess the environmental impacts of urban development on water resources, including water quality, aquatic ecosystems, and groundwater. PC14. Develop mitigation measures to minimize environmental degradation.
Knowledge and Understanding (K)	
Organisation-al Context (Knowledge of the company/ organisation and its processes)	The individual on the job must demonstrate knowledge and understanding of: OK1. Organizational structure, including key departments (such as environmental compliance, project management, engineering, and community relations) and their functions. OK2. Mission and vision of the organization in the hydrological context. OK3. Organization's standard operating procedures for project execution, data collection, and reporting. OK4. Environmental assessments, data management, and compliance with regulatory frameworks OK5. Organization's climate change policies, goals, and commitments.
Technical Knowledge	The individual on the job must demonstrate knowledge and understanding of: TK1. Urban hydrology and hydraulics TK2. Stormwater management principles and practices TK3. Flood risk assessment and management TK4. Water supply and wastewater treatment systems TK5. Environmental impact assessment TK6. Climate change and its impact on urban water resources

Unit No.	07
Skills (S)	
Core Skills/ Generic Skills	Writing Skills The individual on the job must be able to: CS1. write in English (at least working level) and be able to or have the means to give simple instructions in the local language used at the site CS2. prepare and provide clear and simple instructions, details and sketches to co-workers
	Reading Skills The individual on the job must be able to: CS3. read English and be able to or have the means to give simple instructions in the local language used at the site CS4. read and interpret sketches, drawings or instructions provided for the required work CS5. read and interpret various safety and general signage, safety rules and tags, etc., provided at the workplace, including directions for exit routes during emergencies
	Oral Communication (Listening and Speaking skills) The individual on the job must be able to: CS6. speak in English (at least working level) and be able to or have the means to give simple instructions in the local language used at the site CS7. listen attentively and interpret communication/ instructions from the supervisor and other co-workers CS8. convey information clearly and concisely to co-workers

Unit No.	07
Professional Skills	Decision Making
	The individual on the job must be able to: PS1. determine and report to the superior whether the working space is safe for working
	Plan and Organise
	The individual on the job should be able to: PS2. plan work and organise required resources in coordination with team members and superiors
	Problem Solving
	The individual on the job should be able to: PS3. resolve any conflicts within the team
	Analytical Thinking
	The individual on the job should be able to: PS4. analyse and convey to the superior and carry out remedial action
	Critical Thinking
	The individual on the job should be able to: PS5. identify and deal with or report violation of any safety norms which may lead to accidents

UNIT 8 [This Unit covers the skills and knowledge required by a Hydrologist to ensure safety, health, and environmental management]

Unit No.	08
Unit Title	Ensure Safety, Health, and Environmental Management
Description	This Unit describes the skills and knowledge required by a Hydrologist in maintaining safety, health, and environment in the work environment.
Scope	This Unit covers the following: • Ensure safety and health regulations are followed by the jobholder as well as other employees. • Ensure operations at the establishment conform to the requirements for environmental protection.
Performance Criteria (PC) with respect to the Scope	
Element	Performance Criteria (PC)
Ensure Safety and Health Regulations are Followed by the Jobholder as Well as Other Employees	To be competent, the individual must be able to: PC1. Implement organisational safety and health policies. PC2. Implement environmental policies of the organisation. PC3. Identify, through troubleshooting, the bottlenecks and efficiency problems in the distribution network. PC4. Assess risk and possible safety hazards of all aspects of operations. PC5. Guide other employees on the safe operation of machinery, tools, and equipment, and apply them in the formulation of standard operating procedures (SOPs).
Ensure Operations at the Establishment Conform to the Requirements for Environmental Protection	To be competent, the individual must be able to: PC6. Implement the overall environmental policies of the organisation and the country. PC7. Guide other employees on the safe operations of equipment/machinery, and apply them in formulation of SOPs.

Unit No.	08
Knowledge and Understanding (K)	
A. Organisational Context (knowledge of the company/ organisation and its processes)	The individual on the job must demonstrate knowledge and understanding of company: OK1. Policies on safety, health, and environmental protocols. OK2. Procedures and guidelines on safety, health, quality, and environment.
B. Technical Knowledge	The individual on the job must demonstrate knowledge and understanding of: TK1. Safety risk assessment. TK2. EIA processes. TK3. Toolbox talk. TK4. Material safety data sheets (MSDS).
C. Regulatory Content (knowledge of rules and regulation)	The individual on the job must demonstrate knowledge and understanding of: RK1. Laws and regulations related to environment, water, public health, biosafety, and occupational health and safety.
Skills (S)	
A. Core Skills/ Generic Skills	Writing Skills
	The individual on the job must be able to: CS1. Prepare health, safety, and environment SOPs.
	Reading Skills
	The individual on the job must be able to: CS2. Read and interpret internal/external documents related to health, safety, and environmental management.
	Oral Communication (Listening and Speaking skills)
	The individual on the job must be able to: CS3. Communicate health, safety, and environmental information to subordinates and other stakeholders.

Unit No.	08
B. Professional Skills	Decision-Making
	The individual on the job must be able to: PS1. Plan and organise departmental health, safety, and environment talks/meetings. PS2. Carry out departmental health, safety, and environmental risk assessment (in conjunction with the Safety Officer).
	Plan and Organise
	The individual on the job should be able to: PS3. Determine the implications of failure to comply with health, safety, and environmental regulations on the individual and the company.
	Customer Centricity
	The individual on the job should be able to: PS4. Manage relationships with customers on health, safety, and environment issues.
	Problem Solving
	The individual on the job should be able to: PS5. Identify and solve problems with minimal or no supervision. PS6. Make decisions during emergency situations.
	Analytical Thinking
	The individual on the job should be able to: PS7. Analyse and convey to the superior, and carry out remedial action.
	Critical Thinking
	The individual on the job should be able to: PS8. Identify and deal with or report violation of any safety norms which may lead to accidents.

5.0 EQUIPMENT, TOOLS AND CONSUMABLE MATERIALS

Equipment, tools and consumable materials used by the job holder include, but are not limited to:

Hand Tools: Sample Bottles, Chisel, Hammer, Bar tying hook, Bending lever, Gauge measure, Spanners, Hack saw blade and frame, Steel cutting blade, Bar tying hook, Bending lever, etc.

Measuring Instruments: GPS Devices, Topographic Maps, Steel scale, Water Quality Sensors, Flow Meters, Rain Gauges, Surface Water Gauges, Groundwater Monitoring Wells, Soil Moisture Sensors, Try Scale, Spirit level, Plumb bob, Measuring tape, Drone etc.

Power Tools: Cutting machine, Bending machine, Threading machine, etc.

Consumables and General requirements: Reinforcement steel bar, Welding electrodes, Binding wires, Cover blocks, Wooden planks, Steel reinforcement bars tying machine, Lifting appliance (Sling, Shackle, Belts), Mechanical coupler, First aid kit, Fire extinguishers, lime powder, etc.

Personal Protective Equipment: Safety helmet, Safety goggles, Safety shoes, Safety belt, Cotton gloves, Ear plugs, Reflective jackets, Lifejackets, Dust mask, Fire prevention kit, etc.

6.0 DILEMMAS/CHALLENGES AND COMPLEXITIES FOR A JOB HOLDER

Dilemmas associated with the job of a Hydrologist include: working in extreme weather such as hot and cold conditions, exposure flames and electrical power supply, working around and with machinery having moving parts, working in dangerous areas with likelihood of sharp or falling materials and objects, working in confined spaces and at heights with likelihood of falls, working in noisy, wet and dusty environments, exposure to welding fumes and odours, lifting/pulling/pushing heavy materials, long working hours, pressure from supervisors and colleagues, pressure from government regulators, etc.

7.0 ALTERNATIVE CHOICES (SOLUTIONS) TO DILEMMAS AND COMPLEXITIES

Solutions to dilemmas include wearing protective clothing and ensuring their availability and use by other employees, exercising regularly to maintain physical fitness, exercising proper work ergonomics, participating in workplace safety sensitisation and awareness meetings/training sessions, adhering to company's safety and standard operating procedures at all times, consulting extensively within and outside one's department/team on WATER safety issues, planning and prioritising work, etc.

8.0 WORKING CONDITIONS/ENVIRONMENT

Working conditions include indoor and outdoor water sites as well as workshops and factories, may also work in commercial buildings or private homes, confined spaces, handling machines with moving parts, working at heights, working in conditions that may be dirty and noisy, exposure to seasonal heat and cold or adverse weather conditions, emergency call-outs, standing or squatting for long hours and lifting relatively heavy objects. In most cases, the job involves working normal hours, but in some instances, shift work and regular overtime may be required. The job also requires wearing suitable protective clothing such as works suits, ear protectors, safety visors or goggles, gloves and hardhats, safety harnesses etc.

9.0 PARTIES INVOLVED/INTERACTING WITH THE JOB HOLDER OR TRAINEE

9.1 Internal/Within the Organisation

Parties involved/interacting with the job holder who are internal to the organization include supervisors/superiors, trainers, occupational health and safety team, other colleagues, etc.

9.2 External/Outside the Organisation

Parties involved/interacting with the job holder who are external to the organization include government regulators, trainers, clients, suppliers of equipment/ tools/ consumables, fellow Environment and Water Quality Officers from other companies, labour unions/ occupational health and safety associations, etc.

10.0 PHYSICAL DEMANDS ON THE BODY

- Ability to sustain strenuous conditions such as climbing heights;
- Walk and stand for long periods of time;
- Working near/on water bodies
- Bend, stretch, twist, or reach out;
- Lift, carry, push and pull heavy objects;
- Use fingers, hands and feet with ease to complete the assigned task (dexterity);
- Strenuous works that may cause musculoskeletal disorders;
- Etc.

ANNEX A

Criteria for Assessments based on this NOS

A.1 Guidelines for Assessment

- A.1.1** Criteria for assessment for curricula and learning programmes based on this NOS will be created by curricula and programmes developers. Each Performance Criteria (PC) will be assigned marks proportional to its importance in the NOS. Curricula and programmes developers will also lay down proportion of marks for theory and practical skills for each performance criteria, giving more weight to practical skills.

There shall be allocated the 'Total Mark', which will be the sum of all marks in each Unit, distributed across the number of PCs in that particular Unit. The 'out of' mark will be the mark allocated to each PC, which will be shared between theory and skills practical assessments.

- A.1.2** Individual awarding/assessment bodies or institutions and other users of the NOS will create unique question papers for the theory part and evaluations for skill practical part for their respective candidates.

ANNEX B

NOS Version Control

This Annex gives details necessary for the tracking of the NOS versions based on the number of revisions.

NOS Code	DNOS.HD.01		
ZQF Level		Version Number	01
Sector	Water	Date of Approval	
Sub Sector		Date of Last Review	N/A
Occupation	Hydrologist	Date of Next Review	



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