NATIONAL COUNCIL FOR TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING

MAY 2023

PROPOSED OCCUPATIONAL STANDARDS

OCCUPATION: WATER CONSERVANCY AND HYDROPOWER ENGINEERING ENGINEER

LEVEL: NTA 7

TABLE OF CONTENT

CONTENTS

ABBREVIATIONS

CAD	Computer-aided Design
CASS	Topographic/Cadastral Mapping Software (Developed by South Digital Technology Co., Ltd.)
CBET	Competency Based Education and Training
NACTVET	National Council for Technical and Vocational Education and Training
NOS	National Occupational Standards
OS	Occupational Standards
TET	Technical Education and Training
TVET	Technical and Vocational Education and Training

GLOSSARY OF TERMS

Circumstantial Knowledge:	Detailed knowledge, which allows the decision-making in regard to different circumstances and cross cutting issues.
Competence:	The ability to use knowledge, understanding, practical, and thinking skills to perform effectively to the workplace standards required in employment.
Competency:	A description of the ability one possesses when able to perform a given occupational task effectively and efficiently.
Competency-based Education:	An instructional programme that derives its content from validated tasks and bases assessment on the learner's performance.
Curriculum:	A description or composite of statements about "what is to be learned" by the trainee/student in a particular instructional programme; a product that states the "intended learning outcomes".
Educational/Training Programme:	The complete curriculum and instruction (what and how) that is designed to prepare a person for employment in a job or other particular performance situation.
Occupation:	A specific position requiring the performance of specific tasks - essentially the same tasks are performed by all employees having the same title. (Example: baker)
Occupational Area:	This is a broad grouping of related jobs. (Example: food service).
Occupational Standards:	Specific requirements of competences for personnel in a particular occupational area, including knowledge and relevant attitudes. They also act as performance tools of assessment of the prescribed outcomes.
Occupational/Job Analysis:	A process used to identify the tasks that are important to employees in any given occupation.
Performance Criteria:	Indicate expected end results or outcomes in the form of evaluative statements.
Skills:	The ability to perform occupational tasks with a high degree of proficiency within a given occupation. Skill is conceived of as a composite of three completely interdependent components: cognitive, affective, and psychomotor.
Standards:	A set of statements, which, if proved true under working conditions, means that an individual is meeting an expected level and type of performance.

Task Analysis:	The process of analysing each task to determine the steps, circumstantial knowledge, attitudes, performance criteria, tools and materials needed, as well as safety concerns required for the employees performing it.
Task:	A work activity that has a definite beginning and ending, is observable or measurable, consists of two or more definite steps, and leads to products, service, or decisions.
Underpinning Knowledge:	Crucial knowledge that an individual must acquire in order to demonstrate competences that are associated in performing a given task.
Verification process:	The process of having experts review and confirm the importance of the task (competency) statements identified through occupational analysis. Other questions, such as the degree of task learning difficulty are also frequently asked. This process is also sometimes referred to as validation.
Occupational Competence:	The application of knowledge and skills that consistently meet the standards required by the working conditions.

1.0. INTRODUCTION

Technical Education and Training (TET) is one of the most important education sub-sectors in Tanzania, responsible for developing a skilled workforce to support the country's industrialization economic agenda. Tanzania's *Development Vision 2025* intends to raise the country's economy to a middle-income status. This requires a skilled workforce that is aligned with the needs of the public and private sectors of the economy. The National Council for Technical and Vocational Education and Training of Tanzania has begun the job of drafting Occupational Standards that will eventually be adopted as National Occupational Standards for TET in order to ensure that it meets the needs of the labour market and the country's economic agenda.

National Occupational Standards (NOS) are performance criteria that are matched with labour market demands. Each National Occupational Standard describes functions, performance standards, and knowledge/understanding for one important function or task. They combine skills, knowledge, and attitudes to describe best practice. They are useful tools for establishing job roles, personnel recruiting, supervision, and appraisal, as well as TET standards. They're also helpful for benchmarking and harmonizing qualifications on a national and international level. Standards, in general, provide a solid framework for high-quality TET that is labour market-relevant, current and consistent in delivery across all public and private institutions.

However, it must be noted that, Occupational Standards and Training standards/qualifications standards are different. Occupational Standards are defined in terms of activities performed by a person in a selected occupation (e.g., an electrical engineer designs electrical wiring circuits, performs troubleshooting in electrical wiring, etc.) and they are usually defined by employers following procedures agreed upon by all stakeholders. Education and training standards are developed from the activities defined in occupational standards, and they include learning objectives to ensure that the necessary skills and knowledge are developed by a person to enable him or her to function at an agreed level in an occupation. Education and Training standards are used to define curricula in training institutions. It is however critical that there must be a direct link between the Occupational Standards and the training standards to respond to demands of the labour market.

In TET delivery, Tanzania adopted the Competence Based Education and Training (CBET) approach. The CBET approach focuses on providing learners with the skills and knowledge required to meet the Occupational Standards. Occupational Standards are thus the starting point for developing competency-based training (CBET) programmes. TET institutions will be required to benchmark their curricula with relevant Occupational Standards.

Occupational Standards are developed based on a given occupation's current and future demands. As a result, they serve as a means of bridging the gap between the worlds of employment and technical education and training (TET).

Water Conservancy and Hydropower Engineer has its own set of occupational standards. The document explains how the Occupational Standards were developed, as well as the scope, the occupational profile in the form of DACUM charts, and the Occupational Standards.

2.0. OCCUPATIONAL STANDARD DEVELOPMENT PROCESS

The Occupational Standards development process began with an examination of major documents that guide Tanzanian skill development. The *10-year National Skills Development Strategy (2016-2026)* was one of the documents reviewed, and it outlined six (6) economic sectors that should be prioritized when developing skills development programmes.

These sectors include: Transport and Logistics, Tourism and Hospitality, Agribusiness, Construction, Energy and ICT. NACTE labour market reports were also used in the literature review to determine the skills demand in the Tanzanian labour market as a whole.

After the literature review, a workshop comprised of experts and educators with substantial knowledge and experience in the occupation conducted an occupational analysis utilizing the DACUM approach to produce the occupational profile. The analysis resulted in DACUM Charts, which are attached as **Appendix 1** to this document.

The Occupational Standards were then developed. Experts in Occupational Analysis and the Development of Occupational Standards facilitated the workshop. Interviews, online surveys, and a stakeholder forum were used to validate the Occupational Standards. Engineers, supervisory technicians on the job, and experienced Water Conservancy and Hydropower Engineers were key informants in the survey to discover occupational trends. The information was used to gain insight from the workplaces regarding trends and changes in the profession, including how well graduates are prepared for working in the occupation. A total of ..... online surveys were completed by experts from the labour market across the country. Apart from the survey aiding in defining the scope for the occupational analysis, they also served to engage a wide cross-section of experts in the occupation. Apart from this, the stakeholders' forum was attended by ... participants from different parts of the country representing various companies.

3.0. THE SCOPE AND OVERVIEW OF THE OCCUPATION STANDARDS FOR WATER CONSERVANCY AND HYDROPOWER ENGINEERS

These standards cover a broad range of duties and tasks that can be performed by a Water Conservancy and Hydropower Engineer. However, the occupational standards are not meant to

replace individual job descriptions. Instead, they are to be used for guidance in defining skill levels and knowledge for the technician in specific settings or positions. The Water Conservancy and Hydropower Engineer may perform tasks in a number of key areas of the Occupational Standards, but not necessarily in all areas. For example, in large operations, other individuals may be employed or designated to perform specific tasks.

Working in coordination with other engineers, the Water Conservancy and Hydropower Engineer completes the survey, planning, design, construction and operation and maintenance management of hydraulic hub projects. At the construction site of water conservancy projects, Water Conservancy and Hydropower Engineering Engineers can guide and organize technicians to complete various construction tasks, from the composition of water conservancy hubs, the design of various parts of the building size to the drawing of engineering drawings, the construction organization and design work such as construction scheme preparation and schedule development according to the design documents, and finally the organization and management work at the site to ensure the quality, schedule, cost and safety of water conservancy construction projects to achieve the objectives. Generally, the Water Conservancy and Hydropower Engineer performs the following duties:

a) Water conservancy engineering construction

b) Water conservancy project management

c) Safety monitoring of hydraulic structure

d) Design of small and medium sized hydraulic projects

e) Water Project O&M Management

f) Safety monitoring of hydraulic structure

The Occupational Standards have been clustered into NTA qualification levels, i.e. NTA 7 and 8.

4.0. VALIDITY PERIOD

Due to the rapid development of technology, the validity period of occupational standards is 3-5 years. The review will proceed in the same manner as the one before it, with new occupational standards being developed based on current trends of the labour market.

5.0. OCCUPATIONAL STANDARDS

5.1. OCCUPATIONAL STANDARDS FOR WATER CONSERVANCY AND HYDROPOWER ENGINEER - NTA 7

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	ENGINEERING CONSTRUCTION OF SMALL WATER CONSERVANCY WORKS	**DUTY NO.**	701
TASK TITLE	CONSTRUCTION OF SMALL SLUICES	**TASK NO.**	7011
PERFORMANCE CRITERIA	The person performing this task must be able to prepare construction organization and design documents for small sluices in accordance with the requirements of the relevant technical standards, specifications, design documents and works contracts.		
RANGE STATEMENT	The task can be performed in the office or construction site under the supervision of the senior engineer of water conservancy and hydropower engineering. The tools and equipment to be used include: 1. Computer and office operating system; 2. Information on the topography, hydrology, meteorology, geology and other construction conditions of the project site; 3. Design documents for small sluice works; 4. Manuals on the performance of construction machinery for earthworks, concrete works, electromechanical installation works and metal structure installation works.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Analyze construction conditions; 2. Prepare construction technology and site; 3. Select construction diversion methods and carry out the design of diversion buildings; 4. Determine the construction scheme for foundation treatment; 5. Determine the engineering construction scheme for small sluices; 6. Determine the flood interception plan; 7. Prepare the work schedule; 8. Conduct the construction general layout; 9. Prepare target assurance measures for quality, safety and schedule;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine construction diversion options; 1.2 Determine the construction scheme for foundation treatment; 1.3 Determine the engineering construction scheme for small sluices; 1.4 Prepare construction schedule plans; 1.5 Prepare the layout of the construction site; 1.6 Prepare construction organization design documents.

10. Prepare the resource planning; 11. Compile and prepare engineering construction organization design documents for small sluices.	**2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Basic principles of hydraulics; 2.2 Principles of geotechnics and engineering geology; 2.3 Basic principles of concrete structures; 2.4 Principles of reservoir flood regulation algorithms. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Theory of schedule control; 3.2 Theory of construction site layout; 3.3 Theory of value engineering; 3.4 Theory of construction organization design. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Learning skills; 4.3 Management skills; 4.4 Skills for operating computer software; 4.5 Teamwork skills; 4.6 Report writing skills. **5.0 Mathematical skills;** 5.1 Numerical computation; 5.2 Geometry.
DESCRIPTION OF THE END PRODUCT / SERVICE	Scientific and sound construction organization designs for small sluice works are made according to the sluice design objectives and technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Structural components of the sluices; 2. Quality assessment and acceptance standards for the engineering construction of water conservancy projects; 3. Properties and basic principles of commonly-used building materials; 4. Rules for the preparation of project estimates.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	ENGINEERING CONSTRUCTION OF SMALL WATER CONSERVANCY WORKS	**DUTY NO.**	701
TASK TITLE	CONSTRUCTION OF SMALL PUMP STATIONS	**TASK NO.**	7012
PERFORMANCE CRITERIA	The person performing this task must be able to prepare construction organization and design documents for the small pumping in accordance with the requirements of the relevant technical standards, specifications, design documents and works contracts.		
RANGE STATEMENT	The task can be performed in the office or construction site under the supervision of the senior engineer of water conservancy and hydropower engineering. The tools and equipment to be used include: 1. Computer and office operating system; 2. Information on the topography, hydrology, meteorology, geology and other construction conditions of the project site; 3. Engineering design documents for small pump stations; 4. Manuals on the performance of construction machinery for earthworks, concrete works, electromechanical installation works and metal structure installation works;		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Analyze construction conditions; 2. Prepare construction technology and site; 3. Select construction diversion methods and carry out the design of diversion buildings; 4. Determine the construction scheme for foundation treatment; 5. Determine the engineering construction scheme of small pump stations; 6. Determine the flood interception plan; 7. Prepare the work schedule; 8. Conduct the construction general layout; 9. Prepare target assurance measures for quality, safety and schedule; 10. Prepare the resource planning; 11. Compile and prepare engineering construction organization design documents for small pump stations.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine construction diversion options; 1.2 Determine the construction scheme for foundation treatment; 1.3 Determine the engineering construction scheme for small pump stations; 1.4 Prepare construction schedule plans; 1.5 Prepare the layout of the construction site; 1.6 Prepare construction organization design documents. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Basic principles of hydraulics;

	2.2 Principles of geotechnics and engineering geology; 2.3 Basic principles of concrete structures; 2.4 Principles of reservoir flood regulation algorithms. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Theory of schedule control; 3.2 Theory of construction site layout; 3.3 Theory of value engineering; 3.4 Theory of construction organization design. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Learning skills; 4.3 Management skills; 4.4 Skills for operating computer software; 4.5 Teamwork skills; 4.6 Report writing skills. **5.0 Mathematical skills** 5.1 Numerical computation; 5.2 Geometry.
DESCRIPTION OF THE END PRODUCT / SERVICE	Scientific and sound construction organization designs for small pump station works are made according to the pump station design objectives and technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Structural components of the pumping stations; 2. Quality assessment and acceptance standards for the engineering construction of water conservancy projects; 3. Properties and basic principles of commonly-used building materials; 4. Rules for the preparation of water conservancy project estimates.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	ENGINEERING CONSTRUCTION OF SMALL WATER CONSERVANCY WORKS	**DUTY NO.**	701
TASK TITLE	CONSTRUCTION OF CANAL STRUCTURES	**TASK NO.**	7013
PERFORMANCE CRITERIA	The person performing this task must be able to prepare construction organization and design documents for canal structures in accordance with the requirements of the relevant technical standards, specifications, design documents and works contracts.		
RANGE STATEMENT	The task can be performed in the office or construction site under the supervision of the senior engineer of water conservancy and hydropower engineering. The tools and equipment to be used include: 1. Computer and office operating system; 2. Information on the topography, hydrology, meteorology, geology and other construction conditions of the project site; 3. Engineering design documents for canal structures; 4. Manuals on the performance of construction machinery for earthworks, concrete works, electromechanical installation works and metal structure installation works;		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Analyze construction conditions; 2. Prepare construction technology and site; 3. Select construction diversion methods and carry out the design of diversion buildings; 4. Determine the construction scheme for foundation treatment; 5. Determine engineering construction schemes for the canal structures; 6. Determine the flood interception plan; 7. Prepare the work schedule; 8. Conduct the construction general layout; 9. Prepare target assurance measures for quality, safety and schedule; 10. Prepare the resource planning; 11. Compile and prepare engineering construction organization design documents for canal structures.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine construction diversion options; 1.2 Determine the construction scheme for foundation treatment; 1.3 Determine engineering construction schemes for the canal structures; 1.4 Prepare construction schedule plans; 1.5 Prepare the layout of the construction site; 1.6 Prepare construction organization design documents. **2.0 Principle** The person performing this task must be able to explain the following principles:

	2.1 Basic principles of hydraulics; 2.2 Principles of geotechnics and engineering geology; 2.3 Basic principles of concrete structures; 2.4 Principles of reservoir flood regulation algorithms. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Theory of schedule control; 3.2 Theory of construction site layout; 3.3 Theory of value engineering; 3.4 Theory of construction organization design. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Learning skills; 4.3 Management skills; 4.4 Skills for operating computer software; 4.5 Teamwork skills; 4.6 Report writing skills. **5.0 Mathematical skills** 5.1 Numerical computation; 5.2 Geometry.
DESCRIPTION OF THE END PRODUCT / SERVICE	Scientific and sound construction organization designs for canal structures are made in accordance with the design objectives and technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Structural composition of canal structures; 2. Quality assessment and acceptance standards for the engineering construction of water conservancy projects; 3. Properties and basic principles of commonly-used building materials; 4. Rules for the preparation of water conservancy project estimates.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	ENGINEERING CONSTRUCTION OF SMALL WATER CONSERVANCY WORKS	**DUTY NO.**	701
TASK TITLE	CONSTRUCTION OF SMALL EARTH-ROCK DAMS	**TASK NO.**	7014
PERFORMANCE CRITERIA	The person performing this task must be able to prepare construction organization and design documents for small earth-rock dams in accordance with the requirements of the relevant technical standards, specifications, design documents and works contracts.		
RANGE STATEMENT	The task can be performed in the office or construction site under the supervision of the senior engineer of water conservancy and hydropower engineering. The tools and equipment to be used include: 1. Computer and office operating system; 2. Information on the topography, hydrology, meteorology, geology and other construction conditions of the project site; 3. Engineering design documents for small earth-rock dams; 4. Manuals on the performance of construction machinery for earthworks, concrete works, electromechanical installation works and metal structure installation works;		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Analyze construction conditions; 2. Prepare construction technology and site; 3. Select construction diversion methods and carry out the design of diversion buildings; 4. Determine the construction scheme for foundation treatment; 5. Determine the engineering construction scheme of small earth-rock dams; 6. Determine the flood interception plan; 7. Prepare the work schedule; 8. Conduct the construction general layout; 9. Prepare target assurance measures for quality, safety and schedule; 10. Prepare the resource planning; 11. Compile and prepare engineering construction organization design documents for small earth-	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine construction diversion options; 1.2 Determine the construction scheme for foundation treatment; 1.3 Determine the engineering construction scheme for small earth-rock dams; 1.4 Prepare construction schedule plans; 1.5 Prepare the layout of the construction site; 1.6 Prepare construction organization design documents. **2.0 Principle** The person performing this task must be

rock dams.	able to explain the following principles: 2.1 Basic principles of hydraulics; 2.2 Principles of geotechnics and engineering geology; 2.3 Structural fundamentals of earthworks; 2.4 Principles of reservoir flood regulation algorithms. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Theory of schedule control; 3.2 Theory of construction site layout; 3.3 Theory of value engineering; 3.4 Theory of construction organization design. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Learning skills; 4.3 Management skills; 4.4 Skills for operating computer software; 4.5 Teamwork skills; 4.6 Report writing skills. **5.0 Mathematical skills** 5.1 Numerical computation; 5.2 Geometry.
DESCRIPTION OF THE END PRODUCT / SERVICE	Scientific and sound construction organization designs for earth-rock dam works are made according to the earth-rock dam design objectives and technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Structural components of earth-rock dams; 2. Quality assessment and acceptance standards for the engineering construction of water conservancy projects; 3. Properties and basic principles of commonly-used building materials; 4. Rules for the preparation of water conservancy project estimates.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	MONITOR OF THE SAFETY OF HYDRAULIC STRUCTURES	**DUTY NO.**	702
TASK TITLE	SAFETY MONITORING OF HYDRAULIC CONCRETE STRUCTURES	**TASK NO.**	7021
PERFORMANCE CRITERIA	The person performing this task must be able to monitor the safety of hydraulic concrete structures and prepare reports on the analysis of monitoring data in accordance with the requirements of the relevant technical standards, rectification protocols and technical requirements.		
RANGE STATEMENT	The task can be performed in the office or construction site under the supervision of the senior engineer of water conservancy and hydropower engineering. The tools and equipment to be used include: 1. Computer and office operating system; 2. Intelligent monitoring system for the safety of hydraulic concrete structures; 3. Environmental volumes, deformation and seepage monitoring equipment; 4. Stress-strain and temperature monitoring equipment.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Operate intelligent monitoring system for the safety of hydraulic concrete structures; 2. Operate environmental quantity monitoring equipment; 3. Operate deformation monitoring equipment; 4. Operate seepage monitoring equipment; 5. Operate stress-strain and temperature monitoring equipment; 6. Analyze and judge the operational status of monitoring equipment; 7. Analyze and judge the operational status of monitoring systems; 8. Analyze and judge the reasonableness of monitoring data; 9. Prepare safety monitoring reports for hydraulic concrete structures.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Select safety monitoring systems; 1.2 Choose environmental volumes, deformation and seepage monitoring equipment; 1.3 Select stress-strain and temperature monitoring equipment; 1.4 Select monitoring data analysis methods; 1.5 Prepare safety monitoring analysis. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Working principles of monitoring equipment sensor; 2.2 Working principles of the monitoring system.

	3.0 Theories The person performing this task must be able to explain the following: 3.1 Theory of safety monitoring of hydraulic concrete structures; 3.2 Theory of mathematical and statistical analysis; 3.3 Theory of protocols for the integration of safety monitoring information. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Learning skills; 4.3 Management skills; 4.4 Relevant software and hardware operating skills; 4.5 Teamwork skills; 4.6 Report writing skills; 4.7 Data analysis and processing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	In accordance with the requirements of the technical standards, the integral regulations and technical requirements for the safety monitoring of hydraulic concrete structures, the environmental volume, deformation, seepage, stress-strain and temperature of hydraulic concrete structures are monitored for safety and reports on the analysis of the monitoring data are prepared.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Design and construction of hydraulic concrete structures; 2. Internet of Things; 3. Sensor arrangement and installation.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	MONITOR OF THE SAFETY OF HYDRAULIC STRUCTURES	**DUTY NO.**	702
TASK TITLE	STRUCTURAL SAFETY MONITORING OF SLUICES	**TASK NO.**	7022
PERFORMANCE CRITERIA	The person performing this task must be able to monitor the safety of sluices and prepare reports on the analysis of monitoring data in accordance with the requirements of the relevant technical standards, rectification protocols and technical requirements.		
RANGE STATEMENT	The task can be performed in the office or construction site under the supervision of the senior engineer of water conservancy and hydropower engineering. The tools and equipment to be used include: 1. Computer and office operating system; 2. Intelligent monitoring system for the safety of sluices; 3. Environmental volumes, deformation and seepage monitoring equipment; 4. Stress-strain and temperature monitoring equipment.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Operate the intelligent monitoring system for the safety of sluice structures; 2. Operate environmental quantity monitoring equipment; 3. Operate deformation monitoring equipment; 4. Operate seepage monitoring equipment; 5. Operate stress-strain and temperature monitoring equipment; 6. Analyze and judge the operational status of monitoring equipment; 7. Analyze and judge the operational status of monitoring systems; 8. Analyze and judge the reasonableness of monitoring data; 9. Prepare safety monitoring reports for sluice structures.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Select safety monitoring systems; 1.2 Choose environmental volumes, deformation and seepage monitoring equipment; 1.3 Select stress-strain and temperature monitoring equipment; 1.4 Select monitoring data analysis methods; 1.5 Prepare safety monitoring analysis. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Working principles of monitoring equipment sensor; 2.2 Working principles of the monitoring

	system. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Theory of safety monitoring of sluice structures; 3.2 Theory of mathematical and statistical analysis; 3.3 Theory of protocols for the integration of safety monitoring information. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Learning skills; 4.3 Management skills; 4.4 Relevant software and hardware operating skills; 4.5 Teamwork skills; 4.6 Report writing skills; 4.7 Data analysis and processing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	In accordance with the requirements of the technical standards, the integral regulations and technical requirements for the safety monitoring of sluices, the environmental volume, deformation, seepage, stress-strain and temperature of sluices are monitored for safety and reports on the analysis of the monitoring data are prepared.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Design and construction of sluice structures; 2. Internet of Things; 3. Sensor arrangement and installation; 4. Gate installation and operation management.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	MONITOR OF THE SAFETY OF HYDRAULIC STRUCTURES	**DUTY NO.**	702
TASK TITLE	SAFETY MONITORING OF EARTH-ROCK DAMS	**TASK NO.**	7023
PERFORMANCE CRITERIA	The person performing this task must be able to monitor the safety of earth-rock dams and prepare reports on the analysis of monitoring data in accordance with the requirements of the relevant technical standards, rectification protocols and technical requirements.		
RANGE STATEMENT	The task can be performed in the office or construction site under the supervision of the senior engineer of water conservancy and hydropower engineering. The tools and equipment to be used include: 1. Computer and office operating system; 2. Intelligent monitoring systems for the safety of earth-rock dams; 3. Environmental volumes, deformation and seepage monitoring equipment; 4. Pressure (stress) and temperature monitoring equipment.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Operate the intelligent monitoring system for the safety of earth-rock dams; 2. Operate environmental quantity monitoring equipment; 3. Operate deformation monitoring equipment; 4. Operate seepage monitoring equipment; 5. Operate pressure (stress) and temperature monitoring equipment; 6. Analyze and judge the operational status of monitoring equipment; 7. Analyze and judge the operational status of monitoring systems; 8. Analyze and judge the reasonableness of monitoring data; 9. Preparation of safety monitoring reports for earth-rock dams.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Select safety monitoring systems; 1.2 Choose environmental volumes, deformation and seepage monitoring equipment; 1.3 Adopt pressure (stress) and temperature monitoring equipment. 1.4 Select monitoring data analysis methods; 1.5 Prepare safety monitoring analysis. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Working principles of monitoring equipment sensor; 2.2 Working principles of the monitoring

	system. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Theory of safety monitoring of earth-rock dams; 3.2 Theory of mathematical and statistical analysis; 3.3 Theory of protocols for the integration of safety monitoring information. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Learning skills; 4.3 Management skills; 4.4 Relevant software and hardware operating skills; 4.5 Teamwork skills; 4.6 Report writing skills; 4.7 Data analysis and processing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	In accordance with the requirements of the technical standards, the integral regulations and technical requirements for the safety monitoring of earth-rock dams, the environmental volume, deformation, seepage, stress-strain and temperature of earth-rock dams are monitored for safety and reports on the analysis of the monitoring data are prepared.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Design and construction of earth-rock dams; 2. Internet of Things; 3. Sensor arrangement and installation.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	MONITOR OF THE SAFETY OF HYDRAULIC STRUCTURES	**DUTY NO.**	702
TASK TITLE	DEFECT TREATMENT OF HYDRAULIC CONCRETE DISEASE CONTROL AND EARTH-ROCK DAMS	**TASK NO.**	7024
PERFORMANCE CRITERIA	The person performing this task must be able to prevent and treat the defects of hydraulic concrete and earth-rock dams in accordance with the requirements of the relevant technical standards, technical requirements and project information.		
RANGE STATEMENT	The task can be performed in the office or construction site under the supervision of the senior engineer of water conservancy and hydropower engineering. The tools and equipment to be used include: 1. Computer and office operating system; 2. Detection equipment on the strength of hydraulic concrete; 3. Equipment for the repair of hydraulic concrete surfaces; 4. Equipment for the treatment of defects in earth-rock dams.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Correctly analyze and evaluate the presence of disease problems in hydraulic concrete; 2. Correctly analyze and evaluate the problems of deficiencies in earth-rock dams; 3. Operate detection equipment on the strength of hydraulic concrete; 4. Operate equipment for the treatment of surface defects in hydraulic concrete; 5. Operate earth-rock dam defect treatment equipment; 6. Develop implementation programs for the prevention and control of hydraulic concrete defects; 7. Develop implementation programs for the treatment of defects in earth-rock dams; 8. Prepare summary reports on disease control and defect treatment.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Analyze and evaluate hydraulic concrete distress problems; 1.2 Analyze and evaluate the problem of earth-rock dam defects; 1.3 Select equipment and methods for the control of hydraulic concrete defects; 1.4 Select equipment and methods for dealing with defects in earth-rock dams; 1.5 Prepare summary reports on the handling of issues. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Principles of hydraulic concrete

	disease control; 2.2 Principles of earth-rock dam defect treatment. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Theory of quality control of hydraulic concrete; 3.2 Quality control theory for earth-rock dams; 3.3 Theory of hydraulic concrete materials testing; 3.4 Theory of earth and rock material testing. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Learning skills; 4.3 Management skills; 4.4 Relevant software and hardware operating skills; 4.5 Teamwork skills; 4.6 Report writing skills; 4.7 Data analysis and processing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	According to the requirements of the relevant technical standards, technical requirements and project information, disease problems such as cracking, strength, exposed reinforcement and breakage of hydraulic concrete are prevented, defects such as seepage and compaction of earth-rock dams are dealt with, and summary reports of the problems are prepared.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Design and construction of earth-rock dams; 2. Design and construction of hydraulic concrete structures; 3. Knowledge of dam safety monitoring.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	MONITOR OF THE SAFETY OF HYDRAULIC STRUCTURES	**DUTY NO.**	702
TASK TITLE	SAFETY EVALUATION OF HYDRAULIC STRUCTURES	**TASK NO.**	7025
PERFORMANCE CRITERIA	The person performing this task must be able to assess the safety of hydraulic structures and prepare a safety assessment report based on the requirements of the relevant technical standards, monitoring data, project information and technical requirements.		
RANGE STATEMENT	The task can be performed in the office or hydropower station under the supervision of the senior engineer of water conservancy and hydropower engineering. The tools and equipment to be used include: 1. Computer and office operating system; 2. Safety monitoring systems for hydraulic structures; 3. Monitoring equipment for hydraulic structures; 4. Documentation of project information and historical monitoring data.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Operate the monitoring system to query historical data; 2. Operate the monitoring equipment to query historical data; 3. Assess the quality of hydraulic structures in combination with monitoring data; 4. Assess the structural safety of hydraulic structures in combination with monitoring data; 5. Assess the seepage safety of hydraulic structures in combination with monitoring data; 6. Assess the operation management of hydraulic structures in combination with monitoring data; 7. Assess the comprehensive safety of hydraulic structures in combination with monitoring data; 8. Prepare a safety assessment report for hydraulic structures to give the conclusions of the assessment.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Select methods for assessing the quality of the work; 1.2 Select structural safety assessment methods; 1.3 Select seepage safety assessment methods; 1.4 Select O&M assessment methods; 1.5 Select comprehensive assessment methods for the safety of hydraulic structures. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Principles and guidelines for quality and operational management assessment; 2.2 Principles and guidelines for seepage and structural safety assessment;

	2.3 Integrated assessment principles and guidelines. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Theory of safety monitoring of hydraulic structures; 3.2 Theory of mathematical and statistical analysis; 3.3 Theory of integrated safety evaluation of hydraulic structures. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Learning skills; 4.3 Management skills; 4.4 Relevant software and hardware operating skills; 4.5 Teamwork skills; 4.6 Report writing skills; 4.7 Data analysis and processing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Based on the relevant technical standards, monitoring data, project information and the requirements of the technical requirements, the safety of the hydraulic structures in terms of quality, operation and management, seepage and structure is comprehensively assessed and a safety assessment report is prepared and the conclusions are given.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Design and construction of hydraulic structures; 2. Operation and management of hydraulic structures; 3. Knowledge of protocols for compiling safety monitoring information on dams.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	OPERATION AND MAINTENANCE MANAGEMENT OF WATER CONSERVANCY PROJECTS	**DUTY NO.**	**703**
TASK TITLE	MAINTENANCE AND MANAGEMENT OF GATES AND THEIR OPENING AND CLOSING EQUIPMENT	**TASK NO.**	7031
PERFORMANCE CRITERIA	The person performing this task must be able to inspect, operate, maintain and repair gates of hydraulic structures and their opening and closing equipment in accordance with the technical requirements for gates and opening and closing equipment and the manufacturer's maintenance manual.		
RANGE STATEMENT	The task can be performed in the office or hydropower station under the supervision of the senior engineer of water conservancy and hydropower engineering. The tools and equipment to be used include: 1. Computer and office operating system; 2. Metal testing instrument; 3. Measuring tools such as tape measures and vernier calipers; 4. All types of wrenches, bench vices, hand hammers and other pincer tools; 5. Soldering tools such as pliers, grinders and soldering irons; 6. Lubrication tools such as grease guns or oil cans.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Inspect gates and parts found to be covered with debris such as aquatic life attachments and silt; 2. Inspect whether gates are found to be tilted and that door slots are free from obstructions; 3. Inspect whether fasteners are found to be loose or damaged in various parts of the gates and their opening and closing equipment; 4. Inspect whether steel gates and their opening and closing equipment are found to be deficient in their anti-corrosion coating; 5. Operate the opening and closing of gates in	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Inspect gates and parts for cleanliness, jamming, loose fasteners and defective anti-corrosion coatings; 1.2 Operate the opening and closing of gates in situ and their disposal after operation; 1.3 Use wrenches, grease guns and oil cans; 1.4 Clean the surface of the gates and opening and closing equipment and meet the requirements for anti-corrosion treatment.

situ; 6. Reset buttons and switches after shutdown; 7. Clean silt, adherents and upstream and downstream floating objects from gates and parts; Use oil guns or oil pots to lubricate support wheels, guide wheels and sliders; 8. Use manual wrenches to tighten the connecting bolts of the various parts of the gates and opening and closing equipment; 9. Clean the gates and all parts of the opening and closing equipment prior to surface corrosion treatment; 10. Record the inspection, operation, maintenance and repair of gates and opening and closing equipment.	**2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Types and properties of materials commonly-used in the maintenance and repair of gates and opening and closing equipment; 2.2 Knowledge of inspection, operation, maintenance and repair of gates and opening and closing equipment. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Safety operation procedures and precautions; 3.2 Conditions in which gates and opening and closing equipment may be in danger and commonly-used methods of rescue; 3.3 Basic theory of mechanical and hydraulic transmissions. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Interdisciplinary learning skills; 4.3 Management skills; 4.4 Teamwork skills;
DESCRIPTION OF THE END PRODUCT / SERVICE	In accordance with the technical requirements for gates and opening and closing equipment for hydraulic structures and the manufacturer's maintenance manual, gates and their opening and closing equipment for hydraulic structures are inspected, operated, maintained and repaired to ensure their safe and smooth operation.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety operation of measuring instruments; 2. Safety operation of operating machines and tools; 3. Provisions for the inspection of gates and opening and closing equipment; 4. Knowledge of work safety and environmental protection.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	OPERATION AND MAINTENANCE MANAGEMENT OF WATER CONSERVANCY PROJECTS	**DUTY NO.**	**703**
TASK TITLE	MAINTENANCE AND REPAIR OF CONCRETE DAMS	**TASK NO.**	7032
PERFORMANCE CRITERIA	The person performing this task must be able to maintain and repair concrete dams, according to their structural characteristics and the properties of the concrete material, in order to keep them safe, intact and functioning properly.		
RANGE STATEMENT	The task can be performed in the office or hydropower station under the supervision of the senior engineer of water conservancy and hydropower engineering. The tools and equipment to be used include: 1. Computer and office operating system; 2. Instruments for measuring crack widths such as reading microscopes, feeler gauges and strain gauges; 3. Pens, notepads, cameras, video recorders, etc.; 4. Mortar materials of all types of protection; 5. Steel wire brushes, wind and sand guns.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Inspect for surface defects in concrete such as honeycomb, pockmarks, holes, missing edges and corners, extrusion damage, etc.; 2. Inspect for cracks in concrete; 3. Inspect for leaks in the dam body, dam base and seepage around the dam; 4. Be able to clean concrete surfaces and trenches of loose material, weeds, rubbish, etc. and keep surfaces clean and tidy; 5. Repair minor defects in concrete surfaces using cement mortar; 6. Repair microscopic cracks in the surface layer by spraying; 7. Determine initially the causes of leakage and its hazards;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Inspect for concrete surface defects, cracks, leaks in the base and the body of the dam, and leakage around the dam; 1.2 Repair minor defects and micro-cracks in the surface of concrete; 1.3 Determine the causes of leakage and its hazards; **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Concrete material properties; 2.2 Knowledge of concrete dam inspection, maintenance and repair. **3.0 Theories**

8. Document the inspection, maintenance and repair of concrete dams.	The person performing this task must be able to explain the following: 3.1 Safety operation procedures and precautions; 3.2 Investigation of concrete cracks and analysis of their causes; 3.3 Inspection of concrete surface defects, cracks, leaks in the base and body of the dam and leakage around the dam; **4.0 Essential Skills** 4.1 Communication skills; 4.2 Management skills; 4.3 Teamwork skills; 4.4 Entrepreneurial skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Concrete dams are maintained and repaired according to their structural characteristics and the properties of the concrete material, in order to keep them safe, intact and functioning properly.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety operation of measuring instruments; 2. Safety operation of operating machines and tools; 3. Provisions for the inspection and maintenance of concrete dams; 4. Knowledge of work safety and environmental protection.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	OPERATION AND MAINTENANCE MANAGEMENT OF WATER CONSERVANCY PROJECTS	**DUTY NO.**	**703**
TASK TITLE	MAINTENANCE AND MANAGEMENT OF PUMP STATIONS	**TASK NO.**	7033
PERFORMANCE CRITERIA	The person performing this task must be able to maintain and repair the pumps in accordance with their working principles and the manufacturer's manual to keep the pumping station running safely, smoothly and properly.		
RANGE STATEMENT	The task can be performed in the office or hydropower station under the supervision of the senior engineer of water conservancy and hydropower engineering. The tools and equipment to be used include: 1. Computer and office operating systems; 2. Wrench fastening tools; 3. Lubricating oil/lubricating grease; 4. Testing instruments such as ammeters, voltmeters and pressure gauges.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Rotate the coupling to observe whether the pump rotation is flexible and smooth, whether there is debris in the pump, whether there is noise in the bearings and other phenomena, and whether the belt is loose or tight; 2. Inspect and tighten all bolts and screws; 3. Inspect the connection of the motor traverses to ensure the normal direction of rotation of the pump; 4. Inspect whether the instruments are in working order; 5. Replace the lubricating oil and lubricating grease in the bearings at regular intervals; 6. Keep the unit clean by drying the	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Inspect whether the pump rotates flexibly and smoothly, whether there is debris in the pump, whether there is noise in the bearings and whether the belt is loose or tight; 1.2 Operate the pump in situ and dispose after operation. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Principle of water pump operation. **3.0 Theories** The person performing this task must be able to explain

water and oil stains on the pump and pipes after stopping.	the following: 3.1 Safety operation procedures and precautions; 3.2 Selection and matching of units; 3.3 Common faults and elimination methods. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Interdisciplinary learning skills; 4.3 Management skills; 4.4 Teamwork skills; 4.5 Entrepreneurial skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Pumps are maintained and repaired in accordance with their working principles and the manufacturer's manual, and pumping stations are operated safely, smoothly and properly.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety operation of meter testing instruments; 2. Safety operation of operating machines and tools; 3. Common faults and troubleshooting methods for various types of pumps; 4. Knowledge of work safety and environmental protection.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	OPERATION AND MAINTENANCE MANAGEMENT OF WATER CONSERVANCY PROJECTS	**DUTY NO.**	**703**
TASK TITLE	EARTHEN EMBANKMENT PIPE SURGE HAZARD PROTECTION	**TASK NO.**	7034
PERFORMANCE CRITERIA	The person performing this task must be able to accurately identify the risk of pipe surges based on the causes of the surges and use appropriate rescue measures to ensure the safe and smooth operation of the earthen embankment.		
RANGE STATEMENT	The task can be performed at the scene of danger under the supervision of the senior engineer of water conservancy and hydropower engineering. The tools and equipment to be used include: 1. Computer and office operating system; 2. Spades.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Inspect for precursors to the occurrence of pipe surges in earthen embankments, such as overturned sand and bulging water and bubbling springs; 2. Analyze the causes of tube surges; 3. Determine the severity of a pipe surge hazard; 4. Use woven bags or sacks filled with soil to snatch and build sand and gravel around the well at the exit of the pipe gushing, which is synchronously filled with anti-filtration material, and never use impermeable materials; 5. Use good permeable materials to fill in the anti-filtration layer gland when groups of pipe surges appear in the embankment; 6. Use the channel behind the embankment or the pond water level to store water back pressure to stabilize the tube surge hazard. 7. Use straw 10-20cm thick in the raised part of the bale, willow branches or reeds 20-30cm thick on top of it, and finally pressed with bags of soil or	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Inspect for precursors to the occurrence of pipe surges in earthen embankments, such as overturned sand and bulging water and bubbling springs; 1.2 Conduct rescue construction of gravel fence wells; 1.3 Fill the back filter gland; 1.4 Use the channel behind the embankment or the pond water level to store water back pressure to stabilize the tube surge hazard. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Causes of tube surges; 2.2 Precursor phenomena to the occurrence

blocks of stone; 8. Clean up the site and observe the subsequent development of the danger.	of pipe surges and their severity; 2.3 Principle of tube surge rescue measures. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Safety operation procedures and precautions. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Interdisciplinary learning skills; 4.3 Management skills; 4.4 Teamwork skills; 4.5 Entrepreneurial skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The person performing this task must be able to accurately identify the risk of pipe surges based on the causes of the surges and use appropriate rescue measures to ensure the safe and smooth operation of the earthen embankment.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety operation of operating machines and tools; 2. Provisions for routine and flood inspections of earth embankments; 3. Knowledge of work safety and environmental protection.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	ENGINEERING DESIGN OF SMALL WATER CONSERVANCY WORKS	**DUTY NO.**	704
TASK TITLE	DESIGN OF SMALL SLUICES	**TASK NO.**	7041
PERFORMANCE CRITERIA	The person performing this task must be able to develop a reasonable design scheme, according to the requirements of the small sluice, in combination with the geological conditions and relevant technical requirements, in order to obtain a safe and economical design of the small sluices.		
RANGE STATEMENT	The task can be performed in the office, construction site or other sides under the supervision of the senior engineer of water conservancy and hydropower engineering. The tools and equipment to be used include: 1. Computer and office operating system; 2. Information on the topography, hydrology, meteorology, geology and other construction conditions of the project site; 3. Specifications relating to sluices; 4. CAD design drawing software; 5. Relevant engineering calculation software.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Conduct site selection for small sluices; 2. Describe the construction and the requirements of the gate chamber; 3. Design gate holes; 4. Design the energy-dissipation and scour prevention; 5. Calculate gate chamber stresses and slip stability calculations.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Site selection for small sluices; 1.2 Design gate holes; 1.3 Design the energy-dissipation and scour prevention; 1.4 Carry out structural design, stress calculations and slip stability calculations for the lock chamber; 1.5 Perform foundation treatment. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Basic principles of hydraulics; 2.2 Basic principles of hydraulics; 2.3 Principles of reservoir flood regulation algorithms; 2.4 General principles for the impermeable drainage arrangement of the gate base.

	3.0 Theories The person performing this task must be able to explain the following: 3.1 Theory of gate design; 3.2 Theory of energy-dissipation and scour prevention design; 3.3 Theory of slip stability design and stress calculation. **4.0 Essential Skills** 4.1 Data collection skills; 4.2 Software operation; 4.3 Teamwork; 4.4 Report preparation; 4.5 Drawing reading.
DESCRIPTION OF THE END PRODUCT / SERVICE	A reasonable design scheme is developed, according to the requirements of the small sluices, in combination with the geological conditions and relevant technical requirements, in order to obtain a safe and economical design of the small sluices.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Hydrological parameters and geological conditions 2. Classification of water conservancy and hydropower engineering classes and hydraulic structure classes 3. Foundation treatment 4. Weir flow hydraulics calculations

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	ENGINEERING DESIGN OF SMALL WATER CONSERVANCY WORKS	**DUTY NO.**	704
TASK TITLE	DESIGN OF SMALL PUMP STATIONS	**TASK NO.**	7042
PERFORMANCE CRITERIA	The person performing this task must be able to reasonably carry out design schemes in accordance with the requirements of the construction of small pump stations and in accordance with the relevant technical requirements, and ultimately obtain the design of small pumping stations.		
RANGE STATEMENT	The task can be performed in the office, construction site or other sides under the supervision of the senior engineer of water conservancy and hydropower engineering. The tools and equipment to be used include: 1. Computer and office operating system; 2. Engineering-related information; 3. Specifications relating to pumps; 4. CAD design drawing software.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Classify pumps and confirming pump models; 2. Select the unit and confirm the installed capacity; 3. Determine the pumping unit according to actual needs; 4. Identify pump head characteristic curves; 5. Classify the types of pumping stations, according to the characteristics of the foundation structure; 6. Carry out the design of the piping arrangement.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Select the type of pump and its range of applications; 1.2 Confirm the pump type; 1.3 Determine the pumping unit of the pump; 1.4 Identify pump head characteristic curves; 1.5 Classify types of pumping houses; 1.6 Carry out the design of pumping units and piping arrangements. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Basic principles of hydraulics; 2.2 Working principles of pumps; 2.3 Principles of the hydraulic properties. **3.0 Theories**

	The person performing this task must be able to explain the following: 3.1 Pump head characteristic curves; 3.2 Pipeline hydraulic characteristic curves; 3.3 Pump operating conditions. **4.0 Essential Skills** 4.1 Data collection skills; 4.2 Software operation; 4.3 Teamwork; 4.4 Report preparation; 4.5 Drawing reading.
DESCRIPTION OF THE END PRODUCT / SERVICE	Design schemes are reasonably carried out in accordance with the requirements of the construction of small pump stations and in accordance with the relevant technical requirements, and ultimately obtain the design of small pumping stations.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Hydrological parameters and geological conditions; 2. Classification of water conservancy and hydropower engineering classes and hydraulic structure classes; 3. Foundation treatment; 4. Weir flow hydraulics calculations.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	ENGINEERING DESIGN OF SMALL WATER CONSERVANCY WORKS	**DUTY NO.**	704
TASK TITLE	DESIGN OF CANAL STRUCTURES	**TASK NO.**	7043
PERFORMANCE CRITERIA	The person performing this task must be able to develop a reasonable design scheme, according to the requirements of the canal structures, in combination with the geological conditions and relevant technical requirements, in order to obtain a safe and economical design of the canal structures.		
RANGE STATEMENT	The task can be performed in the office, construction site or other sides under the supervision of the senior engineer of water conservancy and hydropower engineering. The tools and equipment to be used include: 1. Computer and office operating system; 2. Information on the topography, hydrology, meteorology, geology and other construction conditions of the project site; 3. Relevant regulations of canal structures; 4. CAD design drawing software.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Determine the arrangement of canal structures; Reasonably arrange the location and spacing of canals and canal structures, taking into account factors such as the topography and landform, water flow path, water quantity requirements and soil conditions; 2. Choose the right channel route based on the function and needs of the channel. Select and optimize channel routes, taking into account factors such as topographic slope, water velocity, soil stability and environmental protection; 3. Consider the general layout and design elements when designing the ferry, including determining the type of ferry (e.g. open, concealed, etc.), size, water supply competence, choice of materials, etc.; 4. Determine the conditions of application for inverted siphons and design suitable inverted siphons as required;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Identify the types of canal structures and their roles; 1.2 Carry out the classification of channels for irrigation purposes; 1.3 Make channel route choices; 1.4 Carry out the design of crossings, inverted siphons and steep slopes and drops. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Basic principles of hydraulics; 2.2 Principles of reservoir flood regulation algorithms. **3.0 Theories** The person performing this task must be able to

5. Understand the forms and main functions of steep slopes and drops. Provide suitable steep slopes and drops as required to allow smooth flow and slow down the velocity of the water to protect the stability of the channel and canal structures.	explain the following: 3.1 Theory of channel design; 3.2 Theory of ferry design. **4.0 Essential Skills** 4.1 Data collection skills; 4.2 Software operation; 4.3 Teamwork; 4.4 Report preparation; 4.5 Drawing reading.
DESCRIPTION OF THE END PRODUCT / SERVICE	According to the construction requirements of the canal structures, in combination with the geological conditions and in accordance with relevant technical requirements, the design scheme is reasonably developed to obtain the final design effect of the canal building.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of hydrology, geology, etc.; 2. Calculation of open channel uniform flow; 3. Drawing of the water surface line.

TABLE 1: DACUM CHARTS FOR WATER CONSERVANCY AND HYDROPOWER ENGINEER - NTA 7

DUTIES	TASKS	ENABLERS
1.0 Engineering construction of small water conservancy works	1.1 Construction of small sluices. 1.2 Construction of small pump stations. 1.3 Construction of canal structures. 1.4 Construction of small earth-rock dams.	**General skills and knowledge** ● Drafting, surveying and proofing ● Communication skills ● Analysis competence ● Computer knowledge ● Design competence ● Software operating competence ● Teamwork skills ● Ability of innovation ● Report writing skills **Tools and equipment** ● Measuring Instrument ● Computer ● Earthmoving machinery ● Transportation machinery ● Earth compaction machinery ● Lifting machinery ● Pile machine ● Grouting pump ● Grout mixer ● Concrete mixers ● Water pump ● Hole-drilling equipment ● Reinforcement processing machinery ● Concrete vibrator ● Cooling equipment, etc. **Materials** ● Formwork ● Reinforcement ● Steel sections and sheet piles ● Coarse and fine aggregates, earth, stone, cement and timber ● Explosives, diesel, petrol, small hardware, water and electricity ● Compressed air, cables, water supply pipes, air supply ducts, bricks, blocks and other materials ● Office supplies **Requirements for employees**

DUTIES	TASKS	ENABLERS
		● Professional dedication ● Innovative spirit ● Teamwork spirit ● Team spirit ● Honesty and trustworthiness ● Scientific spirit and rigor ● Safety consciousness ● Environmental protection awareness ● Big-picture awareness
2.0 Monitor of the safety of hydraulic structures	2.1 Safety monitoring of hydraulic concrete structures. 2.2 Structural safety monitoring of sluices. 2.3 Safety monitoring of earth-rock dams. 2.4 Defect treatment of hydraulic concrete disease control and earth-rock dams. 2.5 Safety evaluation of hydraulic structures. 2.6 Safety monitoring of hydraulic concrete structures.	**General skills and knowledge** ● Communication skills ● Learning skills ● Management skills ● Software and hardware operating skills ● Teamwork skills ● Report writing skills ● Data analysis and processing skills ● Office software operation skills **Tools and equipment** ● Computer and its operating system ● Safety monitoring system ● Security monitoring equipment ● Data analysis software **Materials** ● Safety monitoring specification manual ● Project information and historical monitoring data ● Technical standards for automated safety monitoring **Requirements for employees** ● Teamwork spirit ● Honesty and trustworthiness ● Scientific spirit and rigor ● Safety consciousness ● Environmental protection awareness ● Big-picture awareness
3.0 Operation and maintenance management of	3.1 Maintenance and management of gates and their opening and closing equipment.	**General skills and knowledge** ● Safety operation and safety precautions

DUTIES	TASKS	ENABLERS
water conservancy projects	3.2 Maintenance and repair of concrete dams. 3.3 Maintenance and management of pump stations. 3.4 Earthen embankment hazard rescue.	● Use of the statute book ● Engineering Hydrology and Hydraulics ● Interpretation of technical drawings ● Conservation and maintenance material science **Tools and equipment** ● Computer and its operating system ● Inspection of survey measurement tools ● Maintenance and repair of construction machines and tools **Materials** ● Commonly-used materials for conservation and maintenance ● Basic engineering data and drawings **Requirements for employees** ● Dedicated to work ● Pursuit of excellence ● Professional dedication ● Rigor and truthfulness
4.0 Engineering design of small water conservancy works	4.1 Design of small sluices. 4.2 Design of small pump stations. 4.3 Design of canal structures.	**General skills and knowledge** ● Communication skills ● Learning skills ● Management skills ● Software and hardware operating skills ● Teamwork skills ● Report writing skills ● Data calculation and processing ● Office software operation skills **Tools and equipment** ● Computer and its operating system ● CAD design drawing software ● Information on the topography, hydrology, meteorology, geology and other construction conditions of the project site ● Relevant specifications ● Related engineering calculation

DUTIES	TASKS	ENABLERS
		software **Materials** ● Printer ● A4 paper ● Other materials required for manual calculation needs (pens, books, etc.) **Requirements for employees** ● Teamwork spirit ● Honesty and trustworthiness ● Scientific spirit and rigor ● Safety consciousness ● Environmental protection awareness ● Big-picture awareness