NATIONAL COUNCIL FOR TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING

MARCH 2023

PROPOSED OCCUPATIONAL STANDARDS

OCCUPATION: WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN

LEVEL: NTA 6

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ABBREVIATIONS

CBET	Competency Based Education and Training
CEC	Concrete Engineering Construction
CRW	Construction of Rebar Works
DRO	Drilling Rig Operation
EC	Earthwork Construction
HGO	Hydraulic Gate Operation
HM	Hydrological Monitoring
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
WCPM	Water Conservancy Project Monitoring
WCOCM	Water Conservancy Organization and Construction Management

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: catering service)
Occupational Competence:	The application of knowledge and skills to perform consistently to the standards required in the working context.
Occupational Standards:	Specific requirements of competences people are expected to demonstrate in a particular occupational area, including knowledge and relevant attitudes. They also act as performance tools of assessment of the prescribed outcomes.
Performance Criteria:	Indicate the expected end results or outcome in form of evaluative statements.
Skills:	The ability to perform occupational tasks with a high degree of proficiency within a given occupation. Skills are conceived of as a composite of three completely interdependent components: cognitive, affective, and psychomotor activities.

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, and safety concerns required of 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 a product, service, or decision.
Underpinning Knowledge:	The crucial knowledge that an individual must acquire in order to perform a given task.
Verification Process:	The process of experts reviewing and confirming the statements of tasks (competency) through occupational analysis. Other questions such as the degree of task learning difficulty are also frequently asked. This process is sometimes referred to as validation.

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 Education 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 Occupation 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).

The Water Conservancy and Hydropower Engineering Technician Occupation 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 STANDARDS 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 expert workers 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 Engineering Technicians were key informants in the survey to discover occupational trends. This 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 OCCUPATIONAL STANDARDS FOR WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIANS

The standards cover a broad range of duties and tasks that can be performed by a Water Conservancy and Hydropower Engineering Technician. 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 Engineering Technician 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.

The Water Conservancy and Hydropower Engineering Technician works under the supervision of the engineer, operating the drilling rig to complete drilling construction, and overseeing the construction site, including earthwork and reinforced concrete works. Additionally, they are required to perform water conservancy project monitoring and maintenance, hydraulic gate operation and maintenance, and hydrological surveys. Generally, the Water Conservancy and Hydropower Engineering Technician performs the following duties:

a) Operation of the drilling rig

b) Identification and selection of earthwork construction machinery (equipment)

c) Operation and maintenance of earthwork construction machinery (equipment)

d) Preparation of earthwork construction scheme and offering of onsite guidance

e) Identification and selection of concrete construction materials and equipment

f) Concrete construction and finishing

g) Formulation and check of the concrete construction plan

h) Steel bar processing, connection, and installation

i) Preparation of the steel bar construction scheme

j) Monitoring of the water conservancy project and recording of the data

k) Detection, inspection and maintenance of water conservancy project monitoring facilities

l) Routine inspection and maintenance of hydraulic gate operation, abnormality identification and local maintenance, abnormality elimination, and equipment maintenance

m) Observation and measurement of (test) precipitation, water level, and flow, and reorganization of data

n) Hydrological survey, groundwater observation, and water quality monitoring

o) Installation and maintenance of hydrological survey instruments and equipment, and hydrological information prediction

p) Water conservancy and hydropower engineering construction management

The Occupational Standards have been clustered into NTA qualification levels, i.e. NTA 4, 5 and 6.

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 ENGINEERING TECHNICIAN - NTA 6

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	EXCAVATION OF WATER INTAKE WELLS	**DUTY NO.**	601
TASK TITLE	PREPARATION OF DRILLING TOOLS AND DRILLING MEASUREMENT RECORDS	**TASK NO.**	6011
PERFORMANCE CRITERIA	The person performing this task must be able to select and equip drilling tools, measure drilling tools, correct hole depth, measure hole curvature, record and fill in the team report according to team characteristics.		
RANGE STATEMENT	The task can be performed on the drilling site under the supervision of senior technicians or water conservancy and hydropower engineering engineers. The tools and equipment to be used include: 1. Drill bit; 2. Drill rod; 3. Drill collar; 4. Sediment tube, etc.; 5. Measuring tool; 6. Borehole inclinometer.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**		

The person performing this task must be able to do the following: 1. Select drilling tools according to f ormation characteristics under gui dance; 2. Measure and select drill bits; 3. Install drill bits, drill rods, drill co llars and other drilling tools; 4. Measure, record and correct hole depth; 5. Measure the bend of borehole; 6. Measure water level, water quanti ty and water temperature; 7. Record and fill in the team report.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Choose to equip drilling tools; 1.2 Select the drill bit; 1.3 Use measuring equipment. **2.0 Principle** The person performing this task must be able to explain t he following principles: 2.1 Selection methods of drilling tools according to for mation characteristics; 2.2 Filling requirements in of the team report. **3.0 Theories** The person performing this task must be able to explain t he following: 3.1 Installation of drilling tools; 3.2 Use of measuring tools; 3.3 Correction of hole depth. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Computer operation skills; 4.3 Customer service skills; 4.4 Teamwork skills; 4.5 Report writing skills; 4.6 Tool use and maintenance skills.
DESCRIPTION OF THE END PR ODUCT / SERVICE	Make drilling tools and borehole measurement records a ccording to technical requirements.
CIRCUMSTANTIAL KNOWLED GE	**Detailed knowledge about:** 1. Safety operation of operating tools; 2. Occupational health and safety; 3. Hydrogeological basics; 4. Mechanical basics; 5. Electrical engineering basics; 6. Electrical welding.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	EXCAVATION OF WATER INTAKE WELLS	**DUTY NO.**	601
TASK TITLE	HANDLING OF MAJOR DOWN-HOLE ACCIDENTS	**TASK NO.**	6012
PERFORMANCE CRITERIA	The person performing this task must be able to deal with major down-hole trouble according to technical requirements.		
RANGE STATEMENT	The task can be performed on the drilling site under the supervision of chief engineers or leaders in charge. The tools and equipment to be used include: 1. Die tap and die collar; 2. Catch sleeve; 3. Fishing spear; 4. Cutting knife; 5. Mill; 6. Grappling basket; 7. Lifter.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Follow safety, quality and environmental protection measures when performing this task; 2. Choose correct tools, equipment and safety protection articles for tasks; 3. Check drilling equipment for obvious faults; 4. Check the hole for factors affecting the drilling rig; 5. Determine major down-hole troubles; 6. Eliminate major down-hole troubles; 7. Handle major down-hole troubles.	Detailed knowledge about: **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Handle serious down-hole troubles.

	2.0 Principle The person performing this task must be able to explain t he following principles: 2.1 Handling of down-hole troubles; 2.2 Safety, quality and environmental protection standa rds. **3.0 Theories** The person performing this task must be able to explain t he following: 3.1 Orders of dealing with major down-hole troubles; 3.2 Methods to deal with major down-hole troubles; 3.3 Essentials to deal with major down-hole troubles; 3.4 Project quality indexes and work safety measures. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Computer operation skills; 4.3 Customer service skills; 4.4 Teamwork skills; 4.5 Report writing skills; 4.6 Tool use and maintenance skills.
DESCRIPTION OF THE END PR ODUCT / SERVICE	Deal with major down-hole troubles according to technic al requirements.
CIRCUMSTANTIAL KNOWLED GE	**Detailed knowledge about:** 1. Work safety and management; 2. Engineering quality control; 3. Occupational health and safety; 4. Mechanical basics; 5. Electrical engineering basics; 6. Electrical welding.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	EXCAVATION OF WATER INTAKE WELLS	**DUTY NO.**	601
TASK TITLE	HYDROLOGICAL OBSERVATION AND GEOLOGICAL LOGGING	**TASK NO.**	6013
PERFORMANCE CRITERIA	The person performing this task must be able to complete hydrological observation and geological logging according to technical requirements.		
RANGE STATEMENT	The task can be performed on the drilling site under the supervision of chief engineers or leaders in charge. The tools and equipment to be used include: 1. Hydrological drilling rig; 2. Water gauge; 3. Water thermometer; 4. Calculator; 5. Acrylic tube; 6. Pressure meter; 7. Casing.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		**UNDERPINNING KNOWLEDGE**	

The person performing this task must be able to do the following: 1. Follow safety, quality and environ mental protection measures when performing this task; 2. Choose correct tools, equipment a nd safety protection articles for ta sks; 3. Observe the core; 4. Observe the aquifer; 5. Observe the water temperature; 6. Observe the consumption of flush ing fluid; 7. Observe the phenomenon of bore hole water gushing; 8. Observe the phenomenon in the h ole; 9. Catalog hydrogeological drilling; 10. Collate data.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Observe the core; 1.2 Observe hydrogeology; 1.3 Catalog hydrogeological drilling. **2.0 Principle** The person performing this task must be able to explain t he following principles: 2.1 Stable water level measurement. **3.0 Theories** The person performing this task must be able to explain t he following: 3.1 Core characteristics; 3.2 Contents of hydrogeological observation; 3.3 Hydrogeological drilling catalogue. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Management skills; 4.3 Data storage skills; 4.4 Teamwork skills; 4.5 Computer operation skills; 4.6 Tool and equipment use and maintenance skills; 4.7 Report writing skills.
DESCRIPTION OF THE END PR ODUCT / SERVICE	Conduct hydrological observation and geological catalog report according to technical requirements.
CIRCUMSTANTIAL KNOWLED GE	**Detailed knowledge about:** 1. Work safety and management; 2. Engineering quality control; 3. Occupational health and safety; 4. Mechanical basics; 5. Electrical engineering basics; 6. Electrical welding.

<table>
<tr><td>OCCUPATION</td><td>WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN</td><td>OCCUPATION CODE</td><td></td></tr>
<tr><td>DUTY TITLE</td><td>EXCAVATION OF WATER INTAKE WELLS</td><td>DUTY NO.</td><td>601</td></tr>
<tr><td>TASK TITILE</td><td>COMMANDING AND COMPLETION OF THE DRILLING CONSTRUCTION</td><td>TASK NO.</td><td>6014</td></tr>
<tr><td>PERFORMANCE CRITERIA</td><td colspan="3">The person performing this task must be able to direct the completion of drilling construction according to technical requirements.</td></tr>
<tr><td>RANGE STATEMENT</td><td colspan="3">The task can be performed on the drilling site under the supervision of chief engineers or leaders in charge.
The tools and equipment to be used include:
1. Hydrological drilling rig;
2. Mud pump;
3. Drilling tower;
4. Air compressor;
5. Borehole inclinometer;
6. Well pipe.</td></tr>
<tr><td colspan="4">EVIDENCE REQUIREMENT</td></tr>
<tr><td colspan="2">PRACTICAL PERFORMANCE</td><td colspan="2">UNDERPINNING KNOWLEDGE</td></tr>
<tr><td colspan="2">The person performing this task must be able to do the following:
1. Follow safety, quality and environmental protection measures when performing this task;
2. Choose correct tools, equipment and safety protection articles for tasks;
3. Check down-hole condition;
4. Select drilling parameters and drilling techniques;
5. Find out the drilling law;
6. Handle general down-hole troubles and general equipment accidents;
7. Stop illegal operations;
8. Control material consumption;
9. Clean the tools, equipment and workplace;
10. Store the tools and equipment.</td><td colspan="2">Detailed knowledge about:
1.0 Methods
The person performing this task must be able to explain how to:
1.1 Command the completion of drilling construction;
1.2 Carry out drilling work.

2.0 Principle
The person performing this task must be able to explain the following principles:
2.1 Drilling construction procedures;
2.2 Safety, quality and environmental protection standards.

3.0 Theories
The person performing this task must be able to explain the following:</td></tr>
</table>

	3.1 Drilling equipment; 3.2 Drilling techniques; 3.3 Mud preparation and adjustment; 3.4 Shaft-forming technology; 3.5 Typical equipment failure; 3.6 Project quality indexes and work safety measures. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Computer operation skills; 4.3 Customer service skills; 4.4 Teamwork skills; 4.5 Report writing skills; 4.6 Tool use and maintenance skills.
DESCRIPTION OF THE END PR ODUCT / SERVICE	Complete drilling construction according to technical req uirements.
CIRCUMSTANTIAL KNOWLED GE	**Detailed knowledge about:** 1. Work safety and management; 2. Engineering quality control; 3. Occupational health and safety; 4. Mechanical basics; 5. Electrical engineering basics; 6. Electrical welding.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	WATER CONSERVANCY PROJECT CONSTRUCTION	**DUTY NO.**	602
TASK TITLE	PREPARATION OF THE EARTH WORK EXCAVATION SCHEME	**TASK NO.**	6021
PERFORMANCE CRITERIA	The person performing this task must be able to prepare the scheme of earthwork excavation according to the technical requirements		
RANGE STATEMENT	The task can be performed on the water conservancy and hydropower construction site under the supervision of senior technicians or water conservancy and hydropower engineers. The tools and equipment to be used include: 1. Computer.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Read the project layout; 2. Plan the scope, sequence and stacking position of earthwork excavation; 3. Determine earthwork excavation technology and safety requirements; 4. Draw detailed earthwork excavation drawings; 5. Calculate the quantity of earthwork excavation; 6. Prepare the earthwork excavation scheme.	**Detailed knowledge about:**

	1.0 Methods The person performing this task must be able to explain how to: 1.1 Determine the scope and sequence of earthwork excavation; 1.2 Select the earthwork stacking site; 1.3 Determine the quantity of earthwork excavation. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Construction code for earthwork excavation; 2.2 Safety organization of earthwork excavation. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Earthwork excavation scope; 3.2 Earth excavation sequence; 3.3 Earthwork stacking position; 3.4 Quantity of earthwork excavation. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Computer operation skills; 4.3 Customer service skills; 4.4 Teamwork skills; 4.5 Report writing skills; 4.6 Tool use and maintenance skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Prepare the excavation scheme of earth-rock dam to meet the technical requirements of earthwork transportation and filling.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Preparation of the earthwork excavation scheme based on construction scenario requirements; 2. Work safety and management; 3. Engineering quality control; 4. Occupational health and safety; 5. Mechanical basics; 6. Electrical engineering basics; 7. Electrical welding.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	WATER CONSERVANCY PROJECT CONSTRUCTION	**DUTY NO.**	602
TASK TITLE	PREPARATION OF THE EARTH WORK TRANSPORTATION SCHEME	**TASK NO.**	6022
PERFORMANCE CRITERIA	The person performing this task must be able to prepare the earthwork transportation scheme according to technical requirements.		
RANGE STATEMENT	The task can be performed on the water conservancy and hydropower construction site under the supervision of senior technicians or water conservancy and hydropower engineers. The tools and equipment to be used include: 1. Computer.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Read the project layout; 2. Determine the earthwork transportation distance and earthwork stacking position; 3. Calculate the quantity of earthwork transportation; 4. Determine the combined configuration and safety requirements of earthwork transportation machinery; 5. Draw detailed earthwork transportation drawings; 6. Prepare the earthwork transportation scheme.	**Detailed knowledge about:**

	1.0 Methods The person performing this task must be able to explain how to: 1.1 Determine the quantity of earthwork transportation and transportation distance; 1.2 Determine the earthwork stacking site. **2.0 Principle** The person performing this task must be able to explain t he following principles: 2.1 Construction code for earthwork transportation; 2.2 Safety organization of earthwork transportation. **3.0 Theories** The person performing this task must be able to explain t he following: 3.1 Quantity of earthwork excavation; 3.2 Earthwork transportation distance; 3.3 Combined configuration of earthwork transportatio n equipment; 3.4 Management of earthwork stacking position. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Operation skills; 4.3 Cooperation skills.
DESCRIPTION OF THE END PR ODUCT / SERVICE	Prepare the transportation scheme of earth-rock dam to m eet the technical requirements of earthwork filling.
CIRCUMSTANTIAL KNOWLED GE	**Detailed knowledge about:** 1. Preparation of the earthwork excavation scheme base d on construction scenario requirements; 2. Work safety and management; 3. Engineering quality control; 4. Occupational health and safety; 5. Mechanical basics; 6. Electrical engineering basics; 7. Electrical welding.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	WATER CONSERVANCY PROJECT CONSTRUCTION	**DUTY NO.**	602
TASK TITLE	PREPARATION OF EARTHWORK COMPACTION PLANS	**TASK NO.**	6023
PERFORMANCE CRITERIA	The person performing this task must be able to prepare the earthwork transportation scheme according to technical requirements.		
RANGE STATEMENT	The task can be performed on the water conservancy and hydropower construction site under the supervision of senior technicians or water conservancy and hydropower engineers. The tools and equipment to be used include: 1. Level gauge; 2. Infrared drying oven; 3. Soil wreath knife; 4. Balance.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Read the project layout; 2. Determine the earthwork filling position; 3. Determine the quantity of earthwork filling; 4. Determine the combined configuration and safety requirements of earthwork filling machinery; 5. Draw detailed earthwork filling location plan; 6. Prepare the earthwork rolling scheme.	**Detailed knowledge about:**

	1.0 Methods The person performing this task must be able to explain how to: 1.1 Determine the quantity and compaction parameters of earthwork filling; 1.2 Determine the flow operation layout of dam face. **2.0 Principle** The person performing this task must be able to explain t he following principles: 2.1 Construction code for earthwork rolling; 2.2 Safety organization of earthwork rolling. **3.0 Theories** The person performing this task must be able to explain t he following: 3.1 Calculation of the quantity of earthwork filling; 3.2 Calculation of earthwork compaction parameters; 3.3 Determination of the combined configuration of ear thwork rolling equipment; 3.4 Division and management of pipelining constructio n. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Operation skills; 4.3 Cooperation skills.
DESCRIPTION OF THE END PR ODUCT / SERVICE	Prepare the rolling scheme of earth-rock dam to meet the technical requirements such as rolling quality control.
CIRCUMSTANTIAL KNOWLED GE Delivery of earth-rock dams meeting quality requirements	**Detailed knowledge about:** 1. Preparation of the earthwork excavation scheme base d on construction scenario requirements; 2. Work safety and management; 3. Engineering quality control; 4. Occupational health and safety; 5. Mechanical basics; 6. Electrical engineering basics; 7. Electrical welding.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	WATER CONSERVANCY PROJECT CONSTRUCTION	**DUTY NO.**	602
TASK TITLE	TESTING OF THE CONCRETE PERFORMANCE AND ADJUSTMENT OF THE MIX RATIO	**TASK NO.**	6024
PERFORMANCE CRITERIA	The person performing this task must be able to test the performance of the concrete, adjust the mix ratio and maintain the mixing plant equipment.		
RANGE STATEMENT	The task can be performed on the water conservancy and hydropower construction site under the supervision of senior technicians or water conservancy and hydropower engineers. The tools and equipment to be used include: 1. Slump tester; 2. Concrete extensibility tester; 3. Pressure tester.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Complete the concrete sampling and slump detection within 20min after the concrete is transported to the delivery place, as well as the preparation of the specimens for strength and impermeability test within 40min; 2. Ensure that the sample size for each group should be 1.5 times the amount required for concrete quality inspection items; 3. Ensure that the batching conditions of concrete specimens comply with relevant provisions; 4. Determine the number of retained sets of impermeability test blocks for concrete with impermeability requirements based on the structure scale and requirements; 5. Ensure that the performance indicators of concrete requiring compensation for shrinkage or micro-expansion are tested in accordance with relevant requirements; 6. Test the quality indicators of concrete with other performance requirements in accordance with relevant requirements.	**Detailed knowledge about:**

	1.0 Methods The person performing this task must be able to e xplain how to: 1.1 Sample concrete; 1.2 Carry out concrete strength and impermeabil ity tests; 1.3 Test the compensating shrinkage performanc e of concrete. **2.0 Principle** The person performing this task must be able to e xplain the following principles: 2.1 Specification for concrete quality control; 2.2 Concrete sampling. **3.0 Theories** The person performing this task must be able to e xplain the following: 3.1 Concrete slump test methods; 3.2 Concrete strength grade test. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Management skills; 4.3 Cooperation skills.
DESCRIPTION OF THE END PRODUC T / SERVICE	Test strength grade, impermeability, shrinkage co mpensation and other properties of concrete .
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Strength grade of concrete; 2. Impermeability and durability of concrete; 3. Shrinkage compensation of concrete; 4. Statistical analysis of experimental data.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	WATER CONSERVANCY PROJECT CONSTRUCTION	**DUTY NO.**	602
TASK TITLE	PREPARATION OF THE CONCRETE FORMWORK INSTALLATION SCHEME	**TASK NO.**	6025
PERFORMANCE CRITERIA	The person performing this task must be able to formulate the concrete formwork installation scheme, and perform arching calculation, inspection, cleaning and maintenance.		
RANGE STATEMENT	The task can be performed on the water conservancy and hydropower construction site under the supervision of senior technicians or water conservancy and hydropower engineers. The tools and equipment to be used include: 1. Commonly used machinery for processing formwork materials, installing and removing formworks; 2. Maintenance knowledge of formwork material processing machinery; 3. Lifting machinery knowledge.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Prepare the concrete formwork installation scheme; 2. Make preparations the formwork installation and removal; 3. Check formwork installation; 4. Prepare formwork installation methods and quality standards; 5. Perform formwork and support system monitoring.	**Detailed knowledge about:**

	1.0 Methods The person performing this task must be able to e xplain how to: 1.1 Determine the formwork installation schem e; 1.2 Organize the installation of large formworks; 1.3 Check the quality requirements of large form work installation. **2.0 Principle** The person performing this task must be able to e xplain the following principles: 2.1 Construction codes for reserving camber dur ing formwork installation; 2.2 Formwork detection, cleaning, and maintena nce. **3.0 Theories** The person performing this task must be able to e xplain the following: 3.1 Arching calculation; 3.2 Formwork installation requirements; 3.3 Formwork detection; 3.4 Formwork cleaning; 3.5 Formwork maintenance; 3.6 Deformation of formwork under stress. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Management skills; 4.3 Cooperation skills.
DESCRIPTION OF THE END PRODUC T / SERVICE	Complete formwork installation scheme, camberi ng calculation sheet and maintenance records.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Requirements for large formwork installation; 2. Requirements for large formwork removal.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	WATER CONSERVANCY PROJECT CONSTRUCTION	**DUTY NO.**	602
TASK TITLE	PREPARATION OF THE CONCRETE PLACEMENT SCHEME	**TASK NO.**	6026
PERFORMANCE CRITERIA	The person performing this task must be able to develop the concrete placement scheme, organize the construction, and control the quality of concrete placement.		
RANGE STATEMENT	The task can be performed on the water conservancy and hydropower construction site under the supervision of senior technicians or water conservancy and hydropower engineers. The tools and equipment to be used include: 1. Ultrasonic concrete detector; 2. Automatic integrated rebound hammer; 3. Concrete rebar detector.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1 Determine the concrete placing procedure, flow and method; 2 Select concrete placing equipment and machines and tools, and arrange them reasonably; 3 Determine the staffing requirements for pouring concrete for ordinary structures or members; 4 Put forward the key points of work safety in concrete placement; 5 Perform mass concrete placement for the foundation according to construction codes; 6 Cover and curing according to the special scheme of mass concrete temperature control and curing; 7 Check and supervise the curing of concrete with various special-shaped structures; 8 Determine the type of concrete defects; 9 Draw up the technical scheme of concrete surface finishing.	**Detailed knowledge about:**

	1.0 Methods The person performing this task must be able to e xplain how to: 1.1 Determine the construction scheme for concr ete placement; 1.2 Organize the construction of large volume co ncrete placements; 1.3 Maintain and repair mass concrete. **2.0 Principle** The person performing this task must be able to e xplain the following principles: 2.1 Specifications for the construction of concret e structures; 2.2 Principles of safe organization of concrete pl acement. **3.0 Theories** The person performing this task must be able to e xplain the following: 3.1 Performance of the pouring construction equ ipment, machines and tools; 3.2 Technical elements of structural construction drawings; 3.3 Identification of construction site hazards; 3.4 Factors influencing temperature cracks in ma ss concrete; 3.5 Factors influencing the various methods of c onservation of mass concrete; 3.6 Determination of the quality of maintenance of mass concrete. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Management skills; 4.3 Cooperation skills.
DESCRIPTION OF THE END PRODUC T / SERVICE	Organize the mass concrete placement and compl ete the placement and quality control work.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Use of relevant quality control instruments

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	WATER CONSERVANCY PROJECT CONSTRUCTION	**DUTY NO.**	602
TASK TITLE	PREPARATION OF THE REINFORCEMENT CONSTRUCTION SCHEME	**TASK NO.**	6027
PERFORMANCE CRITERIA	The person performing this task must be able to prepare the steel bar construction scheme according to the technical requirements.		
RANGE STATEMENT	The task can be performed on the water conservancy and hydropower construction site under the supervision of water conservancy and hydropower engineers or civil engineers. The tools and equipment to be used include: 1. Computers and calculators; 2. Drawing Tools; 3. Relevant construction manuals, specifications, drawings, etc.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Prepare construction schemes, special plans and technical disclosure on quality and safety for common reinforcement works; 2. Prepare construction work plans for the shift; 3. Prepare a general prestressing construction scheme.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Prepare construction schemes, special plans and technical disclosure on quality and safety for common reinforcement works, including analysis of the construction process, determination of construction meth

	ods and procedures, preparation of construction pro grams and technical handouts. **2.0 Principle** The person performing this task must be able to explain t he following principles: 2.1 Relevant codes and standards need to be followed i n the preparation of programs and hand-outs; 2.2 Safety, quality and efficiency in the construction pr ocess; 2.3 Optimization and improvement of construction con ditions and requirements. **3.0 Theories** The person performing this task must be able to explain t he following: 3.1 Basic theories and relevant specifications for reinfor cement construction that need to be mastered for the preparation of programs and hand-outs; 3.2 Construction technology and method; 3.3 Control measures of construction safety. **4.0 Essential Skills** 4.1 Construction organization ability; 4.2 Technical analysis ability; 4.3 Program design ability; 4.4 Documentation ability.
DESCRIPTION OF THE END PR ODUCT / SERVICE	Prepare construction schemes, plans and technical submi ssions in accordance with the relevant codes and standar ds to ensure safety, quality and efficiency during constru ction and to improve the quality and effectiveness of the construction.
CIRCUMSTANTIAL KNOWLED GE	**Detailed knowledge about:** 1. Knowledge of construction organization and manage ment; 2. Knowledge of labour quotas; 3. Basic knowledge of quality management.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	WATER CONSERVANCY PROJECT CONSTRUCTION	**DUTY NO.**	602
TASK TITLE	PREPARATION OF COMPONENT REINFORCEMENT MATERIAL LIST	**TASK NO.**	6028
PERFORMANCE CRITERIA	The person performing this task must be able to prepare the component reinforcement material list in accordance with the technical requirements.		
RANGE STATEMENT	The task can be performed on the water conservancy and hydropower construction site under the supervision of water conservancy and hydropower engineers or civil engineers. The tools and equipment to be used include: 1. Reinforcement detailing tools (e.g. steel rulers, angle rulers, wire rods, etc.); 2. Computers and supporting software; 3. Software for the preparation of the material list.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Carry out the reinforcement detailing of complex components and prepare the material list; 2. Carry out reinforcement detailing of special structures such as chimneys and water towers and prepare the material list; 3. Use computer technology for detailing and prepare the material list; 4. Prepare the material list for prestressing tendons and accessories.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Perform member analysis to determine the structural form and dimensions of the member for the reinforcement detailing of complex components; 1.2 Analyse and calculate the reinforcement arrangement according to the design requirements of the component and finally prepare the material list; 1.3 Analyse and calculate the reinforcement arrangement according to the characteristics of the structure and the actual situation, and prepare material list for special structures such as chimneys and water towers. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Actual conditions and requirements of the components and structures, ensuring that the arrangement, qu

	antity and specification of the reinforcement meet th e design requirements; 2.2 Safety and quality issues during construction. **3.0 Theories** The person performing this task must be able to explain t he following: 3.1 Basic theories of reinforcement engineering, such as mechanics of materials and structural mechanics; 3.2 Properties and use requirements of steel reinforcem ent and relevant codes and standards. **4.0. Essential Skills** 4.1 Construction organization ability; 4.2 Technical analysis ability; 4.3 Program design ability; 4.4 Documentation ability.
DESCRIPTION OF THE END PR ODUCT / SERVICE	A material list is formed, which includes the layout of th e reinforcement and details such as quantity and specific ation, providing an important basis for the construction o f the reinforcement. Detailing and the preparation of mat erial list will ensure that the arrangement and use of reinf orcement meet the design requirements, improving the ef ficiency and quality of construction and reducing constru ction risks.
CIRCUMSTANTIAL KNOWLED GE	**Detailed knowledge about:** 1. Knowledge of reinforcement detailing; 2. Features of relevant structures, component reinforce ment and construction; 3. Knowledge of relevant computer-aided software; 4. Knowledge of prestressing tendon detailing.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	WATER CONSERVANCY PROJECT CONSTRUCTION	**DUTY NO.**	602
TASK TITLE	INSPECTION OF CONSTRUCTION QUALITY	**TASK NO.**	6029
PERFORMANCE CRITERIA	The person performing this task must be able to inspect the quality of construction in accordance with technical requirements.		
RANGE STATEMENT	The task can be performed on the water conservancy and hydropower construction site under the supervision of water conservancy and hydropower engineers or civil engineers. The tools and equipment to be used include: 1. Measuring tools, such as steel rulers, calipers and measuring instruments; 2. Tools for examination such as magnifying glasses and microscopes; 3. Inspection aids such as lighting equipment and reflectors; 4. Hand-held vibration measuring instruments, noise meters and other testing equipment.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Check the quality of construction of reinforcement mesh, skeletons and conventional nodes; 2. Check the location of prestressing tendons and taking control measures; 3. Carry out self-tests of prestressing tendons; 4. Carry out mutual inspections of the quality of reinforcement installation; 5. Prevent and control defects in the quality of reinforcement construction.	**Detailed knowledge about:**

	1.0 Methods The person performing this task must be able to explain how to: 1.1 Measure the size and position of the reinforcement using measuring tools; 1.2 Use inspection tools for inspection of defects and lo cation of the reinforcement. **2.0 Principle** The person performing this task must be able to explain t he following principles: 2.1 Inspection of the position, quantity and quality of re inforcement in accordance with the construction dra wings and design requirements; 2.2 Assessment of construction quality in accordance w ith relevant specifications and standards. **3.0 Theories** The person performing this task must be able to explain t he following: 3.1 Construction requirements for the processing, instal lation, connection and tensioning of reinforcement; 3.2 Relevant codes, standards, acceptance criteria and o ther quality requirements. **4.0. Essential Skills** 4.1 Construction organization ability; 4.2 Technical analysis ability; 4.3 Program design ability; 4.4 Documentation ability.
DESCRIPTION OF THE END PR ODUCT / SERVICE	Carry out quality checks on reinforcing mesh, skeletons, nodes and prestressing bars to ensure that the constructio n quality meets the requirements of the relevant codes, st andards and acceptance criteria, thereby ensuring the saf ety and reliability of the reinforcement structure.
CIRCUMSTANTIAL KNOWLED GE	**Detailed knowledge about:** 1. Standard for acceptance of construction quality; 2. Causes of quality defects in reinforcement works and methods of prevention and control.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	WATER CONSERVANCY PROJ ECT CONSTRUCTION	**DUTY NO.**	602
TASK TITLE	FILLING IN OF THE CONSTRU CTION TECHNOLOGY SUMMA RY	**TASK NO.**	60210
PERFORMANCE CRIT ERIA	The person performing this task must be able to complete a technica l summary of reinforcement construction in accordance with the tec hnical requirements.		
RANGE STATEMENT	The task can be performed on the water conservancy and hydropow er construction site under the supervision of water conservancy and hydropower engineers or civil engineers. The tools and equipment to be used include: 1. Computers and related software, such as CAD, BIM, etc., for dr afting, simulation, optimization, etc.; 2. Testing instruments, such as ultrasonic thickness gauges and me tal detectors, for the detection of quality and defects in reinforce ment; 3. Welding equipment, such as electric welding machines, gas wel ding equipment, etc., for the welding of reinforcement; 4. Shearing equipment, such as shears and bending machines, for p rocessing the reinforcement; 5. Hand tools, such as pliers and wrenches, for the installation and adjustment of reinforcement bars.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Research and analyze the actual si tuation of the project to obtain the necessary data and information; 2. Process and analyze data through computer software, e.g. Excel, Au toCAD, Revit; 3. Perform statistics and analysis of t he data to draw relevant indicators and conclusions; 4. Organize and summarize the resul ts of research and analysis and wri te technical summary reports.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Measure the length, diameter, deviation and other i mportant parameters of the reinforcement to ensure construction quality; 1.2 Carry out basic operations such as machining, cuttin g, drilling, detailing, assembling and welding of the reinforcement; 1.3 Select the appropriate connection method for the dif ferent reinforcement structures; Perform connection

	s such as grouting, rolling straight threads and fused metal filled joints. **2.0 Principle** The person performing this task must be able to explain t he following principles: 2.1 Mechanical properties of reinforced concrete; 2.2 Processes such as cutting, bending and joining of rei nforcement; 2.3 Principles of detailing with reinforcement detailing machines; 2.4 Principles and scope of application of reinforcement connection methods; 2.5 Principles and technique for the arrangement and in stallation of reinforcement structures; 2.6 Principles and method of construction processes suc h as prestressing tensioning, anchoring and groutin g. **3.0 Theories** The person performing this task must be able to explain t he following: 3.1 Processing, storage and transport of reinforcement; Knowledge of the precautions to be taken during th e processing of reinforcement including cutting, ben ding and stretching of reinforcement, as well as anti -corrosion and anti-rust measures in storage and tra nsport, to ensure the quality of reinforcement; 3.2 Different types of reinforcement connections, inclu ding welded, threaded, plugged and socket grouted; 3.3 Principles of reinforcement arrangement, including force analysis, structural design, reinforcement alloc ation; 3.4 Precautions during the construction of reinforced co ncrete, including formwork production, concrete pla cement, vibrating and maintenance; 3.5 Precautions during the construction of prestressed c oncrete, including tensioning, fixing and cutting of prestressing tendons. **4.0 Essential Skills** 4.1 Construction organization ability; 4.2 Technical analysis ability; 4.3 Program design ability; 4.4 Documentation ability.
DESCRIPTION OF THE END PR ODUCT / SERVICE	Include the analysis and summary of the problems and so lutions encountered during the construction of the reinfor cement in the technical summary report, and propose im

	provement measures to provide reference and reference f or similar projects in the future.
CIRCUMSTANTIAL KNOWLED GE	**Detailed knowledge about:** 1. Relevant standards, norms and laws and regulations f or building structure and steel reinforcement construc tion, including national and local construction engine ering-related regulations, standards and norms, etc.; 2. Processing and installation techniques, quality inspec tion and acceptance standards, etc. of various types o f reinforcement materials and reinforcements; 3. Process flow and quality requirements for pre-stresse d reinforcement processing, tensioning, curing and pr otection; 4. Basic computer application knowledge which allows the person to use the computer to conduct the detailin g of samples, prepare material lists and draw constru ction drawings, etc.; 5. Modern construction management and work safety m anagement methods, including project planning, cons truction organization, site management, safety measu res.

OCCUPATION	**WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN**	**OCCUPATION CODE**	
DUTY TITLE	MONITORING OF THE SAFETY OF HYDRAULIC STRUCTURES	**DUTY NO.**	603
TASK TITLE	MONITORING OF THE ENVIRONMENTAL QUANTITY OF HYDRAULIC STRUCTURES	**TASK NO.**	6031
PERFORMANCE CRITERIA	The person performing this task must be able to use and maintain environmental quantity monitoring equipment for hydraulic structures.		
RANGE STATEMENT	The task can be performed on the site of environmental quantity monitoring of hydraulic structures under the guidance of a Senior Technician or Water Conservancy and Hydropower Engineering Engineer. The tools and equipment to be used include: 1. Environmental quantity monitoring occupational standards; 2. Environmental quantity monitoring equipment and its specifications.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Follow safety, quality and environmental protection measures when performing this task; 2. Follow the environmental quantity monitoring specifications of hydraulic structures when performing tasks; 3. Inspect water level monitoring facilities; 4. Maintain water level monitoring facilities; 5. Inspect precipitation monitoring facilities; 6. Maintain precipitation monitoring facilities; 7. Inspect water temperature monitoring facilities; 8. Maintain water temperature monitoring facilities; 9. Inspect temperature monitoring facilities; 10. Maintain temperature monitoring facilities.	**Detailed knowledge about:**

	1.0 Methods The person performing this task must be able to explain how to: 1.1 Inspect and maintain water level monitoring facilities; 1.2 Inspect and maintain precipitation monitoring facilities; 1.3 Inspect and maintain water temperature monitoring facilities; 1.4 Inspect and maintain temperature monitoring facilities. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Methods and principles of inspection and maintenance of environmental quantity monitoring facilities of hydraulic structures. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Inspection and maintenance requirements for float type water level gauge, ultrasonic water level gauge, pressure type water level gauge; 3.2 Inspection and maintenance requirements for tipping bucket rain gauge and siphon rain gauge; 3.3 Inspection and maintenance requirements for water temperature monitoring facilities; 3.4 Inspection and maintenance requirements for temperature monitoring facilities. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Computer operation skills; 4.3 Teamwork skills; 4.4 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Complete the inspection and maintenance of the environmental quantity monitoring facilities of hydraulic structures according to the requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety operation of operating tools; 2. Occupational health and safety; 3. Basic knowledge of hydraulic structures; 4. Knowledge of environmental quantity monitoring of hydraulic structures.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	MONITORING OF THE SAFETY OF HYDRAULIC STRUCTURES	DUTY NO.	603
TASK TITLE	MONITORING OF THE DEFORMATION OF HYDRAULIC STRUCTURES	TASK NO.	6032
PERFORMANCE CRITERIA	The person performing this task must be able to use and maintain deformation monitoring equipment for hydraulic structures.		
RANGE STATEMENT	The task can be performed on the deformation monitoring site of hydraulic structures under the guidance of senior technicians or water conservancy and hydropower engineering engineers. The tools and equipment to be used include: 1. Horizontal displacement observation instruments and equipment; 2. Vertical displacement observation instruments and equipment; 3. Joint and crack observation instruments and equipment.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Follow safety, quality and environmental protection measures when performing this task; 2. Follow the deformation monitoring specifications of hydraulic structures when performing tasks; 3. Inspect and maintain vertical displacement monitoring facilities such as vertical displacement base point, measuring point, leveling rod, staff plate and level gauge; 4. Inspect and maintain monitoring facilities such as horizontal displacement base point, measuring point, target and prism; 5. Inspect and maintain joint and surface crack monitoring facilities.	**Detailed knowledge about:**

	1.0 Methods The person performing this task must be able to explain how to: 1.1 Inspect and maintain vertical displacement observation and monitoring facilities; 1.2 Inspect and maintain horizontal displacement observation and monitoring facilities; 1.3 Inspect and maintain seams and observe and monitor surface cracks. **2.0 Principle** The person performing this task must be able to explain the following principles: 2.1 Methods and principles of inspection and maintenance of deformation monitoring facilities of hydraulic structures. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Inspection and maintenance methods of vertical displacement base point, measuring point, leveling rod, staff plate, level gauge, etc.; 3.2 Inspection and maintenance methods of horizontal displacement base point, measuring point, target, prism, etc.; 3.3 Inspection and maintenance requirements for joint and surface crack monitoring facilities. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Computer operation skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Tool use and maintenance skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Complete the inspection and maintenance of the deformation monitoring facilities of hydraulic structures according to the requirements
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety operation of operating tools; 2. Occupational health and safety; 3. Basic knowledge of hydraulic structures; 4. Knowledge of deformation monitoring of hydraulic structures.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	MONITORING OF THE SAFETY OF HYDRAULIC STRUCTURES	**DUTY NO.**	603
TASK TITLE	MONITORING OF THE SEEPAGE OF HYDRAULIC STRUCTURES	**TASK NO.**	6033
PERFORMANCE CRITERIA	The person performing this task must be able to monitor the seepage and maintain the facilities for hydraulic structures.		
RANGE STATEMENT	The task can be performed on the seepage monitoring of hydraulic structures under the guidance of senior technicians or water conservancy and hydropower engineering engineers. The tools and equipment to be used include: 1. Uplift pressure observation instruments and equipment; 2. Wetting line observation instruments and equipment; 3. Seepage pressure observation instruments and equipment; 4. Seepage flow observation instruments and equipment.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Follow safety, quality and environmental protection measures when performing this task; 2. Follow the seepage monitoring specifications of hydraulic structures when performing tasks; 3. Inspect and maintain seepage monitoring instruments and readout instruments; 4. Inspect and maintain the water level measuring needle, water level gauge and water level gauge on the weir.	**Detailed knowledge about:**

	1.0 Methods The person performing this task must be able to explain how to: 1.1 Inspect and maintain uplift pressure observation and monitoring facilities; 1.2 Inspect and maintain the wetting line observation an d monitoring facilities; 1.3 Inspect and maintain seepage pressure observation a nd monitoring facilities; 1.4 Inspect and maintain seepage flow observation and monitoring facilities. **2.0 Principle** The person performing this task must be able to explain t he following principles: 2.1. Methods and principles of inspection and maintenan ce of seepage monitoring facilities for hydraulic stru ctures. **3.0 Theories** The person performing this task must be able to explain t he following: 3.1 Inspection methods of manometers and inspection a nd maintenance requirements for readout instrument s; 3.2 Inspection methods of the water level gauge on the weir. **4.0. Essential Skills** 4.1 Communication skills; 4.2 Computer operation skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Tool use and maintenance skills.
DESCRIPTION OF THE END PR ODUCT / SERVICE	Complete the inspection and maintenance of seepage mo nitoring facilities for hydraulic structures are completed a ccording to the requirements.
CIRCUMSTANTIAL KNOWLED GE	**Detailed knowledge about:** 1. Safety operation of operating tools; 2. Occupational health and safety; 3. Basic knowledge of hydraulic structures; 4. Knowledge of seepage monitoring of hydraulic struct ures.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MONITORING OF THE SAFETY OF HYDRAULIC STRUCTURES	**DUTY NO.**	603
TASK TITLE	MONITORING OF THE STRESS AND STRAIN OF HYDRAULIC STRUCTURES	**TASK NO.**	6034
PERFORMANCE CRIT ERIA	The person performing this task must be able to monitor the stress a nd strain and temperature and maintain the facilities for hydraulic st ructures.		
RANGE STATEMENT	The task may be executed on the at the site of stress and strain and t emperature monitoring of hydraulic structures under the guidance of a Senior Technician or Water Conservancy and Hydropower Engin eering Engineer. The tools and equipment to be used include: 1. Strain meter; 2. Unstressed meter; 3. Thermometer.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Follow safety, quality and environ mental protection measures when performing this task; 2. Follow hydraulic structure stress a nd strain monitoring specification s when performing tasks; 3. Inspect and maintain stress and str ain monitoring facilities; 4. Inspect and maintain temperature monitoring facilities.	**Detailed knowledge about:**

	1.0 Methods The person performing this task must be able to explain how to: 1.1 Inspect and maintain stress and strain observation a nd monitoring facilities; 1.2 Inspect and maintain temperature observation and monitoring facilities. **2.0 Principle** The person performing this task must be able to explain t he following principles: 2.1 Methods and principles of the inspection and mainte nance of stress and strain and temperature monitorin g facilities in hydraulic buildings. **3.0 Theories** The person performing this task must be able to explain t he following: 3.1 Inspection and maintenance requirements for force-strain monitoring facilities; 3.2 Inspection and maintenance requirements for therm ometers. **4.0 Essential Skills** 4.1 Communication skills; 4.2 Computer operation skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Tool use and maintenance skills.
DESCRIPTION OF THE END PR ODUCT / SERVICE	Complete the inspection and maintenance of stress and st rain and temperature monitoring facilities of hydraulic str uctures according to the requirements.
CIRCUMSTANTIAL KNOWLED GE	**Detailed knowledge about:** 1. Safety operation of tools; 2. Occupational health and safety; 3. Basic knowledge of hydraulic structures; 4. Stress and strain knowledge of hydraulic structures.

TABLE 1: DACUM CHARTS FOR WATER CONSERVANCY AND HYDROPOWER ENGINEERING TECHNICIAN - NTA 6

DUTIES	TASKS	ENABLERS
1.0 Excavation of water intake wells	1.1 Preparation of drilling tools and drilling measurement records 1.2 Handling of major down-hole troubles 1.3 Hydrological observation and geological logging 1.4 Commanding and completion of the drilling construction	**Generic skills and knowledge** · Cooperation with with others using communication skills and reporting to the superiors · Drilling construction procedures · Drilling tools and borehole measurement · Handling of major hole accidents · Hydrological observation and geological logging · Drilling construction · Knowledge of safety, quality and environmental protection · Interpretation of construction drawings · Occupational safety and health **Tools and equipment** · Safety helmet, safety belt, work clothes, work shoes, gloves and other personal protective equipment · Fire safety equipment · Work safety signs · Lightning rod, drilling tower shed rope, hoist protection device, faucet guide rope, lifter protective screen and other safety protection facilities **Materials** · Water, cement **Requirements for employees** · Teamwork spirit · Integrity · Safety consciousness · Quality consciousness
2.0 Water conservancy project construction	2.1 Preparation of the earthwork excavation scheme 2.2 Preparation of the earthwork transportation scheme 2.3 Preparation of the earthwork compaction scheme	**Generic skills and knowledge** · Interpretation of all kinds of construction drawings · Calculation of excavation volume · Calculation of transport distance

DUTIES	TASKS	ENABLERS
	2.4 Testing of the concrete performance and adjustment of the mix ratio 2.5 Preparation of the concrete formwork installation scheme. 2.6 Preparation of the concrete placement scheme 2.7 Preparation of the reinforcement construction scheme. 2.8 Preparation of component reinforcement material list 2.9 Inspection of construction quality 2.10 Filling in of the construction technology summary	· Calculation of the configuration quantity of excavation machinery (equipment) · Determination of earthwork compaction parameters · Layout of earthwork excavation, transportation and filling construction · Concrete and raw materials testing · Mass concrete placement and maintenance · Relevant codes and standards, basic principles and processes of reinforcement construction · Construction scheme preparation · Construction quality inspection, testing and control · Write construction technology summaries **Tools and equipment:** · Level gauge · Soil wreath knife · Concrete pump truck · High-pressure pump · High-level pumps and hydraulic and electrical system · Concrete mixing plant measurement and mixing system · Concrete formwork testing tool · Computer and office software · Testing tools · Documentation tool **Materials** · Cement · Admixture · Aggregate · Steel · Wood · Formwork · Reinforcement **Requirements for employees**

DUTIES	TASKS	ENABLERS
		· Relevant construction experience and be familiar with the preparation of construction schemes · Skills of construction quality inspection and be able to judge whether the construction quality meets the requirements · Good recording and summary ability, and be able to accurately fill in the construction technical summary and related documents · Teamwork spirit and be able to cooperate with other construction personnel
3.0 Inspection and maintenance of monitoring facilities for hydraulic structures	3.1 Monitoring of the environmental quantity of hydraulic structures 3.2 Monitoring of the deformation of hydraulic structures 3.3 Monitoring of the seepage of hydraulic structures 3.4 Monitoring of the stress and strain of hydraulic structures	**Generic skills and knowledge** · Environmental quantity monitoring facilities for hydraulic structures · Methods and principles of inspection and maintenance · Methods and principles of inspection and maintenance of deformation monitoring facilities for hydraulic structures · Methods and principles of inspection and maintenance of seepage monitoring facilities for hydraulic · structures · Methods and principles of inspection and maintenance of stress and strain monitoring facilities for hydraulic structures **Tools and equipment** · Water level gauge, rain gauge · Deformation monitoring instruments such as level gauge and total station gauge · Stress and strain gauge, thermometer · Seepage monitoring instrument and readout instrument, etc. **Materials** · Staff plate, prism, etc. **Requirements for employees**

DUTIES	TASKS	ENABLERS
		· Inspection and maintenance of related facilities · Organizational and coordination skills, and cooperation with other types of work