Title	Explain and determine water flow, and the selection of pumps and structures for an extractive site		
Level	6	Credits	20

Purpose	People credited with this unit standard are able to: explain water flow concepts and water quality properties; determine surface water flows in and around extractive sites; demonstrate knowledge of ground water flows at extractive sites; explain the selection process for a pumping system for extractive sites; and explain the purpose of hydraulic structures and describe the selection process for extractive sites.

Classification	Extractive Industries > Extractive Industries Management

Available grade	Achieved

Prerequisite	Unit standard 21155 *Demonstrate knowledge of the management and use of water at an extractive site* or equivalent knowledge or experience.

Guidance Information

1 Performance of the outcomes of this unit standard must comply with the following:

- Health and Safety at Work Act 2015 (HSW);
- Health and Safety at Work (Mining Operations and Quarrying Operations) Regulations 2016;
- Regional Council Hydrology Guidelines.

Any new, amended or replacement Acts, regulations, standards, codes of practice, guidelines, or authority requirements or conditions affecting this unit standard will take precedence for assessment purposes, pending review of this unit standard.

2 Definitions

Company procedures mean the documented methods for performing work activities and include health and safety, operational, environmental, and quality management requirements. They may refer to legislation, regulations, guidelines, standard operating procedures, manuals, codes of practice, or policy statements.

Industry good practice may be documented in management plans, control plans, company procedures, managers' rules, occupational health and safety policy, industry guidelines, codes of practice, manufacturers' instructions, and safe working and/or job procedures (or equivalent).

Outcomes and performance criteria

Outcome 1

Explain water flow concepts and water quality properties.

Performance criteria

1.1 The concept of water flow is explained in terms of movement from high potential energy to low potential energy.

Range work, power, energy, flow rates, momentum.

1.2 Hydraulic head as a driving force is explained in relation to the resultant water pressure at different levels and its relationship with energy.

1.3 The effects of water quality on extractive site operations are explained in relation to quality parameters.

Range water quality parameters include but are not limited to – pH, temperature, turbidity, suspended solids, dissolved oxygen, toxic compounds, hydrocarbon spills.

Outcome 2

Determine surface water flows in and around extractive sites.

Performance criteria

2.1 Water flow is determined in terms of low flows, flood flows, and site risk from runoff in relation to the catchment area and its sources.

Range may include but is not limited to – rainfall statistics, depth-duration tables, storm return periods, topography, vegetation, geology, catchment area, ground saturation, runoff coefficient, hydrograph analysis, flow estimation.

2.2 Water flow is calculated for water channels and pipes.

Range may include but is not limited to – quantity, velocity and area, hydraulic radius, wetted perimeter, V-notch method.

2.3 The effects of interaction between surface flow and ground water are explained.

Range water table, groundwater depth, aquifer, pumping, seepage.

2.4 Design of stable channels is described for an extractive site.

Range may include but is not limited to – bed grade and type, bank batters, erosion control, seepage control, energy dissipation structures, armouring.

2.5 Water uptake and discharge are explained in accordance with a given resource management consent for a selected site.

Outcome 3

Demonstrate knowledge of ground water flows at extractive sites.

Performance criteria

3.1 The effects of ground water on extractive sites are determined.

Range may include but is not limited to – types of ground water, aquifers, hydraulic properties, dewatering, geotechnical stability, ground water contamination.

3.2 Ground water testing methods are described in accordance with industry good practice.

Range includes but is not limited to – non-flowing bores, flowing bores, test equipment, analysis methods.

3.3 Types of bores are explained for extractive sites.

Outcome 4

Explain the selection process for a pumping system for extractive sites.

Performance criteria

4.1 The different types of pumps and pipes are explained in terms of their purpose, application and safety considerations.

Range types of pumps includes but is not limited to – positive displacement pumps (piston, diaphragm), rotodynamic pumps (centrifugal, axial flow, mixed flow), other pump types (jet, submersible, slurry, airlift, borehole).
application includes but is not limited to – bores, sumps, ponds, dams, waterways.
safety considerations include but is not limited to – installation, operation, maintenance, pump removal, energy supply

4.2 Pump characteristics are explained in terms of their design and purpose.

Range includes but is not limited to – flow rate, suction lift, suction head, delivery head, efficiency, power consumption, speed, cavitation, friction losses, water hammer, priming, positive submergence.

4.3 A pumping system selection process is described in accordance with the stated performance requirements for extractive sites.

Range includes but is not limited to – analysis of the relative strengths and limitations of different pumping systems, pump curves, system curves, motor selection.

Outcome 5

Explain the purpose of hydraulic structures and describe the selection process for extractive sites.

Performance criteria

5.1 Basic hydraulic structures are explained in terms of their purposes.

Range includes but is not limited to – orifice structures, culvert, weirs, flumes, spillway, diversion channels, energy dissipation, drainage channels.

5.2 The hydraulic structure selection process for extractive sites is described in terms of the stated performance requirements.

Planned review date	31 December 2029

Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	25 November 2000	31 December 2017
Review	2	24 November 2005	31 December 2017
Rollover and Revision	3	16 July 2010	31 December 2017
Review	4	18 June 2015	31 December 2019
Review	5	1 March 2018	31 December 2027
Review	6	29 May 2025	N/A

Consent and Moderation Requirements (CMR) reference	0114

This CMR can be accessed at http://www.nzqa.govt.nz/framework/search/index.do.

Comments on this unit standard

Please contact Hanga-Aro-Rau Manufacturing, Engineering and Logistics Workforce Development Council qualifications@hangaarorau.nz if you wish to suggest changes to the content of this unit standard.