



Australian Government

Department of Education, Employment and Workplace Relations

NWP421A Collect, measure and process hydrometric stream discharge gauging

Revision Number: 2

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Modification History

NWP421A Release 2: Layout adjusted. No changes to content.

NWP421A Release 1: Primary release.

Unit Descriptor

This unit describes the competencies required to collect data using a range of discharge measuring methods and equipment, measure and calculate readings and interpret and report data for a range of clients and stakeholders.

Application of the Unit

This unit supports the attainment of skills and knowledge required for assistant hydrographers, field hydrologists and water operators responsible for reporting water quality, volume and flow in water systems. This unit is part of the skills set for hydrography and is suitable for entry level and working under the supervision of a senior hydrographer.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Not applicable.

Employability Skills Information

This unit contains employability skills.

Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency. Performance criteria describe the performance needed to demonstrate achievement of the element. Where ***bold italicised*** text is used, further information is detailed in the range statement. Assessment of performance is to be consistent with the evidence guide.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1 Identify flow gauging.	1.1 Identify stream discharge and <i>factors affecting accuracy</i> . 1.2 Identify the purposes of gauging and <i>gauging methodologies</i> . 1.3 Identify the <i>area velocity methods</i> for calculating discharge. 1.4 Identify <i>hazards</i> and hazard management principles according to <i>occupational health and safety requirements</i> .
2 Collect depth and velocity data.	2.1 Take measurements during gauging following occupational health and safety procedures. 2.2 Select verticals for measurement of velocity. 2.3 Select suitable <i>gauging equipment</i> according to the conditions of the location, assignment and client requirements and <i>gauging site conditions</i> . 2.4 Prepare the equipment and gauging site. 2.5 Apply a range of suitable and <i>alternative methods</i> for obtaining the mean velocity in a vertical. 2.6 Apply the mid section and mean section methods. 2.7 Position the current meter according to guidelines. 2.8 Select the appropriate discharge measurement method. 2.9 Calculate the depth settings and point velocity using <i>required mathematical techniques</i> .
3 Calculate discharge.	3.1 Apply corrections for oblique flows and drift angles. 3.2 Calculate the mean velocity for each vertical. 3.3 Calculate the area and discharge corresponding to each subsection. 3.4 Calculate the discharge using the mid section and mean section method. 3.5 Calculate and record the mean stage and rate of change. 3.6 Calculate the channel storage and time of travel effects.
4 Report discharge readings.	4.1 Compare the discharge measurements with the current rating. 4.2 Record the <i>percentage deviation</i> from the rating. 4.3 Grade and record the gauging quality with interpretation comments. 4.4 Gather <i>supporting information</i> from the site and document accurately according to <i>organisation requirements</i> . 4.5 Enter gauging into ratings database according to organisation requirements.

Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

Required skills:

- use area velocity method
- assess hazards and apply relevant precautions and action
- estimate and explain the anticipated vertical distribution
- make calculations on depth and velocity
- maintain the integrity of measurements
- use a range of suitable techniques to accurately determine mean stage in rapidly changing situations
- adjust measurements correctly
- plot discharge measurements on organisation's preferred scale
- use formulae for determining the percentage deviation
- use computing system and software to transfer calculated flows to office database
- assemble and test metering equipment
- check operation of equipment
- check gauging section
- set tag lines
- prepare gauging section

Required knowledge:

- principles of discharge measurement
- methods for calculating mean velocity in a vertical
- methods for determining the cross sectional area at a site
- alternative methods of discharge measurement
- the organisation's operating procedures for hydrometric stream discharge measurement
- the timing, location and number of verticals for stage readings
- the characteristics of a suitable section for wading and boat gauging and how to make modifications
- requirements for surface, single and multipoint floats
- basic mathematical principles for area and velocity measurements
- correction procedures for horizontal angles
- correction procedures for suspension measurements
- techniques for monitoring stage changes during discharge measurement
- weighted mean stage calculations
- discharge and mean stage adjustment
- technical components in calculating discharge
- factors impacting on discharge measurements and the quality of the discharge
- formulae to adjust gaugings
- potential impacts of modifications of site, method or equipment on discharge accuracy
- confidence limits

- function of each field on the measurement forms
- the organisation's registration procedures
- calibration procedures
- OHS procedures, safe operation of equipment and identification of potential hazards

Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

The candidate should demonstrate the ability to collect data using a range of discharge measuring methods and equipment including:

- measuring and calculating readings
- interpreting and reporting data for a range of clients and stakeholders
- gathering data related to client requirements
- interpreting complex documentation and applying it to the specification of hydrometric data collection and reporting procedures
- sampling accurately and consistently with client requirements
- analysing and verifying data using standard procedures, software and databases
- preparing clear and accurate reports
- storing and archiving data
- identifying, reporting and (within scope of job function) solving potential or current problems

Context of and specific resources for assessment

Access to the workplace and resources including:

- documentation that should normally be available in the workplace
- workplace specific equipment and technology
- supervision and experienced team members to provide observations, feedback and third party reports
- enterprise operating procedures and work allocation
- relevant codes, standards, and government regulations

Where applicable, physical resources should include equipment modified for people with disabilities.

Access must be provided to appropriate learning and/or assessment support when indicated by gaps in competency.

Assessment processes and techniques must be culturally appropriate, and appropriate to the language and literacy capacity of the candidate and the work being performed.

Validity and sufficiency of evidence require that:

- competency will need to be demonstrated over a period of time reflecting the scope of the role and the practical requirements of the workplace
- where the assessment is part of a structured learning

experience the evidence collected must relate to a number of performances assessed at different points in time and separated by further learning and practice

- a decision of competence should only be made when the assessor has complete confidence in the person's competence over time and in various contexts
- all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
- where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
- assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit

In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in a manner appropriate to the skill levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the competency and the work being performed.

Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. ***Bold italicised*** wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

- Factors affecting accuracy*** may include:
- laminar flow
 - turbulent flow
 - critical states
 - sensitivity
 - pulsing
 - backwater
- Gauging methodologies*** may include:
- wading
 - travellerway
 - cableway
 - boat
 - bridge
 - portable flume
 - float
 - acoustic profiler
- Area velocity method*** may include:
- AS 3778 - Measurement of Water Flow in Open Channels:
 - velocity-area methods
 - measurement by current-meters and floats
 - operating procedures for discharge measuring equipment and calibration
- Hazards*** may include:
- boat handling
 - bed stability
 - winch operation
 - tag line setting
 - traffic management
 - working at heights
 - manual handling
 - personal protective equipment (PPE)
- Occupational health and safety requirements*** will include:
- hazard recognition:
 - working on and near water
 - safe working depth
 - bank and bed stability
 - rising stage
 - snags

- floating debris
- water temperature
- water contamination
- weather exposure
- rescue procedures
- PPE requirements:
 - onsite communication and procedures for working remotely
 - equipment
 - storage
 - assembly
 - cleaning
 - handling, transport
- personal welfare and safety:
 - medical constraints
 - CPR
 - First Aid
 - water survival and rescue
 - self rescue
 - bush survival
 - 4WD driving and recovery
 - defensive driving
 - boat handling
 - traffic management authority regulations

Gauging equipment may include:

- winch
- travellerway
- cableway
- boat
- vehicle
- trolley mount
- mechanical & acoustic meters
- oil change
- calibration

Gauging site conditions may include:

- hazards
- obstructions
- climatic
- sufficient depth
- sufficient velocity
- flow angle
- laminar flow
- bank condition
- anabranches and multiple channels
- pre-season maintenance

Alternative methods may include:

- volumetric
- flumes
- slope/area techniques
- dilution

Required mathematical techniques will include:

- area
- volume
- mean
- suitable formulae
- trigonometry

Percentage deviation will be determined by:

- checking:
 - calculations
 - equipment
 - control
 - recording equipment
- repeat measurement

Supporting information will include:

- gauging section location and access maps
- photographic records
- site preparation undertaken
- comments on issues encountered

Organisational requirements will include:

- data management and reporting
- worksite procedures
- occupational health and safety procedures

- operating procedures

Unit Sector(s)

Not applicable.

Competency field

Hydrography.