



Australian Government

RIINHB411E Construct artesian (flowing) aquifer bores

Release: 1

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Modification History

Release	Comments
Release 1	This version first released with RII Resources and Infrastructure Industry Training Package Version 5.0.

Application

This unit describes the skills and knowledge required to construct artesian (flowing) aquifer bores. This includes designing, constructing and developing artesian aquifer bores, disinfecting bores and equipment and decommissioning bores.

This unit applies to those working in operational, supervisory or technical specialist roles. They generally perform tasks involving a broad range of varied activities most of which are complex and non-routine and are responsible for the quantity and quality of the output of others.

Licensing, legislative and certification requirements that apply to this unit can vary between states, territories, and Industry sectors. Users must check requirements with relevant body before applying the unit.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
1. Plan and prepare for the construction of artesian (flowing) aquifer bores	1.1 Obtain, interpret and confirm work requirements 1.2 Access, interpret and apply artesian (flowing) aquifer bores construction documentation and confirm work activity is compliant 1.3 Identify hazards and environmental issues, assess the risks and implement control measures in line with workplace procedures 1.4 Select and wear personal protective equipment required for work activities 1.5 Communicate with other personnel at site according to work requirements and confirm briefings and handover details are communicated and received 1.6 Discuss scope of work with client and give technical advice, cost structure, workmanship warranty, quantity and quality of

ELEMENT	PERFORMANCE CRITERIA
	materials, construction standards and methods to be used and gain general agreement on drilling plan 1.7 Complete required reports and provide reports, samples and strata logs, pump and development test results to relevant authorities as required
2. Design bores for artesian aquifer systems	2.1 Determine required construction methods and drilling fluid program according to down-hole conditions and anticipated pressures 2.2 Design bore according to environmental and work requirements 2.3 Select a bore site that will prevent contamination and minimise interference with other bores 2.4 Select likely water entry mechanism from the formation to the bore including open hole, slotted casing screens, gravel packs 2.6 Calculate required artificial pack design parameters, and recommended annular thicknesses required 2.7 Undertake calculations to determine appropriate screen/slot design parameters, including for diameter, length, aperture size 2.8 Select required bore/surface casing types, size, strength and wall thicknesses for the anticipated ground/water quality and pressure conditions and any construction requirements 2.9 Confirm all necessary materials anticipated for the job are available and on site prior to commencement of construction phase
3. Construct bores in artesian aquifer system	3.1 Carry out any pre-start and start up procedures according to manufacturer specifications and workplace procedures 3.2 Select, slot, assemble and insert casing and screens suitable for the formations in which they are deployed 3.3 Select, mix and place grout or seal surface according to legislative and company requirements and manufacturer specifications 3.4 Construct bore according to legislative requirements and workplace procedures 3.5 Use, maintain, test and record nontoxic, removable drilling fluids and additives according to manufacturer specifications and environmental requirements 3.6 Maintain plumbness and alignment of the hole within the required limitations and carry out a plumbness test where required 3.7 Prepare for and recognise any symptoms of a formation kick and take action to control the bore 3.8 Collect, store, record, label and transport formation and water samples according to licensing requirements

ELEMENT	PERFORMANCE CRITERIA
	3.9 Arrange for geophysical logging tools to be run in bore if required 3.10 Determine aquifer formation grain size distribution from sieve analysis and interpret appropriate gravel pack and screen slot aperture dimensions for gravel packed wells 3.11 Select and place artificial pack materials 3.12 Remove drilling fluids from the bore to allow subsequent development 3.13 Maintain tool string inventories according to workplace procedures
4. Construct bore headworks	4.1 Construct headworks for bore including isolation valves to retain/control artesian flow and to permit independent testing of both pressure and flow without interference to reticulation system 4.2 Identify and protect headworks of the bore 4.3 Construct headworks to seal and cap the bore from surface water pollutants, environmental concerns and damage 4.4 Dispose of and neutralise wastewater or hazardous materials from site as required and complete restoration of the bore site camp facilities
5. Develop bore	4.1 Use development techniques with care to prevent collapsing of casing or screens 4.2 Undertake development until a continuous, clean supply of water is obtained according to site, contractual and regulatory requirements 4.3 Measure/calculate and record standing and drawdown water levels 4.4 Perform pump and/or development tests to estimate the sand content and sustainable yield of the bore
6. Disinfect/decontaminate bore and drilling equipment	6.1 Determine and monitor potential contaminants of drilling equipment 6.2 Disinfect and decontaminate bores and installed equipment constructed for potable supplies as required
7. Carry out bore maintenance and rehabilitation	7.1 Carry out and shutdown procedures and secure according to manufacturer specifications and workplace procedures 7.2 Undertake a process of diagnosis to determine likely cause of bore deterioration 7.3 Devise a rehabilitation program according to environmental requirements

ELEMENT	PERFORMANCE CRITERIA
8. Decommission artesian wells with flowing and/or non-flowing elements	8.1 Determine suitable decommissioning procedures and select required materials 8.2 Carry out the decommissioning (abandonment) of artesian aquifer bores 8.3 Place cement bridges at the top of the surface casing and at the surface casing shoe 8.4 Verify position/location of hole for future reference 8.5 Dispose of drill and other fluids safely according to environmental requirements and workplace procedures 8.6 Record entire decommissioning procedure and details of bore cementing according to workplace procedures 8.7 Complete bore completion report and submit to State/Territory Water Authority 8.8 Carry out housekeeping requirements according to workplace procedures

Foundation Skills

This section describes those language, literacy and numeracy and employment skills that are essential to performance.

SKILL	DESCRIPTION
Reading	Identifies and interprets information from workplace procedures, policies and documentation
Numeracy	- Identifies and comprehends relevant mathematical information in relation to constructing artesian (flowing) aquifer bores - Estimates, accurately measures and calculates quantities of fluid volumes, up hole velocity, flow rates, density and viscosity
Oral communication	Presents information to others involved in work activity using industry specific vocabulary

Unit Mapping Information

Supersedes and is equivalent to RIINHB411D Construct artesian (flowing) aquifer production bores.

Links

Companion Volume implementation guides is found on VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=88a61002-9a21-4386-aaf8-69c76e675272>

Assessment Requirements for RIINHB411E Construct artesian (flowing) aquifer bores

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Performance Evidence

The candidate must demonstrate the ability to complete the tasks outlined in the elements, performance criteria and foundation skills of this unit, including evidence of the ability to:

- construct artesian (flowing) aquifer bores on at least two occasions, including:
 - designing the bore to ensure the exclusion of unsuitable waters
 - identifying and applying appropriate headworks design for class 3 bore applications
 - selecting a bore site to prevent contamination and minimise interference with other bores
 - selecting a water entry mechanism from the formation to the bore, including:
 - open hole
 - slotted casing screens
 - gravel packs
 - assembling and inserting casing and screens
 - selecting, mixing and placing grout or otherwise seal surface casing from 10 m into competent impermeable strata and back to the surface with a minimum sheath thickness of 20mm above maximum shoe of coupling joint diameter size
 - grouting to seal intermediate and/or inner production casing strings with a 15mm minimum thickness grout sheath or to seal selected zones so that the water from the production bore is drawn from one primary formation only (unless otherwise allowed by the permit)
 - maintaining, testing and recording fluid properties including viscosity, mud weight, filtration and sand content
 - maintaining plumbness and alignment of the hole
 - developing the bore until a continuous, clean supply of water is obtained
 - testing pumps and developments to estimate the sand content and sustainable yield of the bore.

During the above, the candidate must:

- locate and apply relevant standards, legislation, documentation, policies and procedures

- implement the requirements, procedures and techniques for constructing artesian (flowing) aquifer bores, including:
 - selecting and wearing required personal protective equipment
 - plotting and interpreting sieve analysis results onto graphs preventing the inter mixing of aquifers with different water quality and/or Standing Water Level
- communicate clearly and concisely with clients, co-workers and management to receive and clarify work instructions and coordinate work activities prior to commencing
- comply with written and verbal reporting requirements and procedures work.

Knowledge Evidence

The candidate must be able to demonstrate knowledge to complete the tasks outlined in the elements, performance criteria and foundation skills of this unit, including knowledge of:

- key legislation required to construct artesian (flowing) aquifer bores
- key policies, procedures and established requirements for constructing artesian (flowing) aquifer bores, including those for:
 - Minimum Construction Requirements (MCR)
 - work health and safety
 - environmental issues
 - accidents and emergencies
 - safety data sheets (SDS)
 - fishing operations in regard to types of drilling being undertaken
 - housekeeping
- key site information, including:
 - basic geological formations which permit groundwater movement, including soil and rock classifications
 - factors affecting groundwater quality for aquifer systems, including drillability and stability
- key factors affecting work activities described in performance evidence above, including:
 - objectives of bore development
 - equipment characteristics, technical capabilities and limitations
 - safety hazards and sources of contamination when siting a bore
 - the necessity of having a signed agreement/contract with the client
 - the appropriate casing materials for various applications
 - wire-wound screens
 - drilling fluids, including testing and conditioning
 - grout placement methods and procedures including pressure grouting
 - results of sieve analysis
 - applications for natural pack, stabilising fill and artificial pack completion techniques
 - screen design parameters to ensure appropriate entrance velocities
 - characteristics of ‘good samples’ required for water well construction

- ways in which sampling errors can occur
- types of pathogens and contaminants including bacteria
- key calculations for constructing artesian (flowing) aquifer bores, including those for:
 - hole, annular fill or pack materials and mud pit volume in cubic metres or litres
 - required artificial pack design parameters and recommended annular thickness required
- appropriate screen/slot design parameters, including for diameter, length, aperture size.

Assessment Conditions

Mandatory conditions for assessment of this unit are stipulated below. The assessment must:

- include access to:
 - personal protective equipment
 - equipment required to conduct artesian (flowing) aquifer bores
- be conducted in a safe environment
- be assessed in context of this sector's work environment
- be assessed in compliance with relevant legislation and regulations and using policies, procedures, processes and operational manuals directly related to the industry sector for which it is being assessed
- confirm consistent performance can be applied in a range of relevant workplace circumstances.

Where personal safety or environmental damage are limiting factors, assessment may occur in a simulated work environment* provided it is realistic and sufficiently rigorous to cover all aspects of this sector's workplace performance, including environment, task skills, task management skills, contingency management skills and job role environment skills.

Assessor requirements

Assessors must be able to clearly demonstrate current and relevant industry knowledge and experience to satisfy the mandatory regulatory standards as set out in the Standards for Registered Training Organisations (RTOs) 2015/AQTF mandatory requirements for assessors current at the time of assessment and any relevant licensing and certification requirements. This includes:

- vocational competencies at least to the level being delivered and assessed
- current industry skills directly relevant to the training and assessment being provided
- current knowledge and skills in vocational training and learning that informs their training and assessment
- formal relevant qualifications in training and assessment
- having knowledge of and/or experience using the latest techniques and processes
- possessing the required level of RII training product knowledge
- having an understanding and knowledge of legislation and regulations relevant to the industry and to employment and workplaces
- demonstrating the performance evidence, and knowledge evidence outlined in this unit of competency, and

- the minimum years of current** work experience after competency has been obtained as specified below in an industry sector relevant to the outcomes of the unit.

It is also acceptable for the appropriately qualified assessor to work with an industry expert to conduct assessment together and for the industry expert to be involved in the assessment judgement. The industry expert must have current industry skills directly relevant to the training and assessment being provided. This means the industry subject matter expert must demonstrate skills and knowledge from the minimum years of current work experience after competency has been obtained as specified below, including time spent in roles related to the unit being assessed:

Industry sector	AQF indicator level***	Required assessor or industry subject matter expert experience
Drilling, Metalliferous Mining, Coal Mining, Extractive (Quarrying) and Civil Infrastructure	1	1 year
	2	2 years
Drilling, Coal Mining, Extractive (Quarrying), Metalliferous Mining and Civil Infrastructure	3-6	3 years
Other sectors	Where this unit is being assessed outside of the resources and infrastructure sectors assessor and/or industry subject matter expert experience should be in-line with industry standards for the sector in which it is being assessed and where no industry standard is specified should comply with any relevant regulation.	

*Guidance on simulated environments has been stipulated in the RII implementation guide located on VETNet.

**Assessors can demonstrate current work experience through employment within industry in a role relevant to the outcomes of the unit; or, for external assessors this can be demonstrated through exposure to industry by conducting a minimum number of site assessments as determined by the relevant industry sector, across various locations.

*** While a Unit of competency does not have an AQF level, where a unit is being delivered outside of a qualification the first numeric character in the unit code should be considered as the AQF indicator level for assessment purposes.

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