

SQA Advanced Unit Specification

General information for centres

Unit title: Water Supply Engineering

Unit code: HR5K 48

Unit purpose: This Unit is designed to develop candidate knowledge and skills in the principles and practice of the design and construction of elements in the abstraction, treatment and distribution of water for public consumption

On completion of the Unit the candidate should be able to:

- 1 Use graphical methods to solve hydrological problems such as hydrographs, flood prediction and extreme events.
- 2 Describe and explain the essential features of installations for the abstraction of water for public consumption.
- 3 Describe and explain the essential features of installations for the treatment of water for public consumption.
- 4 Describe and explain the essential features of installations for the distribution of water for public consumption.

Credit points and level: 1 SQA Credit at SCQF level 8: (8 SCQF credit points at SCQF level 8*).

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from National 1 to Doctorates.*

Recommended prior knowledge and skills: It is recommended that candidates undertaking this Unit should have prior knowledge and skills as evidenced by the completion of the following unit: Civil Engineering Specialisms; or equivalent prior knowledge and/or experience.

Core Skills: There are opportunities to develop the Core Skills of Numeracy, and Problem Solving in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Context for delivery: If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

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Assessment: It is possible to assess candidates on an individual outcome basis, by combinations of outcomes, or by a single holistic assessment encompassing all outcomes. Assessment should be conducted under supervised conditions. The assessment(s) should consist of an appropriate balance of restricted response and structured questions. If a single assessment covering all outcomes is used, it should not exceed three hours in duration. It should be noted that candidates must achieve all the minimum evidence specified for each outcome in order to complete the unit successfully.

Where evidence for outcomes is assessed on a sample basis, the whole of the content listed in the knowledge and/or skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different knowledge and skills items should be sampled on each assessment occasion.

The sections of the unit stating outcomes, knowledge and/or skills, and evidence requirements are mandatory.

An exemplar instrument of assessment and marking guidelines has been produced to provide examples of the type of evidence required to demonstrate achievement of the aims of this Unit and to indicate the national standard of achievement at SCQF level 8.

SQA Advanced Unit specification: statement of standards

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The sections of the Unit stating the Outcomes, knowledge and/or skills, and evidence requirements are mandatory.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the knowledge and/or skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

Throughout the unit emphasis will be placed where appropriate on the application of Health and Safety and Sustainability. Safe working practices should be looked at in accordance with current safety codes of practice and regulations. Sustainability should include reference to criteria affecting sustainability, the impact on the environment of not implementing sustainability, and the legislation promoting sustainability.

Outcome 1

Use graphical methods to solve hydrological problems such as hydrographs, flood prediction and extreme events

Knowledge and/or skills

- ◆ Rainfall
- ◆ Catchment areas
- ◆ River flows
- ◆ Hydrographs
- ◆ Flood events

Evidence Requirements

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ identify appropriate input criteria for addressing hydrological problems
- ◆ analyse problems in hydrology

Evidence for the knowledge and/or skills for this Outcome will be provided on a sample basis. In any assessment of this Outcome, a minimum of **four out of five** knowledge and/or skills items should be sampled. Candidates must provide a satisfactory response in regard to all four knowledge and/or skills items.

Evidence should be generated through assessment undertaken in controlled supervised conditions. Assessment should be conducted under open book conditions.

Assessment guidelines

The assessment for this Outcome might be combined with those for some or all of the other outcomes in the Unit.

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Outcome 2

Describe and explain the essential features of installations for the abstraction of water for public consumption

Knowledge and/or skills

- ◆ Impounding and storage reservoirs
- ◆ Dam type and location
- ◆ Overflow and draw-off
- ◆ River abstraction
- ◆ Aquifers and boreholes
- ◆ Desalination

Evidence Requirements

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ explain the selection of sites for and processes involved in water abstraction

Evidence for the knowledge and/or skills for this Outcome will be provided on a sample basis. In any assessment of this Outcome, a minimum of **four out of six** knowledge and/or skills items should be sampled. Candidates must provide a satisfactory response in regard to all four knowledge and/or skills items.

Evidence should be generated through assessment undertaken in controlled supervised conditions. Assessment should be conducted under open book conditions.

Assessment guidelines

The assessment for this Outcome might be combined with those for some or all of the other outcomes in the Unit.

Outcome 3

Describe and explain the essential features of installations for the treatment of water for public consumption

Knowledge and/or skills

- ◆ Impurities and quality
- ◆ Settlement/coagulation/flocculation
- ◆ Filtration
- ◆ Chemical treatment
- ◆ Disinfection
- ◆ Sludge processing

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Evidence Requirements

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ identify processes in water treatment, explaining the criteria for alternative treatment processes

Evidence for the knowledge and/or skills for this Outcome will be provided on a sample basis. In any assessment of this Outcome, a minimum of **four out of six** knowledge and/or skills items should be sampled. Candidates must provide a satisfactory response in regard to all four knowledge and/or skills items.

Evidence should be generated through assessment undertaken in controlled supervised conditions. Assessment should be conducted under open book conditions.

Assessment guidelines

The assessment for this Outcome might be combined with those for some or all of the other outcomes in the Unit.

Outcome 4

Describe and explain the essential features of installations for the distribution of water for public consumption

Knowledge and/or skills

- ◆ Transmission mains
- ◆ Service reservoirs
- ◆ User supply networks
- ◆ Pipe materials
- ◆ Pressure requirements
- ◆ Leakage

Evidence Requirements

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ explain distribution systems configurations, specifying selected network elements

Evidence for the knowledge and/or skills for this Outcome will be provided on a sample basis. In any assessment of this Outcome, a minimum of **four out of six** knowledge and/or skills items should be sampled. Candidates must provide a satisfactory response in regard to all four knowledge and/or skills items.

Evidence should be generated through assessment undertaken in controlled supervised conditions. Assessment should be conducted under open book conditions.

Assessment guidelines

The assessment for this Outcome might be combined with those for some or all of the other outcomes in the Unit.

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Administrative Information

Unit code:	HR5K 48
Unit title:	Water Supply Engineering
Superclass category:	TL
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FURTHER INFORMATION: Call SQA's Customer Contact Centre on 44 (0) 141 500 5030 or 0345 279 1000. Alternatively, complete our Centre Feedback Form.

SQA Advanced Unit specification: support notes

Unit title: Water Supply Engineering

This part of the Unit specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

Guidance on the content and context for this Unit

This Unit provides the candidate with the knowledge and skills to carry out the analysis of basic hydrological problems relevant to water supply. It also introduces some key aspects of the abstraction, treatment and distribution systems for public water supply. Attention should be paid in the delivery of this Unit to the content of other related units in the programme. In particular, it should be noted that some introductory water supply elements are featured in the unit entitled Civil Engineering Specialisms. There is also a related unit in Public Health Engineering.

Recommended class time allocations to each outcome are given as guidance towards the depth of treatment that might be applied to each topic. This guidance has been used in the design of the assessment exemplar material for this Unit.

1 Graphical methods to solve hydrological problems (10 hours)

Rainfall: hydrological cycle; local and national precipitation patterns; rain gauging; intensity/duration relationships.

Catchment areas: areal extent; runoff factors; influence of shape, slope, size, soil absorption and solid geology.

River flows: natural water flows; gauging; relationship to rainfall, groundwater flows and storage.

Hydrographs: natural hydrographs; unit hydrographs; baseflow; peaking; application.

Flood events: storage equation in flood routing; inflow and discharge hydrographs for impounding reservoirs; statistical estimation of extreme events.

2 Installations for the abstraction of water for public consumption (10 hours)

Impounding and storage reservoirs: volume; yield; type and function; environmental issues.

Dam type and location: types and components in earth fill and concrete dams; geological, topographical, structural and economic factors in location.

Overflow and draw-off: wave protection: spillway types and features; erosion control; draw-off towers; onward transmission to treatment.

River abstraction: weirs; intake screens; yield; transmission to storage and treatment.

Aquifers and boreholes: geological investigation; proving; features of borehole installations.

Desalination: methods of seawater desalination.

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3 Installations for the treatment of water for public consumption (10 hours)

Impurities and quality: sources and types of impurity in raw water; water-borne diseases; legal requirements and obligations.

Settlement/coagulation/flocculation: types of settlement tank; processes of coagulation/flocculation and the chemical/physical processes involved.

Filtration: slow sand filters; types of rapid gravity filters; filter media; filter cleaning; membrane filtration; emergency water treatment.

Chemical treatment: dissolved chemical removal; ion exchange; hardness control; pH control; removal of excess chlorine; adsorption; fluoridation.

Disinfection: chlorination; ozonization; ultraviolet light; other methods.

Sludge processing: thickening; settlement; dewatering; disposal.

4 Installations for the distribution of water for public consumption (10 hours)

Transmission mains: material, pressure and functional requirements.

Service reservoirs: design; location; capacity requirements for emergency and equalising storage.

Distribution networks: linear, cross-linked and ring systems; types and functions of valves.

Pipe materials: common pipe materials; jointing; bedding.

Pressure requirements: maximum and minimum requirements for domestic supply; influence of topography, distance and network configuration; head reduction.

Leakage: sources, cost and extent of leakage in a network; monitoring; repair and replacement of components.

Guidance on the delivery and assessment of this Unit

Since this Unit relies in part on the candidate’s knowledge from a previously completed unit, the unit should be studied in the second year of a two-year programme. Case studies could usefully be employed to illustrate the practical working context of the material delivered. This might involve practitioners to deal with some aspects of the content or site visits where these are possible. In addition, where the centre has access to appropriate laboratories or design software, this might be used to allow a broader application of the concepts.

Candidates would normally work individually but should be encouraged to participate in group work and discussion in relation to their own studies or experiences. Assessment may be formative and summative and both may feature as part of the process. Although assessment must be focussed on the individual achievement of each candidate, group work may contribute as appropriate. Integrative project work might assist in linking this Unit with other related units. Appropriate attention must be given to health and safety arrangements in relation to the topics covered.

The volume of evidence required for each outcome should take into account the overall number of assessments being contemplated within this Unit and the design of the overall delivery programme. In designing the assessment instrument(s) opportunities should be taken to generate appropriate evidence to contribute to the development of core skills elements.

Where available, evidence from the workplace can also be incorporated to enhance the learning outcomes, provided that such evidence is appropriate and authenticated as the candidate’s own work.

Opportunities for developing Core Skills

Opportunities for the development of Core Skills at the output level are more fully identified in the Core Skills Sign Posting Guide’. The grid below is indicative of the opportunities for core skills development within this Unit.

Core Skill	Outcome 1	Outcome 2	Outcome 3	Outcome 4
1 Communication				
Reading				
Writing				
Oral				
2 Numeracy				
Using Number	3		3	
Using Graphical Information	3	3	3	3
3 IT				
Using Information Technology				
4 Problem Solving				
Critical Thinking	3	3	3	3
Planning and Organising				
Reviewing and Evaluating				
5 Working with Others				

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Open learning

Where appropriate materials exist, this Unit could be delivered by distance learning, which may incorporate some degree of online support. However, with regard to assessment, planning would be required by the centre concerned to ensure the sufficiency and authenticity of candidate evidence. Arrangements would need to be put in place to ensure that assessments were conducted under controlled supervised conditions.

Equality and inclusion

This Unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.

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- 4 Describe and explain the essential features of installations for the distribution of water for public consumption.

Evidence that you can satisfy the knowledge and skill elements of this Unit will be obtained by assessment in controlled supervised conditions in an open book context.