

Higher National Unit Specification

General information for centres

Unit title: Public Health Engineering

Unit code: DW5P 35

Unit purpose: This Unit is designed to develop candidate knowledge and skills in the principles and practice of wastewater management and treatment.

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

- 1 Apply hydrological principles to the design of surface water drainage systems (including sustainable systems).
- 2 Explain the design of foul and combined sewerage systems.
- 3 Describe and explain the requirements for the control of discharges to rivers and coastal waters.
- 4 Explain the functions and designs of wastewater treatment elements.

Credit points and level: 1 HN 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 Access 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 units: 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.

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.

General information for centres (cont)

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.

Higher National 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 & 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

Apply hydrological principles to the design of surface water drainage systems (including sustainable systems)

Knowledge and/or skills

- ◆ Rainfall characteristics
- ◆ Catchment characteristics
- ◆ Pipe design flows
- ◆ Design methods
- ◆ System storage
- ◆ Sustainable systems

Evidence Requirements

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

- ◆ specify and analyse problems in surface water drainage
- ◆ apply appropriate design criteria to determine suitable elements in surface water drainage

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.

Higher National Unit specification: statement of standards (cont)

Unit title: Public Health Engineering

Assessment guidelines

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

Outcome 2

Explain the design of foul and combined sewerage systems

Knowledge and/or skills

- ◆ System types
- ◆ Design flows
- ◆ Pipe sizing
- ◆ Storage and overflow
- ◆ Construction
- ◆ Maintenance

Evidence Requirements

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

- ◆ identify appropriate design, construction and maintenance criteria for foul and combined sewerage
- ◆ specify and analyse problems in foul and/or combined sewerage

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 requirements for the control of discharges to rivers and coastal waters

Higher National Unit specification: statement of standards (cont)

Unit title: Public Health Engineering

Knowledge and/or skills

- ◆ Pollutants
- ◆ Regulation
- ◆ Discharge standards
- ◆ Standard tests
- ◆ Dilution/dispersion
- ◆ Biochemical processes

Evidence Requirements

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

- ◆ identify the regulatory framework controlling wastewater discharges
- ◆ explain the processes involved in pollutant reduction

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

Explain the functions and designs of wastewater treatment elements

Knowledge and/or skills

- ◆ Performance requirements
- ◆ Preliminary treatment elements
- ◆ Primary treatment elements
- ◆ Secondary treatment elements
- ◆ Tertiary treatment elements
- ◆ Sludge control

Evidence Requirements

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

Higher National Unit specification: statement of standards (cont)

Unit title: Public Health Engineering

- ◆ explain sewage treatment processes
- ◆ apply appropriate criteria to assess and/or design sewage treatment 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.

Administrative Information

Unit code:	DW5P 35
Unit title:	Public Health Engineering
Superclass category:	TL
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Higher National Unit specification: support notes

Unit title: Public Health 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 basic designs of surface water drainage elements and sewage treatment elements. It introduces some key features of foul and combined sewerage systems and the control of discharges to receiving waters. It seeks to provide the candidate with a basic environmental awareness in relation to public health engineering. 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 material is featured in the unit entitled Civil Engineering Specialisms. There is also a related unit in Water Supply 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 Hydrological principles in the design of surface water drainage systems (including sustainable systems) (10 hours).

Rainfall characteristics: intensity/duration relationships; factors affecting intensity; standard methods of estimating design rainfall.

Catchment characteristics: area; soil type; wetness; permeability; shape; slope; routing.

Pipe design flows: gradient/depth/discharge/velocity relationships; times of entry, flow and concentration; design charts and software; application to networks.

Design methods: modified rational and other methods; network checks by manual and/or computer based procedures.

System storage: headwater, on-line, off-line, and exit storage.

Sustainable systems: storage ponds; swales; permeable areas; filter systems; quality issues.

2 Design of foul and combined sewerage systems (10 hours)

System types: large and small scale systems; combined, separate and partially separate systems.

Design flows: dry weather flow; peak flow; self cleansing velocity; infiltration; industrial flows; domestic flows.

Pipe sizing: rule-of-thumb methods; tables, charts and software for pipe sizing; network principles.

Higher National Unit specification: support notes (cont)

Unit title: Public Health Engineering

Storage and overflow: on-line storage; combined sewer overflows – types, requirements and pollution control.

Construction: manhole types and construction; pipe materials and bedding.

Maintenance: access; manual and automatic inspection techniques; health and safety issues.

3 Control of discharges to rivers and coastal waters (10 hours).

Pollutants: sources, nature and extent of common wastewater borne pollutants and diseases.

Regulation: appropriate European and national statutory requirements for wastewater treatments and discharge; role of protection agencies.

Discharge standards: definitions of biochemical oxygen demand (BOD) and suspended solids (SS); appropriate standards; control of other specific pollutants.

Standard tests: sampling and testing for discharge and performance monitoring.

Dilution/dispersion: introduction to principles of interaction between discharge and receiving water; decay curves.

Biochemical processes: introduction to aerobic and anaerobic processes.

4 Function and design of wastewater treatment elements (10 hours).

Performance requirements: small and large scale works; principles of treatment; historical development; process reductions in BOD and SS; relationship to receiving water requirements.

Preliminary treatment elements: inlet works; screening; grit removal; comminution; grease removal; disposal of screenings; odour control.

Primary treatment elements: storm tanks; sedimentation processes; types and sizes of tank; sludge and scum removal.

Secondary treatment elements: oxidation ponds; activated sludge; percolating filters; reed beds.

Tertiary treatment elements: phosphate removal; filtration; ultraviolet disinfection; metallic element removal.

Sludge control: thickening; digestion; dewatering; disposal.

Higher National Unit specification: support notes (cont)

Unit title: Public Health Engineering

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 and /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.

Higher National Unit specification: support notes (cont)

Unit title: Public Health Engineering

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

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.

Candidates with additional support needs

This Unit specification is intended to ensure that there are no artificial barriers to learning or assessment. The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative Outcomes for Units. For information on these, please refer to the SQA document *Guidance on Alternative Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs*, which is available on SQA's website: www.sqa.org.uk.

General information for candidates

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- 4 Explain the functions and designs of wastewater treatment elements.

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.