Higher National Unit specification

General information for centres

Unit title: Freshwater Environments: Management and Protection

Unit code: F435 35

Unit purpose: This Unit develops understanding and knowledge of freshwater catchments, habitats and ecosystems, the pollution issues affecting them and the management techniques that are important in maintaining water quality. It covers the management and pollution issues arising within catchments, along with the legislative roles and remits of UK regulating bodies and other agencies responsible for overseeing water quality, and the importance of pressure groups.

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

1 Explain the key components and processes of freshwater catchments, habitats and ecosystems.
2 Compare significant pollutants and impacts of human activities on freshwater environments.
3 Evaluate management techniques designed to maintain and improve water quality.
4 Explain the regulatory roles and activities of the authorities responsible for maintaining water quality.

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: Access to this Unit will be at the discretion of the centre. However, it would be beneficial if candidates had experience of studying ecology or environmental science subject(s) at SCQF level 6/7.

Core Skills: There are opportunities to develop the component 'Written Communication' of the Core Skill Communication at SCQF level 6 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: This Unit could be assessed holistically using a single integrated case study based on a local catchment. Alternatively, each Outcome could be assessed separately using extended response questions.

Higher National Unit specification: statement of standards

Unit title: Freshwater Environments: Management and Protection

Unit code: F435 35

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.

Outcome 1

Explain the key components and processes of freshwater catchments, habitats and ecosystems

Knowledge and/or Skills

- Catchment characteristics
- Habitat characteristics
- Ecosystem characteristics

Evidence Requirements

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

- describe the structure of a named catchment in terms of its geography, underlying geology and the main types of land use throughout the catchment
- explain how the hydrological cycle relates to a named catchment especially in relation to the movement of water between the main freshwater habitats in the catchment
- explain the distribution of running water, standing water and wetland habitats within a named catchment, including the linkages between them
- for one named freshwater habitat within a catchment, explain the main components of the flora and fauna and the trophic relationships between them in relation to the sources of energy and key nutrients

A candidate's response can be judged to be satisfactory where the evidence provided is sufficient to meet the requirements above.

Assessment Guidelines

This Outcome could be assessed by extended response questions. Alternatively it could be combined with the assessment of Outcomes 2, 3 and 4 as part of a single holistic assessment for the Unit using a case study of a selected catchment, ideally but not necessarily, following on-site study of key locations. The selected catchment should allow candidates to generate all the evidence stipulated in the Evidence Requirements for each Outcome.

Higher National Unit specification: statement of standards (cont)

Unit title: Freshwater Environments: Management and Protection

Outcome 2

Compare significant pollutants and impacts of human activities on freshwater ecosystems

Knowledge and/or Skills

- Pollutants
- Human activities
- Environmental impacts

Evidence Requirements

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

- explain the main differences between acute and chronic and/or cumulative toxicity and the three main effects of transformations in the aquatic environment
- describe the main point and diffuse sources of water pollution in a catchment, to include an example each of a biological, physical and chemical source
- compare the key characteristics and effects on a freshwater ecosystem of one biological, one physical and one chemical pollutant
- compare the potential environmental, ecological and aesthetic impacts on a catchment of the following human activities: agriculture, forestry, infrastructure development and recreation

A candidate's response can be judged to be satisfactory where the evidence provided is sufficient to meet the requirements above.

Assessment Guidelines

This Outcome could be assessed by extended response questions. Alternatively it could be combined with the assessment of Outcomes 1, 3 and 4 in a single holistic assessment for the Unit using a case study of a selected catchment, ideally but not necessarily, following on-site study of key locations. The selected catchment should allow candidates to generate all the evidence stipulated in the Evidence Requirements for each Outcome.

Outcome 3

Evaluate management techniques designed to maintain and improve water quality

Knowledge and/or Skills

- Treatment of pollutants prior to discharge
- Land management methods
- Restoration techniques

Evidence Requirements

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

- explain, with examples, how effluents may be treated prior to discharge to reduce the impact of pollutants
- explain how land management methods may be modified to reduce impacts on aquatic environments, including an example from agriculture and forestry
- evaluate three restoration techniques to apply to a degraded freshwater habitat

A candidate's response can be judged to be satisfactory where the evidence provided is sufficient to meet the requirements above.

Assessment Guidelines

This Outcome could be assessed by extended response questions. Alternatively it could be combined with Outcomes 1, 2 and 4 in a single holistic assessment for the Unit using a case study of a selected catchment, ideally but not necessarily, following on-site study of key locations. The selected catchment should allow candidates to generate all the evidence stipulated in the Evidence Requirements for each Outcome.

Outcome 4

Explain the regulatory roles and activities of the authorities and bodies responsible for maintaining water quality

Knowledge and/or Skills

- Regulatory authorities
- Non-regulatory bodies
- Activities: advisory, regulatory, analytical
- Water quality — assessment and monitoring

Evidence Requirements

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

- explain the remit of the regulatory authorities currently responsible for maintaining water quality in Scotland
- explain the remit of two non-regulatory bodies with an interest in maintaining water quality
- explain the role of one regulatory and one non-regulatory body in providing advice, enforcing regulations and analysing water quality
- explain how biological and chemical methods may be used to assess and monitor water quality

A candidate's response can be judged to be satisfactory where the evidence provided is sufficient to meet the requirements above.

Higher National Unit specification: statement of standards (cont)

Unit title: Freshwater Environments: Management and Protection

Assessment Guidelines

This Outcome could be assessed by extended response questions. Alternatively it could be combined with the assessment of Outcomes 1, 2 and 3 in a single holistic assessment for the Unit using a case study of a selected catchment, ideally but not necessarily, following on-site study of key locations. The selected catchment should allow candidates to generate all the evidence stipulated in the Evidence Requirements for each Outcome.

Administrative Information

Unit code: F435 35

Unit title: Freshwater Environments: Management and Protection

Superclass category: QA

Original date of publication: August 2008

Version: 01

History of changes:

Version	Description of change	Date

Source: SQA

SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of Higher National qualifications.

Additional copies of this Unit specification can be purchased from the Scottish Qualifications Authority. Please contact the Customer Contact Centre for further details, telephone 0845 279 1000.

Higher National Unit specification: support notes

Unit title: Freshwater Environments: Management and Protection

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 develops understanding and knowledge of freshwater ecosystems, the pollution issues affecting them and the management techniques that are important in maintaining water quality. The management and pollution issues arising within a catchment, and their impact on water quality, are covered, along with the legislative roles and remits of UK agencies responsible for overseeing water quality.

Outcome 1

An understanding of the key components of freshwater ecosystems is essential in successfully considering the management of the aquatic environment. Descriptions of aquatic ecosystems and habitats should make reference to natural inputs and outputs that occur in such ecosystems. The role of aquatic ecosystems as a habitat for macrophytes, micro-organisms (eg bacteria, algae, plankton), invertebrates and vertebrates, and the interactions between such flora and fauna, should be considered. The role of catchment characteristics such as geography, geology, and land use in helping to define and evolve an aquatic ecosystem should be put into context, preferably focussing on local examples, with the possibility of field trips to visit key sites.

The hydrology of aquatic ecosystems, in terms of hydrological cycles (eg precipitation, transpiration, evaporation, seepage, river flow, groundwater), water storage and movement through the landscape should also be discussed. This could lead into a discussion of how running water, standing water and wetland habitats are distributed within a named catchment, linked by the flow of water through the hydrological cycle. For one of these habitats, the main species of plants and animals should be considered and placed into the context of trophic relationships (food webs). This could include the identification of the sources of energy within the habitat (allochthonous, autochthonous) and the key nutrients, such as nitrate and phosphate.

Outcome 2

This Outcome looks at significant pollutants and the impact of human activities on freshwater ecosystems and catchments and should include both point and diffuse sources of pollution. Potential pollutants include those from industry, agriculture, domestic effluent, historic effluents (eg abandoned mine/spoil heap drainage), forestry, urbanisation, and landfill. Examples should be given of biological pollutants (eg invasive alien species, micro-organisms, organic wastes), physical pollutants (eg sediment, particulate matter, fly tipping) and chemical pollutants (eg nitrogen, phosphorus, metals, agro-chemicals, acidification). Using one example each of biological, physical and chemical pollutants, key characteristics and effects on a freshwater ecosystem should be compared. The characteristics discussed should consider the differences between acute and chronic/cumulative toxicity, and the effects of transformations in the aquatic environment (eg combination with other chemicals, effects of oxygenation/deoxygenation, pH).

Impacts of pollutants could include environmental effects (eg biochemical oxygen demand, sedimentation and loss of habitats/breeding grounds, eutrophication), biological changes (eg biochemical transformations, endocrine disruption), and aesthetic effects (eg litter and fly tipping, detergent foam, suspended solids, oil).

The impact of human activities covers a variety of activities including agriculture and forestry, recreational activities and infrastructure development, which may involve water abstraction (resulting in reduction in water flow, diversion of water, risk of contamination, hydrogeological impacts), flood prevention, altered drainage and canalisation. Potential effects of these activities should be compared in terms of environmental, ecological and aesthetic impacts.

Outcome 3

A wide range of management techniques designed to maintain and improve water quality could be introduced, to develop a real understanding of the breadth and depth of the subject. Techniques should include prevention of point source (eg wastewater, industrial effluent treatment), and diffuse sources (eg land management to prevent pollution from agriculture and forestry: soil erosion prevention, agro-chemical storage and use; and urban drainage). There should also be discussion of restoration techniques for running water and wetlands (eg riffles, shading, bank erosion prevention, reversal of canalisation, reversal of drainage, vegetation management), with an evaluation of their effectiveness and limitations.

Outcome 4

The role and activities of both regulatory authorities and voluntary bodies such as the Rivers Trusts (or equivalent body) could be discussed, in terms of their roles and remits in providing advice, enforcing regulations and analysing water quality. The importance of using the relevant indicator of water quality, and the relevance of various indicators should be considered, including reference to both chemical and biological indicators, and the use of classification schemes within the UK.

Guidance on the delivery and assessment of this Unit

This Unit is likely to form part of a Group Award designed to provide candidates with knowledge and skills for employment within a countryside management environment. There may be opportunities for integration of delivery and assessment with earth science or ecology Units.

It is anticipated that lectures and class discussion will be supplemented with site visits whenever possible. Each Outcome could be assessed separately by extended response questions, but the Unit lends itself to a holistic approach with a single integrated case study assessment based on a local catchment. To spread the assessment load, sections of the case study could be submitted at intervals throughout the delivery of the Unit.

The case study should allow candidates to generate all of the evidence stipulated in the Evidence Requirements for each Outcome. In the event of re-assessment the tutor should select a substantially different case study scenario.

Higher National Unit specification: support notes (cont)

Unit title: Freshwater Environments: Management and Protection

Opportunities for developing Core Skills

Although the Unit is designed to provide candidates with the knowledge and skills related to their specific occupational area there are opportunities to develop the Core Skill of Communication.. The production of a case study report which was well structured, logical, clear and properly referenced could contribute towards the Component 'Written Communication' of the Core Skill Communication at SCQF level 6.

Open learning

It would be possible to deliver this Unit by distance or blended learning methods, including internet-based material and directed reading. Arrangements could be made for a field trip to visit the selected catchment, or candidates could choose a catchment local to their homes.

With regard to assessment, planning would be required by the centre to ensure the sufficiency and authenticity of the candidate evidence.

Candidates with disabilities and/or additional support needs

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. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* **(www.sqa.org.uk)**.

General information for candidates

Unit title: Freshwater Environments: Management and Protection

This Unit will help you develop understanding and knowledge of freshwater ecosystems, the pollution issues affecting them and the management techniques that are important in maintaining water quality.

Outcome 1 looks at the key components of freshwater ecosystems. An understanding of these is essential in successfully considering the management of the aquatic environment. You will learn about the role of aquatic ecosystems as a habitat for plants, micro-organisms, invertebrates and vertebrates, and the interactions between them. Catchment characteristics such as geography, geology, hydrology and land use will be studied by focussing on local examples, with the possibility of field trips to visit key sites.

In Outcome 2 you will discuss significant pollutants and their impact on the catchment, for example pollutants from industry, agriculture, domestic effluent, mine spoil heaps, forestry, urbanisation, and landfill. This Outcome also looks at how a variety of human activities can impact on aquatic environments.

In Outcome 3, a wide range of management techniques designed to maintain and improve water quality will be introduced, to help you develop a real understanding of the breadth and depth of the subject. Techniques include treatment of wastewater and industrial effluent and land management to prevent pollution from agriculture and forestry.

In Outcome 4 you will find out how the statutory authorities and voluntary bodies monitor and regulate water quality.

It is anticipated that lectures and class discussion will be supplemented with site visits whenever possible. Each Outcome may be assessed separately by extended response questions, or all Outcomes could be assessed holistically using a single integrated case study assessment based on a local catchment.

There are opportunities to develop the component ‘Written Communication’ of the Core Skill Communication at SCQF level 6 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.