HORIZON NUCLEAR POWER

WYLFA NEWYDD

ENERGY WORKING FOR BRITAIN

Wylfa Newydd Project

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Wylfa Newydd Project

Horizon Nuclear Power Ltd

Fluvial Geomorphology Baseline Report

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Project manager:	Rob Bromley
Author:	Sera Roberts, Katy Kemble

Jacobs U.K. Limited

1180 Eskdale Road
Winnersh, Wokingham
Reading RG41 5TU
United Kingdom
T +44 (0)118 946 7000
F +44 (0)118 946 7001
www.jacobs.com

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Contents

Executive Summary

Horizon Nuclear Power Ltd (Horizon) is currently planning to develop a new Nuclear Power Station to the west of Cemaes, Anglesey, as identified in the *National Policy Statement for Nuclear Power Generation (EN-6)* [RD1]. As a Nationally Significant Infrastructure Project under the *Planning Act 2008*, the construction and operation must be authorised by a Development Consent Order.

Jacobs UK Ltd (Jacobs) has been commissioned by Horizon to undertake a fluvial geomorphology assessment and review of physical processes information/data to inform the Development Consent Order Environmental Statement. This report summarises the baseline conditions for the fluvial geomorphology aspect of the Wylfa Newydd Project study area.

Geomorphological reconnaissance surveys were undertaken in November 2014 and July 2015 to assess the baseline condition of the key watercourses potentially affected by the Wylfa Newydd Project. The reconnaissance surveys provide a record of the geomorphological conditions of the watercourses at the time of the surveys and also provide an understanding of the nature of the catchments and other associated watercourses/drainage ditches. A photographic record of the general character of the watercourses is included in this report.

This report specifically details the results from the reconnaissance surveys and a desk study of available information, including map analysis (historical and contemporary), geology, soils and aerial photography. The baseline assessment concluded that the fluvial watercourses had typically been historically artificially straightened and possibly dredged for agricultural drainage purposes. The survey noted that they often demarked field boundaries and had little or no vegetated riparian buffer between the channel and cultivated land. The majority of the channels had inputs from several diffuse and point sources of fine sediment, primarily from animal poaching and inputs from field drains.

1. Introduction

1.1 Overview

Horizon Nuclear Power Ltd. (Horizon) is currently planning to develop a new Nuclear Power Station to the west of Cemaes, Anglesey, as identified in the *National Policy Statement for Nuclear Power Generation (EN-6)* [RD1]. As a Nationally Significant Infrastructure Project under the *Planning Act 2008*, the construction and operation must be authorised by a Development Consent Order. Jacobs UK Ltd (Jacobs) was commissioned by Horizon to prepare a fluvial geomorphology baseline to inform the Environmental Impact Assessment.

This report details the geomorphological baseline for all the watercourses within the Wylfa Newydd Project study area (hereafter referred to as the 'study area') (see figure 1.1) with the exception of two watercourses (see section 2.3). This includes a desk study and geomorphological reconnaissance surveys.

1.2 Site description

The Wylfa Newydd Development Area includes the Power Station Site and surrounding area to be used for the construction and operation of the Power Station. It is bounded to the north by the coast and the Existing Power Station. To the east, it is separated from Cemaes by a narrow corridor of agricultural land. The A5025 and residential properties define part of the south-east boundary, with a small parcel of land bordering the road to the north-east of Tregele. To the south and west, the Wylfa Newydd Development Area abuts agricultural land, and to the west it adjoins the coastal hinterland.

The fluvial geomorphology study area is defined as being 1km from the Wylfa Newydd Development Area boundary and predominantly consists of agricultural land used for animal grazing. It also includes the Existing Power Station and the village of Tregele. A location plan of the fluvial geomorphology study area and key receptors considered within this report is provided in figure 1.1.

1.3 Study aims and objectives

The objectives of the fluvial geomorphology baseline report are to characterise the fluvial environment and collect baseline data to inform the Development Consent Order required to construct and operate the Power Station. As part of the Environmental Impact Assessment and Habitats Regulations Assessments, the need for detailed knowledge of temporal and spatial data on the watercourses has been identified. In particular, the Environmental Statement is supported by a Water Framework Directive (WFD) Compliance Assessment (Application Reference Number: 8.26) to assess the potential for deterioration of the WFD water bodies. All of the watercourses within this report form part of WFD coastal water body catchments with the exception of the Afon Wygyr which is classified as a fluvial water body.

This report presents the findings of geomorphological reconnaissance surveys undertaken in November 2014 and July 2015 by geomorphologists as well as desk study information.

The specific aims of this work include:

- provision of an understanding of the baseline geomorphological conditions of the watercourses within the study area;
- provision of a report that can be referred to throughout the Environmental Impact Assessment process for key geomorphological information for the Wylfa Newydd Project;
- informing a WFD Compliance Assessment, including the fluvial, estuarine and coastal water bodies;
- informing the Habitats Regulations Assessment;
- informing the relevant Environmental Impact Assessment (Scoping and Environmental Statement) chapter; and
- informing Environmental Permitting (where applicable).

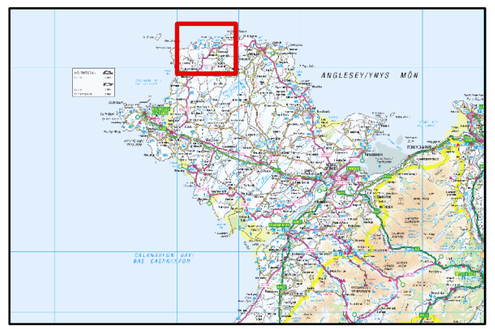
FIGURE 1.1

Nant Porth-y-pistyll
Tre'r Gof SSSI drains
Afon Traeth Mawr
Afon Cafnan Tributary
Nant Cemlyn
Nant Cemaes
Afon Wygyr
Afon Cafnan
Nant Caerdegog Uchaf
Afon Cefn Coch
Bod-hedd Drain
Cemlyn Bay
Cemaes Bay
A5025

Legend

- Wylfa Newydd Development Area
- Fluvial geomorphology study area
- Main river water body
- Other watercourses
- Coastal water body
- Nant Caerdegog Isaf - section to realign as part of project

The coastal areas shown within the study area are considered within the fluvial geomorphology assessment to determine potential downstream effects; however, the direct impacts are assessed within the Marine Environment chapter.



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ENVIRONMENTAL STATEMENT

Drawing Title: FLUVIAL GEOMORPHOLOGY STUDY AREA AND KEY RECEPTORS

Scale @ A3	1:30,000	DO NOT SCALE
Jacobs No.	60PO8077	
Client No.		

Drawing No.: 60PO8077_DCO_D_08_02

0 0.25 0.5 1 1.5 2 2.5 Kilometres

2. Methodology

The baseline report is based on a combination of a desk study, reviewing existing information relevant to the water bodies in the study area and geomorphological reconnaissance surveys to further develop the key baseline observations. The following steps were undertaken:

- collation and review of baseline desk-based information on the study area, including WFD water bodies and catchment information; and
- geomorphological reconnaissance surveys of the key watercourses in the vicinity of the Wylfa Newydd Project.

The findings of the desk study and geomorphological reconnaissance surveys are presented below.

The study area is based on stream catchments within a 1km radius of the Wylfa Newydd Development Area. Consideration is given to associated upstream and downstream water bodies outwith the study area, to ensure all surface water features of relevance are captured. Each water body has been individually assessed drawing upon informed professional judgement and an understanding of the proposed activities associated with the Wylfa Newydd Project. Potential effects and pathways have been assessed for those water bodies. This work resulted in two of the water bodies being scoped out as no potential effects were identified (as detailed in section 2.3).

All WFD data used in this report are based on the Cycle 2 data provided by Natural Resources Wales (NRW) [RD2]. This is with the exception of water body lengths which have been taken from the spatial data worksheet originally produced by the Environment Agency [RD3].

2.1 Desk study

The desk study includes a review of available information and data on soils and geology, historical map analysis and key literature. The following is a list of the key documentation/data used to inform the desk study:

- Western Wales River Basin Management Plan (RBMP) [RD2];
- contemporary Ordnance Survey (OS) maps [RD4];
- Multi-Agency Geographic Information for the Countryside (MAGIC) interactive maps [RD5];
- geological maps [RD6];
- Water Watch Wales [RD7]; and
- aerial photographs [RD8].

2.2 Geomorphological reconnaissance surveys

Geomorphological reconnaissance surveys were undertaken by two geomorphologists from 17–20 November 2014 and 20–24 July 2015. The reconnaissance surveys assessed the baseline condition of the three fluvial water bodies potentially affected by the Wylfa Newydd Project. The reconnaissance surveys provided an understanding of the existing geomorphological conditions of the water bodies and, where possible, condition of the channel upstream and downstream. A photographic record of the general character of the watercourses was made and is presented in section 5 of this report.

The following locations were observed during the geomorphological reconnaissance surveys and are shown on Figure 1.1:

- Nant Cemlyn:
  - at SH 33500 92149; and
  - between SH 33457 92440 and SH 33338 92865.
- Afon Cafnan:

- between SH 33790 90073 and SH 34123 90781; and
- between SH 33992 91651 and SH 34458 93382;
- the Nant Caerdegog Isaf between SH 34794 91742 and SH 35066 92183 and between SH 34938 92529 and SH 34003 92325;
- the Afon Cefn Coch between SH 34320 90533 and SH 34439 90754; and
- the Bod Hedd Drain between SH 33665 89627 and SH 33806 90052.

- Afon Wygyr:
  - at SH 40093 91600;
  - at SH 38259 91771; and
  - between SH 37147 93248 and SH 37225 93521.
- Tre'r Gof Site of Special Scientific Interest (SSSI) Drains:
  - between SH 35824 93671 and SH 35941 93702.
- Nant Cemaes:
  - at SH 36558 93074; and
  - between SH 36890 93643 and SH 36938 93683.

2.3 Site screening

As part of the baseline, a site selection process has been undertaken to establish the watercourses that are within the study area and those that should be excluded. The following details the two watercourses that will not be considered as part of the Wylfa Newydd Project and the reasoning behind this. The remaining watercourses labelled on figure 1.1 are included within this study.

Afon Hen Borth – the Afon Hen Borth flows from Mynachdy to the sea at Hen Borth. The watercourse is located approximately 1.5km from the Wylfa Newydd Development Area from which no pathways exist to the watercourse. For this reason, the Afon Hen Borth is not considered in this baseline assessment.

Afon Traeth Mawr– This watercourse is located north-east of Cemaes and flows from Tyddyn Rhydderch to Traeth Mawr. The watercourse is located over 1km from the Wylfa Newydd Development Area from which no pathways exist to the watercourse; therefore, it is not considered further.

3. Desk study

The study area encompasses a number of watercourses and drainage ditches, a number of which are unnamed. For the purposes of this baseline assessment a number of the watercourses have been assigned names for ease of reference; figure 1.1 provides an overview of these for this assessment. The following provides the desk-based information obtained for the watercourses. Where references are made to the left and right bank, this is referring to the banks as if looking downstream.

3.1 Nant Cemlyn

Based on OS maps the Nant Cemlyn flows in an easterly and then northerly direction towards Cemlyn Lagoon. Cemlyn Bay is both a Special Area of Conservation under the Habitats Directive (92/43/EEC) and a Special Protection Area under the Birds Directive (2009/147/EC). The Nant Cemlyn is approximately 1.9km long with a catchment area of 3.4km^2.

The valley profile appears to be shallow and most of the Nant Cemlyn has been realigned to have a straight planform, likely to accommodate field boundaries and aid field drainage. The most significant channel realignment is along the road between Tyddyn Sydney and Neuadd. The main land use is agricultural with the fields being used predominantly as pasture for grazing, and some as tilled arable land.

From aerial imagery the riparian vegetated zone appears to be poor, with large sections being non-existent, and where present consists of scattered, singular broad-leaved trees. Livestock appear to have access to the banks in some sections, where bank erosion may be subsequently accelerated through poaching.

The Nant Cemlyn forms part of the Cemlyn Lagoon coastal WFD water body, which lies within the Western Wales RBMP (NRW, 2015a). The Cemlyn Lagoon water body is currently classified as achieving Good overall status and as the Nant Cemlyn forms part of this catchment it too is assessed under the WFD. Section 4 of this report provides an overview of the WFD water bodies. The Nant Cemlyn is also associated with Natura 2000 protected areas, which are Cemlyn Bay (a Special Area of Conservation) and the Ynys Feurig, Cemlyn Bay and The Skerries (a Special Protection Area).

3.1.1 Geology and soils

The bedrock is a combination of areas of both mica schist and psammite (Harbour Group) at the source, with an area of sedimentary and igneous rock (Church Bay Tuffs and Skerries Grits) at the mouth at Cemlyn Bay. Superficial deposits are dominated by glacial till [RD6].

The whole area is underlain by a Secondary B bedrock aquifer, meaning the bedrock has low permeability, but has some layers that may store some water due to local features such as fissures, thin permeable horizons and weathering. There is one superficial Secondary A aquifer located at the source of the Nant Cemlyn, whilst the glacial till is defined as a Secondary (Undifferentiated) aquifer by NRW.

Most of the Nant Cemlyn flows over soils which are freely draining, slightly acid loamy soils, which are suitable to support arable and grassland land uses. The water draining from this soil tends to infiltrate into groundwater and/or local watercourses meaning a steady flow is typically present in the channel.

3.1.2 Historical map analysis

Historical map analysis has shown that there has been no significant change in the planform of the Nant Cemlyn since 1889.

3.2 Afon Cafnan

Based on OS maps [RD4] the Afon Cafnan flows from Llyn Llygeirian northwards to where it reaches the Irish Sea at Porth-y-pistyll, just to the west of the Existing Power Station. The river is approximately 4.9km long with a total catchment area of 11.4km^2. Lengths of the Afon Cafnan have been realigned and now have an artificially straight planform. It is likely that the current planform is a reflection of the historical need to establish relatively

straight field boundaries within parcels of land to improve access and amount of land available to farm. Realignment probably also gave an opportunity to make some channels deeper, particularly in fields with poor arterial drainage. Some areas were observed with evidence of some natural adjustment (such as downstream of Mynydd-Ithel) where the channel was recorded as sinuous within the confines of a relatively narrow river corridor.

The vegetation within the riparian zone was noted to be fragmented along most of the Afon Cafnan. The majority of the river was noted to have a single discontinuous line of trees along both banks. Some lengths were observed to have continuous tree cover, mainly near Cefn Coch, near to the disused windmill at Glan Rhyd adjacent to the A5025 and at Pont Cafnan.

The predominant land use appears from aerial photography to be livestock grazing. A number of fords cross the watercourse and the accelerated erosion typically associated with poaching and such river crossings have probably contributed to sediment loading within the watercourse above that considered as natural. However, no data have been specifically collected on the suspended sediment load within the watercourse.

The Afon Cafnan (and its tributaries detailed below) forms part of The Skerries coastal WFD water body, covered by the Western Wales RBMP [RD2]. The Skerries water body is currently classified as achieving High overall status and as the Afon Cafnan forms part of this WFD water body it too is assessed under the WFD legislation. Section 4 provides an overview of the WFD water bodies.

3.2.1 Geology and soils

The bedrock alternates between sedimentary and igneous rock (Church Bay Tuffs and Skerries Grits) and areas of metamorphic mica schist and psammite (Harbour Group) from the source at Llyn Llygeirian, across to Porth-y-pistyll. Superficial deposits are dominated by glacial till [Rd6].

The whole area is underlain by Secondary B bedrock aquifers, meaning the bedrock has low permeability but with some layers that may store some water due to local features such as fissures, thin permeable horizons and weathering. The glacial till is defined as a Secondary (Undifferentiated) aquifer by NRW.

The soil between the source of the watercourse at Llyn Llygeirian and the disused windmill at Glan Rhyd adjacent to the A5025 is classed as slowly permeable, seasonally wet, acid loamy and clayey soil. For this soil type, drainage is impeded and likely to result in seasonal wetlands, with land use being mainly grazing and forestry. Water on this soil tends to drain to nearby drains and watercourses. Downstream of the disused windmill at Glan Rhyd the soil type is described as freely draining, slightly acid loamy soils, suitable to support arable and grassland land uses. Water draining on this soil tends to infiltrate into groundwater and/or local watercourses meaning a steady flow is typically present in the channel.

3.2.2 Historical map analysis

Historical map analysis shows that there has been no significant change in the planform of Afon Cafnan since 1889. However, a map from 1887 does label a ‘mill (disused)’ at the location of the current cascade immediately downstream of the small road bridge to the west of the current A5025.

3.2.3 Key tributaries

The following are the key tributaries of the Afon Cafnan, which, along with the Afon Cafnan, are classified by NRW as Main Rivers.

3.2.3.1 Nant Caerdegog Isaf

The Nant Caerdegog Isaf is located to the west of Tregele and the A5025. The watercourse has its source at Groes-Fechan Farm and flows approximately 2km before its confluence with the Afon Cafnan. Aerial photography suggests that this watercourse has a straight planform and a vegetated riparian zone of shrubs in the upstream sections. A less significant vegetated riparian buffer zone was observed in the downstream sections.

3.2.3.2 Nant Caerdegog Uchaf

The Nant Caerdegog Uchaf is located to the north of Llyn Llygeirian and south of the A5025. The watercourse has its source near Mynydd Mechell and flows approximately 3km before its confluence with the Afon Cafnan. Aerial photography suggests that this watercourse has a straight planform and a vegetated riparian zone of shrubs in the upstream sections.

3.2.3.3 Afon Cefn Coch

The source of Afon Cefn Coch is located at Pandy bungalow at Cefn Coch. The watercourse flows north-west for approximately 2.1km where it joins with the Afon Cafnan. The watercourse has an artificially straight planform through agricultural land and semi-improved grassland. Aerial photography suggests this watercourse has a vegetated riparian zone of trees and shrubs on the right bank but no significant vegetation within the riparian buffer on the left bank.

3.2.3.4 Bod-hedd drain

The Bod-hedd drain is sourced from springs around Bont Newydd. The watercourse flows north-eastwards for approximately 1.7km where it joins the Afon Cafnan. The watercourse has an artificially straightened planform through agricultural, semi-improved grassland. Aerial photography suggests this watercourse has a vegetated riparian zone of shrub along the majority of its course and a discontinuous line of trees particularly in the downstream section.

3.3 Afon Wygyr

The Afon Wygyr is located to the east of the Wylfa Newydd Development Area. Although the watercourse will not be impacted by the Power Station construction and operation, a baseline has been provided to inform the WFD Compliance Assessment (Application Reference Number: 8.26).

The source of the Afon Wygyr is to the east of Bodewryd, from where it flows north-west to its mouth at Cemaes Bay. The water body acts as a natural field boundary throughout most of the catchment and has a relatively straight artificial planform. Aerial photography reveals that the water body is bordered predominantly by agricultural fields, consisting of both semi-improved grassland and tilled arable fields. There appears to be very little riparian corridor present on either bank, with some isolated trees evident from aerial photography.

The Afon Wygyr is classified as a fluvial WFD water body (GB110102059170) and lies within the Western Wales RBMP [RD2]. It is approximately 5.7km in length and has a catchment area of 30.1km^2. The Afon Wygyr is assessed by NRW to be at Moderate Status.

3.3.1 Geology and soils

The Afon Wygyr water body is underlain by superficial deposits of glacial till. The bedrock consists of mica schist and psammite from the New Harbour Group formed Period [RD6].

The soil within the catchment is classified as a slowly permeable, seasonally wet, acid loamy and clayey soil. For this soil type, drainage is impeded and likely to result in seasonal wetlands, with the land use being mainly grazing and forestry. Water on this soil tends to drain to nearby drains and watercourses.

3.3.2 Historical map analysis

The planform of the Afon Wygyr at Cemaes has not altered significantly since 1887. Historical maps depict a mill race present from 1887, which appears to have become a disconnected drain by 2002.

3.4 Tre'r Gof SSSI drains

The Tre'r Gof SSSI drains are a network of small watercourses that ultimately feed into one channel. The watercourses are located within the Tre'r Gof SSSI to the east of the Existing Power Station. The watercourses

appear to have an artificially straightened planform and discharge into the Irish Sea at Porth Wylfa. The outfall into the sea is artificial and the invert level controls the drainage through the SSSI and the drains. The surrounding land use was observed during the walkover survey to be predominantly grassland and marshland. Some sections of the watercourse had a vegetated riparian buffer zone.

The Tre'r Gof SSSI drains form part of the Anglesey North coastal WFD water body, covered by the Western Wales RBMP [RD2]. The Anglesey North water body is currently classified as achieving Moderate Status and as the Tre'r Gof SSSI drains form part of this catchment it too is assessed under the WFD legislation. Section 4 of this report provides an overview of the WFD water bodies.

3.4.1 Geology and soils

The Tre'r Gof SSSI drains are underlain by glacial till and alluvial superficial deposits (approximately 30m in thickness) consisting of clay, silt, sand and gravel and laterally extensive peat deposits in the basin that forms the SSSI. The bedrock consists of mica schist and psammite from the New Harbour Group [RD6].

Soils across the floor of the Tre'r Gof SSSI basin are dominated by peat and are poorly draining.

3.4.2 Historical map analysis

There has been no significant change to the planform of the Tre'r Gof SSSI Drains since 1889.

3.5 Nant Cemaes

This small watercourse, which has its source in agricultural field drains to the east of Tregele, flows northwards through agricultural fields and through Cemaes before discharging into Cemaes Bay. The watercourse has a straight planform and no significant vegetated riparian zone; however, trees appear to contribute to some form of vegetated riparian buffer.

The Nant Cemaes forms part of the Anglesey North coastal WFD water body, covered by the Western Wales RBMP [RD2]. The Anglesey North water body is currently classified as achieving Moderate Status and as the Nant Cemaes forms part of this catchment it too is assessed under the WFD legislation. Section 4 provides an overview of the WFD water bodies.

3.5.1 Geology and soils

The Nant Cemaes is underlain by glacial till and alluvial superficial deposits. The bedrock predominantly consists of mica schist and psammite from the New Harbour Group, with some areas of Church Bay Tuffs and Skerries Grits in upper sections (BGS, 2014).

Soils in the upper catchment are classified as slowly permeable, seasonally wet loamy and clayey soils, with runoff typically draining into the stream network. Soils in the lower catchment are classified as freely draining slightly acid loamy soils and lead to water passing into the watercourses.

3.5.2 Historical map analysis

There has been no significant change to the planform of the Nant Cemaes since 1889.

3.6 Other watercourses

The smaller watercourses within the study area are typically drainage ditches forming boundaries of the adjacent agricultural land. Ultimately these drain into the larger watercourses outlined in section 3.1 to section 3.5 of this report. These watercourses/drains flow through a predominantly rural catchment with few settlements and are fundamental to the drainage network within the study area. Historical maps show little natural adjustment in the watercourses. The watercourses typically act as a pathway for fine sediment and pollutant transfer from the surrounding land uses and are key to understanding the geomorphological process within the catchments.

4. Water Framework Directive status

Tables 4.1 and 4.2 detail key information for each of the fluvial and coastal WFD water bodies respectively. This includes key quality elements, namely biological, physico-chemical and hydromorphological[1] parameters.

The Western Wales RBMP [RD2], and specifically the *Ynys Môn Management Catchment Summary* published by NRW [RD9], has been subject to consultation that ended in April 2015. The information used in this baseline report is from Cycle 2 of the WFD covering the period from 2016–2021. As part of Cycle 2, a number of the watercourses have been 'declassified' as fluvial water bodies but instead are reported as coastal water bodies, these include:

- Cemlyn Lagoon:
  - Nant Cemlyn.
- The Skerries:
  - Afon Cafnan;
  - Nant Caerdegog Isaf;
  - Nant Caerdegog Uchaf;
  - Afon Cefn Coch; and
  - Bod-hedd Drain.
- Anglesey North:
  - Tre'r Gof SSSI drains; and
  - Nant Cemaes.

The *Ynys Môn Management Catchment Summary* briefly describes the current status of the water environment, its main challenges, objectives and measures. The stated aim (page 9) is "*to develop a single integrated programme of measures by 2021 that meets WFD Objectives*". The objectives include to:

- prevent deterioration in status (from current reported status);
- achieve the objectives for protected areas (i.e. water-dependent Natura 2000 sites); and
- aim to achieve Good overall status for surface and ground waters.

Table 4.1: Baseline description of biological, physico-chemical and hydromorphological quality elements for the fluvial WFD water bodies (NRW, 2015)

Element	Classification
Water body ID	GB110102059170
Water body name	Afon Wygyr
Water body length [RD3]	30.1km^2
Hydromorphological status	Not Designated Artificial/Heavily Modified Water Bodies
Overall ecological status	Moderate Ecological Status
Predicted status objective (2021)	Good Ecological Status

[1] The term hydromorphology covers both hydrology and geomorphology. The term was developed and is used specifically for the WFD.

Table 4.2: Baseline description of biological, physico-chemical and hydromorphological quality elements for the coastal WFD water bodies (NRW, 2015)

Element	Classification		
Water body ID	GB611010390000	GB641010620000	GB610100083000
Water body name	The Skerries	Anglesey North	Cemlyn Lagoon
Water body area [RD3]	47.2km^2	126km^2	0.17km^2
Hydromorphological status	Not designated Artificial/Heavily Modified Water Bodies	Not designated Artificial/Heavily Modified Water Bodies	Designated Artificial/Heavily Modified Water Bodies
Overall ecological status	High Ecological Status	Moderate Ecological Status	Good Ecological Potential
Predicted status objective (2021)	High Ecological Status	Good Ecological Status	Good Ecological Potential

5. Contemporary characteristics

The following section establishes contemporary characteristics of the watercourses surveyed in November 2014 and July 2015. The baseline details have been outlined for the watercourses in line with the fluvial WFD hydromorphological quality elements to support the WFD compliance assessment being undertaken for the Wylfa Newydd Project. Where references are made to the left and right bank, this is referring to the banks as if looking downstream.

5.1 Nant Cemlyn

The Nant Cemlyn is a small channel demarking a field boundary within the Wylfa Newydd Development Area. During the surveys the channel was found to be approximately 2m in width as it flowed north towards Neuadd. The watercourse was observed to become a narrower channel, approximately 1m wide, continuing to flow north alongside Nanner Road. Some areas of natural adjustment were found, with erosion and deposition creating a sinuous planform within the artificially constrained channel (figure 5.1). Several areas of poaching and consequent slumping were noted on the left bank of the channel.

Culverts and bridges were present along the entire reach. Some terrestrial vegetation was present within the channel and on banks (figure 5.2), and the substrate consisted of gravel, cobbles and pebbles (figure 5.3).

Figure 5.1: Erosion present on the left bank of the Nant Cemlyn, primarily caused by poaching

Figure 5.2: Nant Cemlyn flowing downstream alongside Nanner Road

Figure 5.3: Gravel and cobble substrate present in the downstream section of the Nant Cemlyn

Table 5.1 provides a summary of key hydromorphological observations made during the geomorphological reconnaissance surveys, including flow dynamics, lateral and longitudinal connectivity, depth and width variations, substrate and riparian corridor structure.

Table 5.1: Baseline description of hydromorphological quality elements for the Cemlyn Stream

Quality Elements	Description
Quantity and dynamics of water flow	Two to three flow types were observed, mainly run and glide flow with some areas of riffles. Flow appeared to be constrained, but some evidence indicating that during higher flows the stream overtops the banks. Flow at the time of survey was low, with little rainfall over the previous few weeks.
Connection to groundwater bodies	The Nant Cemlyn lies above the Ynys Môn Secondary WFD groundwater body (GB41002G204400). The stream is unlikely to be in continuity with the Ynys Môn Secondary groundwater body as low permeability drift deposits are present beneath most of the Nant Cemlyn.
River continuity	Longitudinal connectivity was noted to be affected by the presence of three culverts. A minor bridge and a footbridge also impacted lateral connectivity during flood events due to the abutments on the banks. One of the culverts adjacent to Nanner Road appeared to be partially blocked with flow backing up and flooding into the adjacent field. A fence was observed within the channel upstream of the Nanner Road bridge which also affected longitudinal connectivity through trapping of debris. Lateral connectivity with the floodplain was observed to affect the downstream reach on the right bank (near to a stone wall) (approximately 2m–2.5m high).
River depth and width variation	The channel was approximately 0.5m–1m in width and 0.1m–0.2m in depth.
Structure and substrate of the river bed	Some areas of gravel and cobble substrate were noted as present within the downstream section of the reach. The substrate was found to be predominantly silt in the upstream reach.
Structure of the riparian zone	The riparian zone was found to consist of mainly simple (one-species) and uniform (two-species) vegetation, primarily low grasses and shrubs. No substantial buffer zone was observed to be present between the agricultural fields and the river channel.

5.2 Afon Cafnan

The Afon Cafnan is a small channel routed north from Llyn Llygeirian to Porth-y-pistyll. It has a relatively straight artificial planform forming the boundary between several fields (figure 5.4). During the surveys the water body was noted as showing signs of natural processes and adjustment between Mynydd-Ithel and Cafnan, with a slightly meandering channel and areas of deposition and erosion. Significant poaching was also observed within this section (figure 5.5). A natural bedrock cascade was found to be present within the upstream reach immediately downstream of the small road (referred to as Mountain Road) crossing (figure 5.6).

On average, the channel width was recorded as being approximately 0.8m–1m with areas of poaching and erosion causing it to be enlarged in some sections. Between Mynydd-Ithel and Cafnan, the watercourse increased in width to approximately 1m–2m. The water depth was noted to range from 0.1m–0.3m upstream of Mynydd-Ithel and 0.5m–1m downstream of Mynydd-Ithel. The longitudinal connectivity of the watercourse was found to be affected by culverts and bridges throughout its length.

There were some areas of good flow diversity, gravel substrate (figure 5.7) and riparian vegetation. The water body was observed to support some macrophytes, their abundance being greater in those areas with reduced tree and scrub cover (figure 5.8).

At the downstream reach at Felin Gafnan large trees and shrubs were found to form a riparian corridor, shading the left bank. Ferns dominated the steeper right bank (figures 5.9 and 5.10). The river was observed to flow over a rocky foreshore into Porth-y-pistyll (figure 5.11).

Figure 5.4: Straight planform of Afon Cafnan running parallel to the A5025

Figure 5.5: Poached banks along the watercourse between Mynydd-Ithel and Cafnan

Figure 5.6: Natural bedrock cascade located immediately north of a B-road bridge within the upstream section of the watercourse

Figure 5.7: Gravel substrate observed between Mynydd-Ithel and Cafnan

Figure 5.8: Macrophytes observed within the watercourse approximately 350m downstream of the confluence with Caerdegog Isaf

Figure 5.9: Shaded downstream section of the watercourse at Felin Gafnan

Figure 5.10: Water body with bedrock forming right bank and pebble/cobble substrate at the downstream reach at Felin Gafnan

Figure 5.11: Watercourse flowing over rocky foreshore of Porth y Felin into Porth-y-pistyll

Table 5.2 provides a summary of key hydromorphological observations made during the geomorphological reconnaissance surveys, including flow dynamics, lateral and longitudinal connectivity, depth and width variations, substrate and riparian corridor structure.

Table 5.2: Baseline description of hydromorphological elements for the Afon Cafnan

Quality Elements	Description
Quantity and dynamics of water flow	Four to five flow types were observed including smooth flow, runs, glides, riffles and cascade flow.
Connection to groundwater bodies	The Afon Cafnan lies above the Ynys Môn Secondary WFD groundwater body (GB41002G204400). The river is unlikely to be in continuity with the Ynys Môn Secondary groundwater body as low permeability drift deposits are present beneath most of the Afon Cafnan.
River continuity	The reaches of the Afon Cafnan surveyed were found to be impacted longitudinally. A collapsed twin culvert, a weir and several fences and gates were noted to cross the water body. Several clear span structures also cross the channel, locally altering the lateral connectivity as a result of the bridge abutments. Lateral connectivity with the floodplain was found to be impacted by embankments along both banks (0.2m–0.3m high) for approximately 300m upstream of the A5025 (not continuous). Lateral connectivity was also found to be naturally constrained in the downstream reach by Mountain Road as a result of exposed bedrock rising approximately 1.5m–2m up the right bank in some locations (figure 5.6).
River depth and width variation	The width of the Afon Cafnan was measured as approximately 0.8m–1m upstream of Mynydd-Ithel (with some exceptions e.g. rock cascade and poached areas) and between 1m–2m downstream of Mynydd-Ithel. The river depth was found to range from 0.1m–0.3m upstream of Mynydd-Ithel increasing to 0.5–1m downstream of Mynydd-Ithel.
Structure and substrate of the river bed	The structure and substrate of the Afon Cafnan was noted to vary considerably along its length. The majority of the river was noted to have a gravel and pebble substrate with some siltation, especially in areas affected by poaching and at junctions with field drains. Two notable areas of bedrock were also found to be present, namely at the rock cascade in the upstream reach by Mountain Road and at Felin Gafnan.
Structure of the riparian zone	The riparian zone was found to consist mainly of simple (one-species) and uniform (two-species) vegetation, primarily low grasses and shrubs. The riparian zone was noted to be slightly more complex at Felin Gafnan with several species of trees and shrubs observed over a distance of approximately 200m before the channel reached the foreshore. No substantial vegetated buffer zone was noted as present between the agricultural fields and the channel within the upper section of the river. Within the downstream section of the watercourse, large trees and shrubs were found to be present alternating along the left and right banks.

The baseline conditions for the tributaries of the Afon Cafnan are outlined below.

5.2.1 Nant Caerdegog Isaf

The Nant Caerdegog Isaf is located east of the Afon Cafnan and west of Tregele and the A5025. The watercourse rises within the Cae Gwyn SSSI, which is designated for wetland areas which feed into the Nant Caerdegog Isaf. The watercourse has a straight artificial planform with a uniform and modified channel cross-section. The watercourse width was noted to range from 1.5m–3.5m, with an average depth of approximately 0.6m (figure 5.12) and a water depth typically between 0.05m and 0.15m.

The substrate was found to consist mainly of silt with some fine gravel (figure 5.13). However, the channel bed was observed to be obscured in several lengths by overgrown terrestrial vegetation. At the time of survey, lengths of no perceptible flow and other lengths of smooth flow were observed. The watercourse was assessed to be a sediment sink and appeared to be narrowing locally (figure 5.14).

Figure 5.12: Section of no perceptible flow 400m upstream of the confluence with Afon Cafnan

Figure 5.13: Silt and gravel substrate 600m upstream of the confluence with the Afon Cafnan

Figure 5.14: Watercourse narrowing 600m upstream of the confluence with the Afon Cafnan

5.2.2 Afon Cefn Coch

The Afon Cefn Coch is located east of the Afon Cafnan, adjacent to Pandy bungalow at Cefn Coch. The watercourse has a straight planform with a uniform channel cross-section and several sections were observed to be choked with terrestrial vegetation (figure 5.15). The watercourse was noted to be approximately 1.5m in width with a typical depth of 0.4m.

The substrate was found to consist mainly of silt (figure 5.16) and lengths of the watercourse were poached by livestock (figure 5.17). There was no perceptible flow at the time of surveys. The watercourse was assessed as being overwide and overdeep[2] and to be a sediment sink.

[2] The terms overwide and overdeep refer to the channel having been artificially modified to create an oversized channel that naturally would have been narrower and shallower. This is typically done to improve conveyance and prevent flooding of the surrounding land.

Figure 5.15: Upstream length of the Afon Cefn Coch choked with vegetation

Figure 5.16: Silt substrate in the Afon Cefn Coch, 400m upstream of the confluence with the Afon Cafnan

Figure 5.17: Livestock poaching the banks of the Afon Cefn Coch, 400m upstream of the confluence with the Afon Cafnan

5.2.3 Bod-hedd Drain

Bod-hedd Drain is predominantly a small artificial straight drain with a uniform cross-section and with no vegetated riparian buffer. The channel was noted as approximately 0.2–0.5m wide with a 1.5m deep left bank and a shallower right bank. There appeared to be some local deposition of silt at the channel margins (figure 5.18), particularly upstream of the confluence with the Afon Cafnan. The bed substrate was found to be typically fine and coarse gravel and some silt. The left bank appeared to be poached, potentially acting as a sediment source.

Figure 5.18: Bod-hedd Drain immediately upstream of confluence with the Afon Cafnan

5.3 Afon Wygyr

Only a short reach of the Afon Wygyr was surveyed, from the A5025 through Cemaes to Cemaes Bay.

The Afon Wygyr at Cemaes is a fairly uniform channel, noted to be approximately 4m wide throughout (figure 5.19). The substrate was found to consist mainly of gravel and pebbles, the flow being mainly glide and runs. Some areas of erosion were observed in the form of undercutting. Poaching was also observed at some locations along the banks, reducing the bank slope and leading to erosion (figure 5.20). Depositional features were also observed, including side bars.

The channel at Cemaes was found to be shaded by large isolated trees along both banks (figure 5.21). However, other than this, only a simple vegetated riparian zone was observed consisting mainly of grasses. Bank reinforcement in the form of gabion mattresses and riprap were found to be present adjacent to the footbridge in the downstream reach near Cemaes Bay (figure 5.22). Some woody material was also noted to be present within the channel.

Figure 5.19: Afon Wygyr watercourse shaded by large trees on the left bank

Figure 5.20: Gravel substrate and eroded left bank and gravel bar in the Afon Wygyr

Figure 5.21: Afon Wygyr looking upstream

Figure 5.22: Gabion baskets along the right bank under a footbridge crossing the Afon Wygyr

Table 5.3 provides a summary of key hydromorphological observations made during the geomorphological reconnaissance surveys of the Afon Wygyr at Cemaes, including flow dynamics, lateral and longitudinal connectivity, depth and width variations, substrate and riparian corridor structure.

Table 5.3: Baseline description of the hydromorphological quality elements for Wygyr WFD water body within the surveyed reach (water body ID: GB110102059170)

Quality Elements	Description
Quantity and dynamics of water flow	Two to three flow types were observed including glides and runs. Some riffles were present within shallower sections of the river.
Connection to groundwater bodies	Afon Wygyr water body lies above the Ynys Môn Secondary WFD groundwater body (GB41002G204400). The river is unlikely to be in continuity with the Ynys Môn Secondary groundwater body as low permeability drift deposits are present beneath most of the Afon Wygyr.
River continuity	Lateral continuity was found to be impacted locally as a result of the bridge abutments of a major bridge and a footbridge within the downstream reach and the A5025 road bridge in the upstream reach. Small lengths of bank reinforcement (gabion baskets and riprap) were observed in the downstream reach, affecting lateral connectivity with the floodplain.
River depth and width variation	The reach of the Afon Wygyr through Cemaes was observed to be a consistent approximate 4m width and 0.3m depth throughout.
Structure and substrate of the river bed	Substrate was found to consist of gravels and cobbles, with some siltation in areas of slacker flow.
Structure of the riparian zone	The majority of the riparian zone was found to consist of simple vegetation (grass). Scattered trees were found along both banks.

5.4 Tre'r Gof SSSI Drains

The Tre'r Gof SSSI drains were surveyed only during the August 2015 site visit. The watercourses have an artificially straight planform, with a uniform channel cross-section assessed as being overdeep and overwide. The watercourses were found to be choked with terrestrial vegetation (figure 5.23) and assessed as being a sink for sediment and narrowing locally. The channel substrate was found to consist predominantly of silt.

Figure 5.23: Choked channel forming part of Tre'r Gof SSSI Drains

Table 5.4 provides a summary of key hydromorphological observations made during the geomorphological reconnaissance surveys of the Tre'r Gof SSSI Drains.

Table 5.4: Baseline description of the hydromorphological quality elements for the Tre'r Gof SSSI Drains

Quality Elements	Description
Quantity and dynamics of water flow	At the time of survey, no water was noted within the drains.
Connection to groundwater bodies	The Tre'r Gof SSSI drains lie above the Ynys Môn Secondary WFD groundwater body (GB41002G204400). The SSSI overlies some 30m of superficial deposits and the drains are likely to be linked to shallow groundwater flow through the near-surface superficial deposits.
River continuity	The drains were observed to be choked with terrestrial vegetation and to be a sink of sediment, suggesting that longitudinal connectivity is likely to be impeded. The area is formed by a fen, with some lateral connectivity from the drains with the land adjacent to the drains during periods of high flow.
River depth and width variation	The channels were undefined in places and observation of the cross-sections was impeded at the time of survey by dense vegetation.
Structure and substrate of the river bed	Channel substrate was found to consist predominantly of silt.
Structure of the riparian zone	The surrounding area is formed of a fen with mosaic of rich-fen and associated grassland communities. No trees were observed.

5.5 Nant Cemaes

The Nant Cemaes, which is a small watercourse that flows from its source west of Llanfechell for approximately 3.5km before flowing through Cemaes and discharging into Cemaes Bay (figure 5.24), was surveyed only during the August 2015 site visit. The watercourse was noted to have a straight artificial planform with a uniform channel cross-section which was overdeep and overwide. Smooth flow was found to be the predominant flow type at the time of survey. Rippled flow was also observed at the mouth of the watercourse where it flowed into Cemaes Bay. The upstream reach along the A5025 was observed to be artificially reinforced (figure 5.25) with a silty substrate. The downstream reach immediately upstream of Cemaes Bay was found to have fully vegetated banks (figure 5.26).

Figure 5.24: Nant Cemaes discharging into Cemaes Bay

Figure 5.25: Bank and bed reinforcement on the Nant Cemaes

Figure 5.26: Vegetated banks along the Nant Cemaes

Table 5.5 provides a summary of key hydromorphological observations made during the geomorphological reconnaissance surveys of the Nant Cemaes.

Table 5.5: Baseline description of the hydromorphological quality elements for the Nant Cemaes

Quality Elements	Description
Quantity and dynamics of water flow	The water levels were low at the time of survey. The typical flow type identified was smooth flow, with an area of rippled flow at the mouth of the watercourse by Cemaes Bay.
Connection to groundwater bodies	The Nant Cemaes lies above the Ynys Môn Secondary WFD groundwater body (GB41002G204400). The stream is unlikely to be in continuity with the Ynys Môn Secondary groundwater body as low permeability drift deposits are present beneath most of the watercourse.
River continuity	Lateral connectivity of the channel with the floodplain was intermittent throughout the reaches surveyed. The stream length along the A5025 was artificially reinforced, limiting lateral connectivity.
River depth and width variation	The channel had a uniform channel cross-section which was overdeep and overwide.
Structure and substrate of the river bed	The channel bed primarily consisted of silt with some gravels noted.
Structure of the riparian zone	The riparian corridor was influenced by agricultural practices. The downstream length of channel located immediately upstream of Cemaes Bay had fully vegetated banks.

6. Conclusions

This report specifically details the results of the reconnaissance surveys and a desk study of available information, including map analysis (historical and contemporary), geology, soils and aerial photography within the study area. This baseline report concludes that a number of the fluvial watercourses have been artificially straightened and possibly dredged for arterial drainage purposes. During the survey it was noted that at particular locations these straight channels demarked field boundaries and were noted to have little or no vegetated riparian buffer between the channel and cultivated land. The channels were found to have several diffuse and point sources of fine sediment, primarily from animal poaching and field drains.

The Nant Cemlyn is a small channel that was observed to have local natural adjustment with erosion and deposition creating a relatively sinuous planform within the constrained channel. Several areas of poaching and consequent slumping were evident along the stream.

The reconnaissance survey revealed that the Afon Cafnan appeared to be locally adjusting. Erosion and deposition was observed to have led to lengths of channel having developed a sinuous planform. Two lengths of the Afon Cafnan were observed to have bedrock outcrops in the banks and/or beds, particularly at Felin Gafnan. Some lengths with good flow diversity, gravel substrate and riparian vegetation were seen. The river was found to support some macrophytes, their abundance being greater in those areas with reduced trees and scrub.

The desk study and reconnaissance surveys of the Afon Wygyr in Cemaes confirmed it to be a fairly uniform and relatively wide channel. Its substrate was found to consist of gravel and pebbles, with deposition creating flow diversity including riffles. The channel was noted to have a simple riparian zone with a semi-continuous line of trees along both banks.

The Tre'r Gof SSSI drains were noted to have an artificially straight planform, with a uniform channel cross-section assessed as being overdeep and overwide. The channel substrate was found to consist predominantly of silt.

The Nant Cemaes was noted to be a small watercourse with a straight artificial planform with a uniform channel cross-section which was overdeep and overwide. Lengths were observed to be artificially reinforced with silty substrate.

7. References

ID	Reference
RD1	Department of Energy and Climate Change. 2011. National Policy Statement for Nuclear Power Generation (EN-6). London: The Stationery Office.
RD2	Natural Resources Wales. 2015. Western Wales River Basin Management Plan 2015–2021 Summary. [Online] [Accessed: 11/05/2016] Available from: https://naturalresources.wales/media/676165/wwrbdsummary.pdf.
RD3	Environment Agency. 2014. Water body spatial data worksheet. [Online] [Accessed: 12/05/2016] Available from: www.environment-agency.gov.uk
RD4	Ordnance Survey. 2016.Ordnance survey mapping. [Online] [Accessed: 11/05/2016] Available from: https://osmaps.ordnancesurvey.co.uk/53.09434,-2.70286,15
RD5	Department for Environment, Food and Rural Affairs. 2016. MAGIC Interactive Map. [Online] [Accessed: 11/05/2016] Available from: http://magic.defra.gov.uk/MagicMap.aspx
RD6	British Geological Survey. 2016. Geology of Britain Viewer. [Online] [Accessed: 11/05/2016] Available from: http://mapapps.bgs.ac.uk/geologyofbritain/home.html
RD7	Natural Resources Wales. 2015b. Water Watch Wales. [Online] [Accessed: 11/02/16] Available from: http://waterwatchwales.naturalresourceswales.gov.uk/en/map.html?webmap=19a122a3308b4d99a7076fda60ba4a04
RD8	Bing. 2016. Aerial imagery. [Online] [Accessed: 11/05/2016] Available from: http://www.bing.com/maps/
RD9	Natural Resources Wales. 2014. Ynys Môn Management Catchment Summary. [Online] [Accessed: 11/05/2016] Available from: https://www.naturalresources.wales/media/3213/ynys-mon-management-catchment.pdf

8. Glossary

Title	Definition
Aquifer	Geological strata of sufficient porosity and permeability to allow significant groundwater movement.
Baseline conditions (or baseline environment)	The environment as it appears (or would appear) prior to the implementation of a project together with any known or foreseeable future changes that would take place before completion of the project.
British Geological Survey (BGS)	The BGS is a part of the Natural Environment Research Council and provides expert services and impartial advice in all areas of geoscience.
Bedrock	Solid rock formations underlying superficial deposits (if present).
Catchment	A drainage/basin area within which precipitation drains into a river system and eventually to the sea.
Deposition	Laying down of part, or all, of the sediment load of a stream on the bed, banks or floodplain. Mostly occurs as high flows recede. The process forms various sediment features such as bars, berms and floodplain deposits.
Environment Agency	The Government agency in England responsible for environmental permitting, with a mandate to protect and improve the environment and to promote sustainable development.
Ecological status	The overall ecological status assessed by a number of different quality elements (biological, physico-chemical and geomorphological) that represent indicators of the overall quality of the water body.
Erosion	Removal of sediment or bedrock from the bed or banks of the channel by flowing water (and other mechanisms such as wind or wave). Mostly occurs during high flows and flood events. Forms various river features such as scour holes and steep outer banks.
Existing environment	See 'baseline conditions'.
Floodplain	A floodplain is flat, or nearly flat, land adjacent to a stream or river, stretching from the banks of its channel to the base of the enclosing valley walls, and (under natural conditions) experiencing flooding during periods of high discharge.
Fluvial geomorphology	The study of landforms and the processes that create them in relation to rivers, lakes, coasts and estuaries.
Geomorphology	The study of landforms and the processes that create them.
Good Ecological Status	WFD term denoting a slight deviation from 'reference conditions' in a water body. The term also denotes a water body where the biological, chemical and physico-chemical and hydromorphological conditions associated with little or no human pressure.
Groundwater	All water that is below the surface of the ground in the saturation zone (below the water table) and in direct contact with the ground or subsoil.
Harbour Group	Geological formation name. Mostly turbidites (geologic deposits of a turbidity current), but their grainsize is typically much finer, with abundant, greenish silty or muddy layers (pelites) alternating with thin sandy layers (see 'psammite'). The sediment is chiefly the reworked product of island-arc volcanoes.
Hydromorphology	An interdisciplinary science that focuses on the fluvial interaction with surrounding landforms and sediment processes.
Hydrology	The science that deals with the processes governing the depletion and replenishment of the water resources of the land areas of the Earth.
Invertebrates	Animals without backbones.
Landform	The shape and form of the land surface, which has resulted from combinations of geology, geomorphology, slope, elevation and physical processes.
Macrophyte	Emergent, submergent or floating aquatic plant that provides cover for fish and substrate for aquatic invertebrates; it also produces oxygen and acts as substrate and food for some fish and wildlife.
Mica schist	A rock composed essentially of quartz and mica.

Title	Definition
Moderate Ecological Status	WFD term denoting a moderate deviation from the 'reference condition' in a water body for biological, physico-chemical and morphological elements.
Planform	The shape of a river channel (e.g. meandering or braided) as viewed from the air.
Pool	A topographic low point in the bed of a channel providing a relatively deep area of water.
Psammite	A metamorphic rock consisting of sand consolidated with some cement (e.g. clay, quartz, etc.).
Reach	A length of channel which, for example, may have a homogeneous morphology (river type).
Reference condition	A length of watercourse that is either near natural conditions or has recovered to reach equilibrium and can be used to form an understanding of what the watercourse baseline could be expected to be if not modified.
Riffle	A riffle is a short, relatively shallow and coarse-bedded length of stream. It is a natural topographical high point in the bed of the channel and riffles commonly alternate with deeper pools.
Riparian zone (or area)	The riparian zone or riparian area is the interface between the land and a stream or river. Plant habitats and communities along the river margins and banks are called riparian vegetation. Riparian zones are significant because they have a role to play in soil conservation (e.g. from adjacent farmland), habitat diversity and because of their influence on fauna and aquatic ecosystems (including grassland, woodland and wetland).
River Basin Management Plan (RBMP)	A requirement of the Water Framework Directive that outlines the current status of all water bodies. It also outlines a plan for achieving the protection, improvement and sustainable use of water within a river's catchment area.
Runoff	Precipitation that flows as surface water from a site, catchment or region to a watercourse.
Secondary A aquifer	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.
Secondary B aquifer	Predominantly lower-permeability rock or soil layers that may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.
Sediment	Organic and inorganic material.
Sinuosity	A description of a river's tendency not to follow a straight path.
Site of Special Scientific Interest (SSSI)	Sites designated for their flora, fauna or geological or physiographical features under the *Wildlife and Countryside Act 1981* (as amended).
Straightening (also known as realignment)	Artificial relocation of a river channel within a river valley/floodplain. The channel may have been historically moved for a number of reasons including forming straight boundaries between parcels of land (especially on smaller streams) or in conjunction with deepening to facilitate drainage of the land.
Study area	The spatial area within which environmental effects are assessed.
Superficial deposits	Unconsolidated (loose) deposits overlying the bedrock.
Till	Unsorted glacial deposit.
Walkover survey	An initial study of a site or location.
Water body	A defined management unit under the WFD.
Water Framework Directive (WFD)	A substantial piece of European Union water legislation that came into force in 2000, with the overarching objective to get all water bodies in Europe to attain Good or High Ecological Status. RBMPs have been created that set out measures and potential mitigation to ensure that water bodies achieve 'Good Ecological Status' by 2027.