

## Appendix C

### Celtic Energy Restoration Drainage Proposals

# **CELTIC ENERGY LTD**

## **NANT HELEN REMAINDER SURFACE COAL MINE SITE**

### **Condition 45: Restoration of Watercourses – Design Statement Revision C**

#### **1.0 Introduction**

The overall site restoration strategy was established through the original planning consent, to which reference has been made in developing these proposals to restore the watercourses affected by the site workings. The site covers the head of the local catchment areas, with the larger part of the site draining towards the north to the Afon Tawe and the southern part of the site draining towards the south to the Dulais. A very small triangle of land to the east drains towards the Afon Pyrddin.

A restoration scheme has been submitted under condition 45 of the current Planning Permission and the restoration of the watercourses is specifically referenced in part g) to enhance biodiversity and in part i) to create attenuation ponds, water features, wetlands and reed beds to achieve maximum ecological diversification.

#### **2.0 Design Principles**

The restoration of the watercourses has been designed to incorporate attenuation ponds, wetlands and rush-lined channel beds in accordance with the submitted scheme. These water features will slow down and reduce surface water flows away from the site and re-connect the restored on-site watercourses to the existing downstream watercourses that were severed by the site operations.

Wherever gentler gradients permit, the watercourses will be clay-lined and planted with rushes; wetlands are located into the proposed landscape where possible. The gradients along some of the watercourses are steep and for slopes in excess of 1 in 12 the channel beds will need to be reinforced with rock. These sections will be stepped and formed with back-fall areas to provide small pools and to help slow the flows.

In between the more gentle and steep gradients the watercourse beds will be lined with loose stone/gravel. The size of the gravel beds that will be required for stability have been determined by calculation and typical details of each of the three types of construction are included on the watercourse restoration drawings.

Of the total length of new watercourses, an estimated 17% will be rush-lined, 53% formed with stone/gravel beds and 30% will need to be reinforced with rock. Natural materials will be sourced from the site as much as possible for use in the construction of the new watercourses.

Reference has been made to the original planning application documents to compare the original surface water run-off from the site and the long-term surface run-off resulting from the restoration proposals. Preliminary designs have been undertaken for the proposed

on-site water features to act as attenuation ponds and reduce the surface water run-off from the site to lower flow rates than were experienced before the site was brought into operation. The principle of reducing the flows away from the site also serves to reduce possible flood risk in the downstream receiving watercourses including the main rivers, the Afon Tawe and the Dulais.

A summary comparison table of the pre- and post-operational surface water run-off rates to each of the original catchment areas follows, together with a second table showing the results of the preliminary attenuation assessments. Calculations for each watercourse and the associated attenuation assessments are included as separate attachments.

### 3.0 Q<sub>100</sub> Off-Site Flow Comparisons

Original Site Catchment	Original Q <sub>100</sub> Site Run-off (cumec)	Proposed Watercourse	Proposed Q <sub>100</sub> Site Run-off (cumec)	Difference in Flows Off-site (Percentage)
1a	0.310	Site run-off	0.268	-14%
1b	3.000	Site run-off	0.251	-92%
1c	3.600	A	1.080	-70%
1d	4.200	C	1.522	-64%
1e	1.480	E	1.066	-28%
1f	1.010	Site run-off	0.967	-4%
1g	1.090	D	0.441	-60%
2a	1.330	H	0.397	-70%
2b	1.620	G1 and G2	0.819	-49%
2c	0.830	F	0.216	-74%

### 4.0 Preliminary Q<sub>100</sub> Attenuation Assessments

Attenuation Pond	Flow Control Structure (m)	Maximum Q <sub>100</sub> Attenuation Volume (cum)	Maximum Q <sub>100</sub> Water Level Variations (m)	Maximum Q <sub>100</sub> Outflow (cumec)
A1 UPPER	1.000	4528	0.495	0.594
A2 LOWER	1.000	6477	0.615	0.820
C	1.400	2534	0.443	0.704
F UPPER	1.000	716	0.313	0.299
F LOWER	1.000	1974	0.252	0.216
G1 UPPER	1.100	1037	0.910	1.627
G1 LOWER	0.700	1758	0.896	1.011
G2 UPPER	0.300	1229	0.570	0.220
G2 LOWER	0.550	2597	0.914	0.819
H UPPER	1.000	801	0.481	0.568
H LOWER	1.000	1213	0.379	0.397

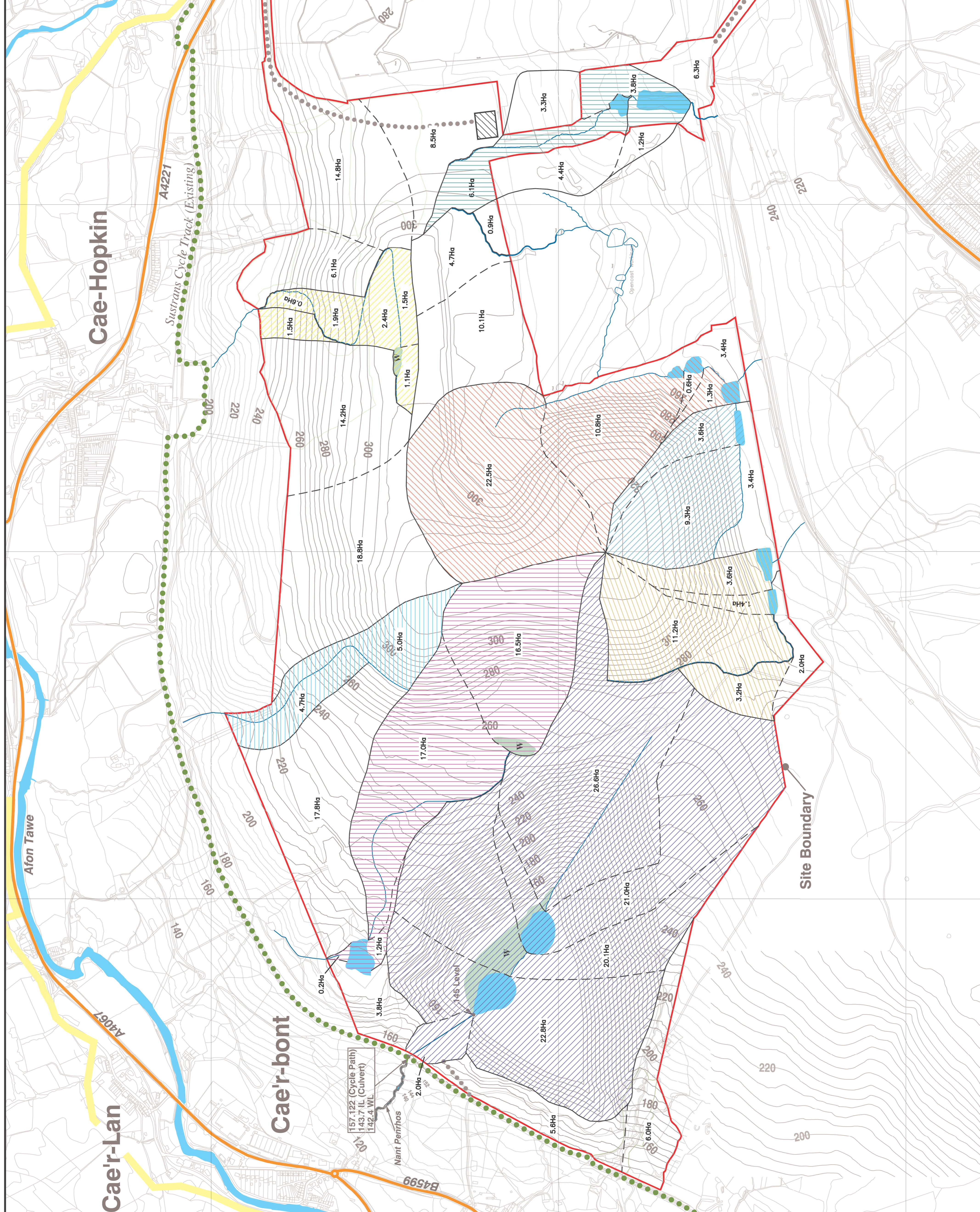
## **5.0 Condition 45 Drawings**

2363-D01-C	Proposed Restoration Water Features
2363-D02-C	Restoration Watercourses Catchment Plan
2363-D04-C	Watercourse A Longitudinal Section
2363-D05-C	Watercourse C Longitudinal Section
2363-D06-C	Watercourse D Longitudinal Section
2363-D07-B	Watercourse E Longitudinal Section
2363-D08-B	Watercourse F Longitudinal Section
2363-D09-B	Watercourse G1 Longitudinal Section
2363-D10-B	Watercourse G2 Longitudinal Section
2363-D11-B	Watercourse H Longitudinal Section
2363-D12-B	Restoration Watercourse Details
2363-D13-C	Water Features and Landscape

## **6.0 Condition 45 Calculations**

2363-C01-C	Restoration Watercourse A
2363-C02-C	Restoration Watercourse C
2363-C03-C	Restoration Watercourse D
2363-C04-B	Restoration Watercourse E
2363-C05-B	Restoration Watercourse F
2363-C06-B	Restoration Watercourse G1
2363-C07-B	Restoration Watercourse G2
2363-C08-B	Restoration Watercourse H
2363-C09-C	Site Run-off to Areas 1a, 1b, 1c, 1d, 1e and 1f

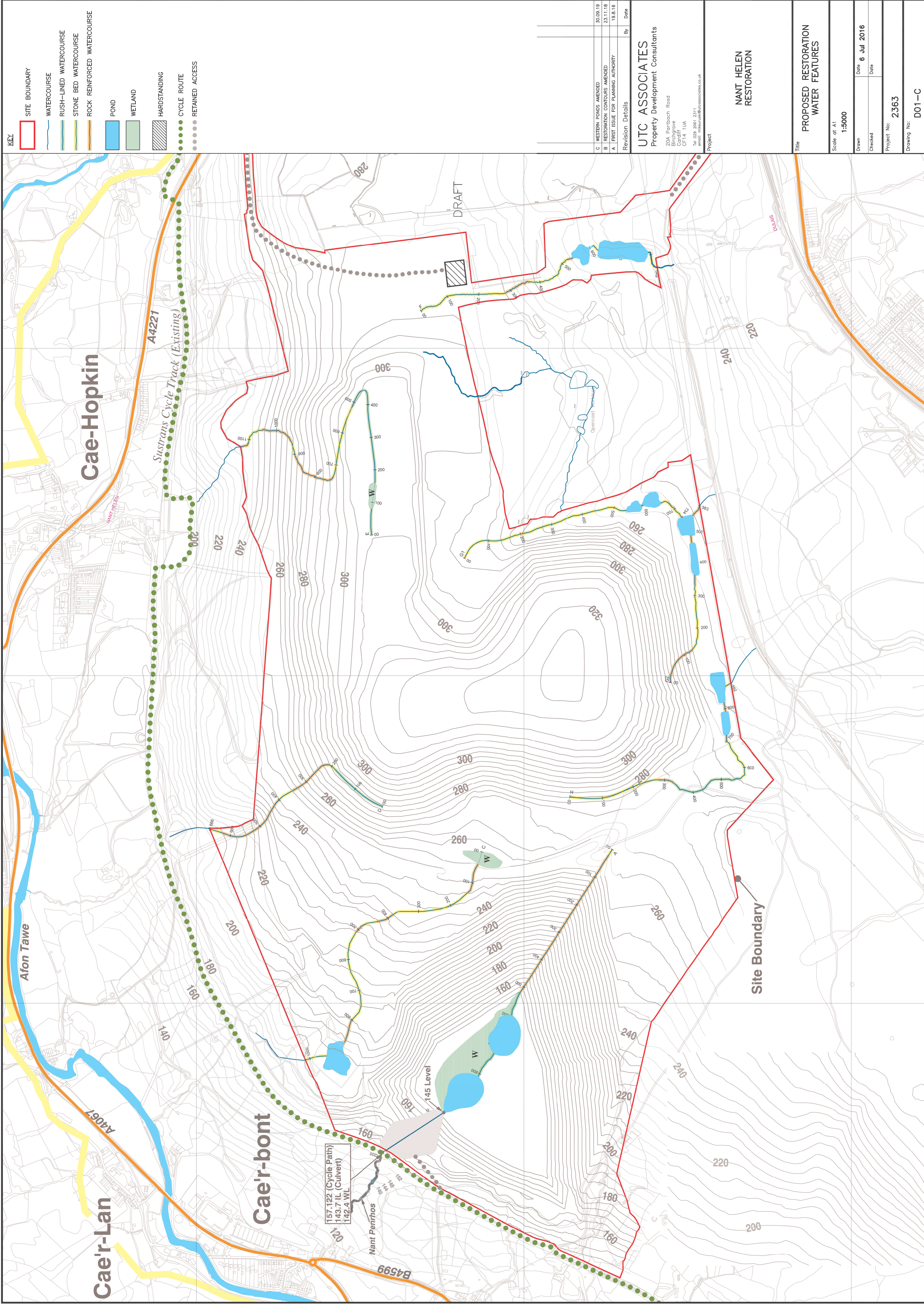
KEY	
	SITE BOUNDARY
	WATERCOURSE A CATCHMENT AREA
	WATERCOURSE C CATCHMENT AREA
	WATERCOURSE D CATCHMENT AREA
	WATERCOURSE E CATCHMENT AREA
	WATERCOURSE F CATCHMENT AREA
	WATERCOURSE G1 CATCHMENT AREA
	WATERCOURSE G2 CATCHMENT AREA
	WATERCOURSE H CATCHMENT AREA



C WESTERN PONDS AMENDED	30.09.19	By	Date
B RESTORATION CONTOURS AMENDED	23.11.18		
A FIRST ISSUE FOR PLANNING AUTHORITY	19.08.16		

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Project		NANT HELEN RESTORATION
Title		
RESTORATION WATERCOURSES CATCHMENT PLAN		
Scale at A1		
1:5000		
Drawn	Date	29 Jun 2016
Checked	Date	
Project No:		2363
Drawing No:		D02-C



- KEY**
- SITE BOUNDARY
  - WATERCOURSE
  - RUSH-LINED WATERCOURSE
  - STONE BED WATERCOURSE
  - ROCK REINFORCED WATERCOURSE
  - POND
  - WETLAND
  - HARDSTANDING
  - CYCLE ROUTE
  - RETAINED ACCESS

C WESTERN PONDS AMENDED	30.09.19	By	Date
B RESTORATION CONTOURS AMENDED	23.11.18		
A FIRST ISSUE FOR PLANNING AUTHORITY	19.8.16		

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**NANT HELEN RESTORATION**

Title		PROPOSED RESTORATION WATER FEATURES	
Scale at A1	1:5000	Drawn	Date 6 Jul 2016
		Checked	Date
		Project No:	2363
		Drawing No:	D01-C

**Cae-Hopkin**

*Sustrans Cycle Track (Existing)*

DRAFT

**Site Boundary**

**Afon Tawe**

**Cae'r-Lan**

**Cae'r-bont**

157.122 (Cycle Path)  
 143.7 IL (Culvert)  
 142.4 WL

Nant Penrhos

145 Level

**A4221**

**A4067**

**B4599**

**DUBAIS**

## **Appendix D**

### Hydrological Calculations Technical Note

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Project title	Nant Helen Complementary Restoration Earthworks	Job number	264904
cc		File reference	
Prepared by	Rob Varley	Date	04 December 2019
Subject	Nant Helen Complementary Restoration Earthworks - Hydrological Assessment		

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## 1 Introduction

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The Nant Helen site to the north of Onllwyn is an open cast mine owned and operated by Celtic Energy. The mining operations currently being undertaken will cease in 2021, at which point Celtic Energy will be required to restore the land in accordance with regulatory requirements and the agreements with Powys County Council (PCC). A restoration scheme for the site has been submitted for approval through the Planning process.

Following discussions with both PCC and Neath Port Talbot County Borough Council (NPTCBC), the local authorities have expressed a desire to develop restoration proposals for the Nant Helen site which will create long term, sustainable jobs.

As such, the Nant Helen Complementary Earthworks Scheme looks to provide a flexible landform that can be used or adapted for a diverse set of future uses. This could range from the traditional agriculture, woodland and nature conservation purposes, to amenity, leisure and tourism uses.

Other potential uses for the site could also include industrial purposes such as the Welsh Government's (WG) proposal to develop a rail testing and storage facility, known as the Global Centre of Rail Excellence (GCRE) at this site together with the adjacent Onllwyn Washery.

For the proposed scheme, an earthworks plateau is proposed that can be adapted for all the above purposes. Consideration has been given to providing suitable longitudinal gradients and track radii should the GRCE project proceed. It is proposed that the construction of this earthworks plateau will be undertaken in tandem with the restoration scheme for the site.

A planning application has been prepared for the Nant Helen Complementary Earthworks. A separate planning application will be submitted at a future date to cover any additional infrastructure required to bring the site to its selected future use.

This technical note details the hydrological calculations undertaken to determine the Greenfield Runoff Rate (GRR) for the scheme.



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## 2 Overview of site

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### 2.1 Site Description

The Nant Helen Complementary Earthworks Scheme consists of an inner and an outer track loop. The outer track loop encompasses a ridgeline running from east to west across the centre of the site. This ridgeline forms the catchment boundary for three adjacent watercourses:

- The River Tawe, located to the north of the site (River Tawe Catchment)
- The River Dulais, located to the south of the site (River Dulais Catchment)
- The Afon Pyrddin, located to the east of the site (Afon Pyrddin Catchment)

The extent of each of these catchments relative to the planning boundary has been shown in Appendix A. The total area within the Planning boundary is approximately 416ha.

Stormwater runoff from the site is conveyed via a number of smaller streams and ditches, which discharge into the major watercourses as tributaries. A number of these tributaries have been severed during the open cast mining operations that have taken place on the site.

As part of the Celtic Energy restoration scheme, these tributaries and associated catchment areas are proposed to be reinstated. However, the proposed restoration scheme highlights that the discharge rate from these catchments will be attenuated to discharge rates significantly less than the calculated Greenfield Runoff Rate (GRR). This was queried during a meeting with Celtic Energy, where it was established that a number of tributaries within the River Tawe Catchment have experienced fluvial flooding issues in the past. Therefore, the proposed discharge from the reinstated catchments had been reduced from the GRR to help alleviate these downstream flooding issues.

This note has been prepared to establish the GRR for the site, and as such the restoration scheme is not considered. However, these reductions to the GRR for the River Tawe catchment have been adopted as discussed in the overarching drainage strategy report for the scheme.

### 2.2 Site Catchment Descriptors

The descriptors for the three catchments were obtained from the FEH Online Service. The catchments selected were the smallest catchments that included the largest possible portion of the study site, so the catchment descriptors were site-specific as possible. This meant that to represent the River Tawe and River Dulais Catchments, a smaller tributary was selected to minimise the inclusion of adjacent areas and therefore obtain catchment descriptors representative of the site.

The purchased descriptors were subsequently compared (Table 1), and the below findings noted:

- The FARL index demonstrates that the watercourses are not controlled upstream of the site by lakes or reservoirs.

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- The FPEXT descriptor shows that a larger proportion of the Afon Pyrddin catchment would be inundated during a 1:100-year flooding event, although the value is still relatively small.
- The Base Flow Index (BFIHOST) is relatively similar for all catchments, but slightly higher for the Afon Pyrddin catchment.
- The Standard Average Annual Rainfall 1961-1990 (SAAR6190) is similar between the three sites.
- The urban extent is higher for the Afon Pyrddin catchment as the catchment area encompasses a portion of the village of Coelbren.
- The descriptor SPRHOST indicates that the soil within all catchments has a relatively low permeability.

<b>Table 1 - Comparison of the River Tawe, River Dulais and Afon Pyrddin Catchment Descriptors</b>			
<b>Catchment Descriptor</b>	<b>River Tawe Catchment</b>	<b>River Dulais Catchment</b>	<b>Afon Pyrddin Catchment</b>
AREA (km <sup>2</sup> )	0.54	1.04	0.61
FARL	1	1	1
FPEXT	0.0092	0.0241	0.0776
BFIHOST	0.306	0.286	0.319
SAAR6190 (mm)	1775	1826	1789
SPRHOST (%)	50.86	52.90	44.77
URBEXT2000	0.000	0.000	0.0245

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## 3 Hydrological Assessment

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To design the cut off ditches, culverts, cascades and attenuation volumes required for the scheme, the GRR for the 1, 30 and 100-year return period events is required.

To calculate these, a hydrological analysis has been undertaken on the River Dulais, Afon Pyrddin and River Tawe Catchments. Although each of these catchments have been separated into a number of sub-catchments serving individual tributaries, these would be too small to analyse individually. Therefore, an analysis has been undertaken on each overarching catchment and the results will be applied to each sub-catchment area.

Three calculation methods have been used to derive this rate, the FEH Statistical, ReFH rainfall-runoff (Version 2.2) and IH124 methods. The parameters used and results from each analysis are detailed in the sections below.

Refer to Section 4 for a summary of the results.

### 3.1 River Dulais Catchment

#### 3.1.1 IH124 Method

To undertake the IH124 Method, the source control module within Microdrainage was applied.

The point SAAR value of 1800mm was applied using the interactive map within the microdrainage software. This value of 1800mm is between the values obtained for the three catchments, which demonstrates this will be a good representative of the average SAAR value for the site.

The area of the River Dulais catchment contained within the planning application boundary was measured to be 167Ha. This area was applied within the software to determine the peak GRR for the total site. The peak GRR has been calculated for the 1 year, 30 year and 100-year return period events and was subsequently scaled by the area to give the GRR per hectare:

- 1:1 year rainfall event – 12.8l/s/ha
- 1:30 year rainfall event – 25.7l/s/ha
- 1:100 year rainfall event – 31.8l/s/ha

Refer to *Figure 1: IH124 Calculation undertaken within Microdrainage for the River Dulais Catchment* Figure 1 for the Microdrainage summary of results.