Appendix 11B

Drainage Strategy

Welsh Government

Global Centre of Rail Excellence

Drainage Strategy Report

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Job number 264904

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Contents

Appendices

Appendix E

GCRE Nant Helen
Proposed Drainage Drawings

Appendix F

Washery Site Drawings

Appendix G

DCWW Pre planning Response

1 Project Overview

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). The Nant Helen Complementary Earthworks restoration scheme for the site has been approved 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.

The approved Nant Helen Complementary Earthworks Scheme provides a flexible landform that can be used or adapted for a diverse set of future uses. One use for the site is for industrial purposes, in particular the Welsh Government's (WG) proposal to develop a rail testing and storage facility, known as the Global Centre of Rail Excellence (GCRE). This also includes developing the adjacent Onllwyn Washery into a rail maintenance and research facility.

The GCRE development will comprise of two tracks on sleepers set into a ballast track foundation, associated Overhead Line Equipment (OLE) to support electric trains and all required supporting infrastructure. This will be located on the 17.5m wide flat plateaus provided by the Complementary Earthworks. An access track will also be located adjacent to the track.

A new private access road is proposed to replace the existing which connects Onllwyn Road and the A4221. This will be diverted from its original route where necessary to suit the development, bridging over the cuttings.

The existing coal washery site is proposed to be redeveloped to a rail maintenance facility and research centre. The proposals currently comprise of numerous track sidings and buildings required to support the facility. The storm and foul discharge will need to be managed as the maintenance facility works will produce trade effluent which will need to be disposed of in a suitable agreed manner.

This drainage strategy is written to cover the requirements of the GCRE infrastructure, the diverted private road and the redevelopment of the Washery. New storm drainage infrastructure will be required to serve the GCRE development , however the general principle for the Nant Helen site is to retain all storm drainage features associated with the Nant Helen Complementary Earthworks drainage strategy where possible, and either amend or relocate to suit the GCRE requirements. The proposed road and rail maintenance facility, which have not been covered in the Nant Helen Complementary Earthworks drainage strategy, will require a new storm drainage provision with green infrastructure solutions, examples include swales, ditches and attenuation ponds.

2 The Site

2.1 Site Location and Description

The Nant Helen site is currently an open cast coal mine, owned and operated by Celtic Energy. The quarrying works being undertaken are nearing completion for the site. Following completion, the land is to be restored in accordance with the proposed restoration scheme which has been prepared separately by Celtic Energy. This will also include the construction of earthworks cuttings and embankments, with associated drainage features, as per the Complementary Earthworks scheme.

The site is located at approximate National Grid reference 283000, 210000. The area encompassed within the Nant Helen site planning application boundary is approximately 416ha. The existing Washery site is approximately 49ha. The Nant Helen and Washery Site locations can be seen in Figure 1.

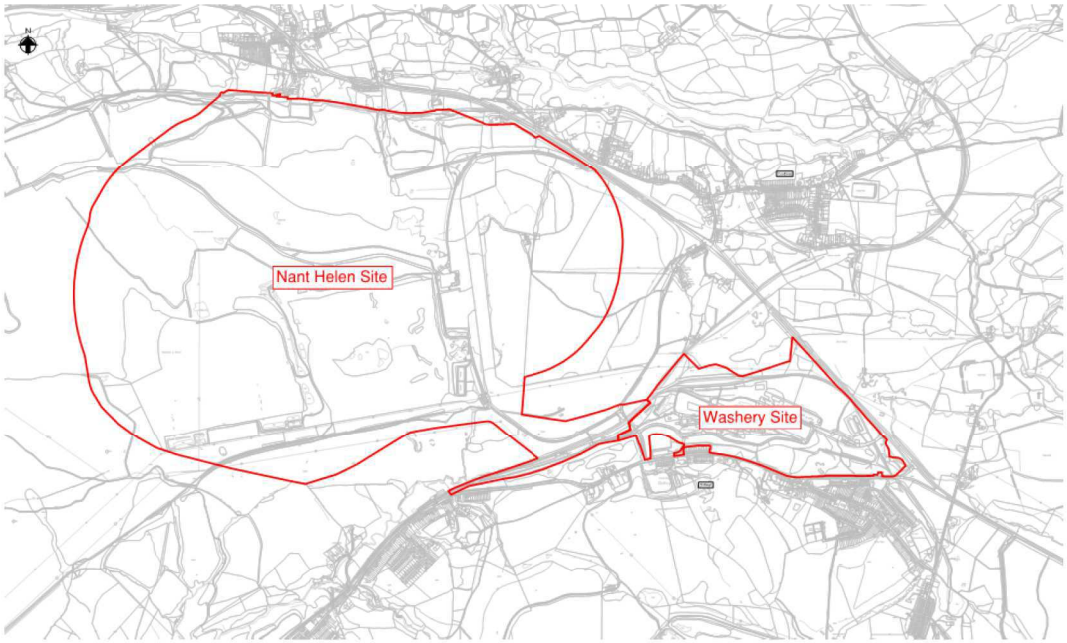

Figure 1: Site Location on OS Mapping (red – planning application boundary)

The site is proposed to be developed into a rail testing and storage facility, named the Global Centre of Rail Excellence (GCRE). Utilising the earthworks platforms provided by the Complementary Earthworks scheme, the testing track on the Nant Helen site development will comprise of two tracks on sleepers set into a ballast track foundation, associated Overhead Line Equipment (OLE) to support electric trains and an access track. The plateaus provided in the Contemporary Earthworks are anticipated to be sufficiently wide to contain the proposed works. Local earthworks reprofiling may be required to tie the works into the Complementarity Earthworks scheme.

The existing private track that runs through the site connecting Onllwyn Road and the A4221 will be diverted from its original route to suit the Complementary Earthworks development, bridging over the cuttings where necessary.

The Nant Helen site is located on the border between Neath Port Talbot and Powys, south of Caehopkin and north of Onllwyn. The site is bounded at the east by the A4221 highway and Onllwyn Road. The northern boundary of the site is formed by the Sustrans Cycle Route 43 and the southern boundary by an existing rail corridor. There are numerous engineered and natural ditches located within and around the site.

Adjacent to the Nant Helen site is the existing Coal Washery. This is currently a working coal washing facility and the proposal is to develop this into a rail maintenance facility comprising of numerous rail sidings and associated buildings to operate the maintenance facility. This will require both storm and foul drainage, including trade effluent provision.

On the rail approach to the Washery from the south west, prior to the proposed GCRE track connecting point, additional sidings are proposed. The existing rail track running from the south west through Seven Sisters terminates within the Washery site, and generally follows the line of the A4109 with the road to the south.

The Washery site is bounded by Wembley Avenue to the south and the A4221 to the east. There is a positive storm and foul network associated with the Washery as well as a local natural ditch network surrounding the site.

The River Dulais runs in a south westerly direction down the valley, predominantly to the north of the existing rail track. Tributaries to the river connect underneath the track in numerous locations. As the track approaches the Washery, the tributaries closely follow and run parallel to the track.

2.2 Site Topography

2.2.1 Nant Helen Site

The Nant Helen site is located around a ridgeline which runs from east to west on the site. To the north of this ridge, the land slopes down at a moderate gradient to the Sustrans cycle route. Similarly, the land south of the ridge falls at a moderate gradient to the rail line. The ridgeline finishes within the site extent to the east and small portion at the eastern extent of the site slopes down towards the A4221.

Owing to the opencast mining operations which take place on the western area of the site, the topography within the site changes due to the large scale earthworks taking place and the movement of earthworks material.

Celtic Energy have provided their proposed restoration contours which cover a portion of the site. The proposals broadly represent the existing topography described above, although the ridge line contained within the restoration proposals has been shifted to the north and a flat plateau is proposed at the ridgeline.

Where the proposed development is within the extent of the restoration scheme, the restoration levels have been applied as the baseline for the proposed drainage and earthworks. Outside of the restoration extent, 2m resolution LIDAR data has been applied for the baseline model.

A drawing has been produced which shows the topography of the site on this basis and can be seen in Appendix A.

2.2.2 Washery Site

The Washery site is located at the base of the hill with the brow being just south of the site boundary. The site high point (255m AOD) is located just east of centre on the southern site boundary and is on the downslope of the hills northern face. As the hill continues to fall, there is a slight plateau set at approximately 240m AOD located north east of the site high point where the land gently slopes away towards the site boundary in all directions.

North of the site the elevation starts to rise which has produced a local flat valley at approximately 230m AOD north of the site boundary.

The Washery development itself has also altered the natural topography, reprofiling areas to suit the development needs, namely larger gentle graded plateaus for the rail sidings and operations. In general, the overall direction of the natural contours has been retained with the western portion of the site sloping to the River Dulais to the west and the eastern portion of the site sloping east towards the A4221. The existing topography can be seen on CG2502 and CG2503 in Appendix F.

2.3 Published Flood Risk Maps

The Flood Risk maps hosted on the Natural Resources Wales (NRW) web portal have been checked for the site. These are detailed in the following subsections.

2.3.1 Development Advice Maps

The Development Advice Map (DAM) has been consulted to determine whether the site is located within a surface water flood zone. The map shows that the proposed development within the Nant Helen site is located entirely within Zone A, which is considered to be at little or no risk of fluvial or tidal/coastal flooding. An extract from the DAM can be seen in Figure 2.

The DAM shows the Washery site to be predominantly in Flood Zone A, an extract can be found in Figure 3. A small section on the eastern boundary is located in Zone C2 however this position correlates to an existing watercourse and no development is planned in this area.

As such, a Flood Consequence Assessment will not be required.

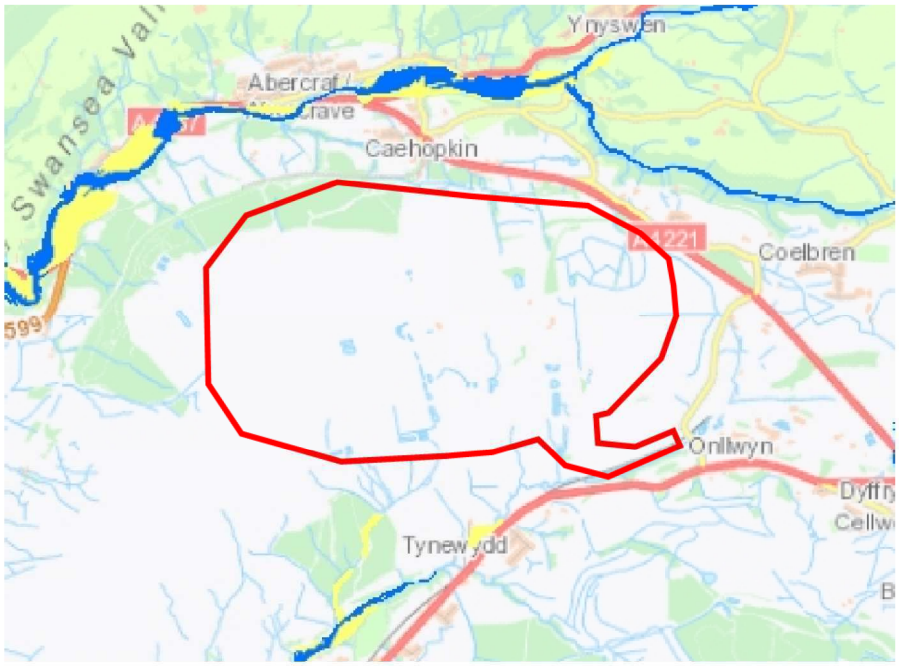

Figure 2: Long term flood risk Development Advice Map for the Nant Helen site. Yellow – Zone B, Blue – Zone C2

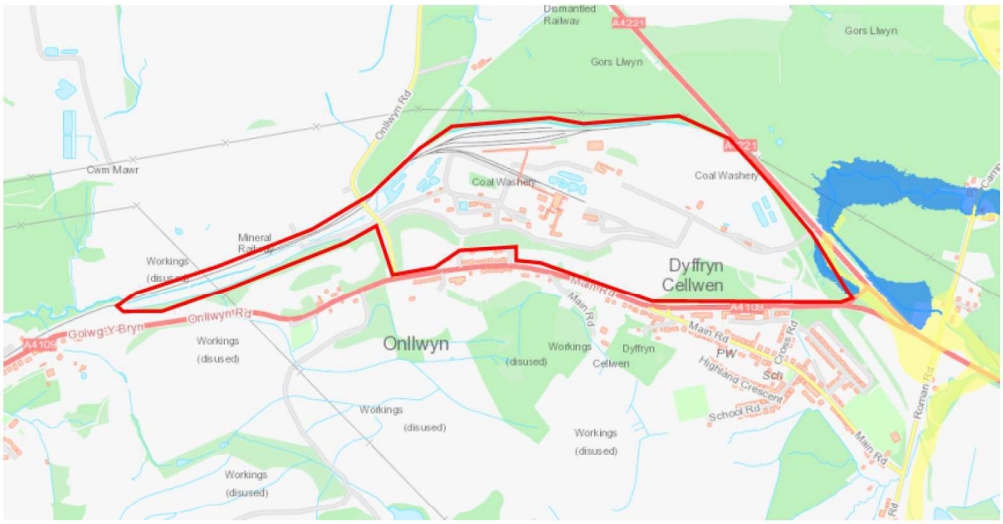

Figure 3 - Long term flood risk Development Advice Map for the Washery site. Yellow – Zone B, Blue – Zone C2

2.3.2 Fluvial, Reservoir, Coastal and Surface Water Flooding

Owing to the location and elevation of the site, there is no risk from Fluvial, Reservoir or Coastal Flooding.

The surface water flood maps show a number of areas within the Nant Helen GCRE site at low, medium and high risk of surface water flooding. These are generally centred around the numerous water features and ponds, see Figure 4.

The surface water flood map for the Washery site can be seen in Figure 5. The land directly to the north of the Washery site is subject to low, medium and high

surface water flood risk however, development is not currently planned for this area. There are some areas of surface water flooding risk on the Washery site which are to be expected as these largely correlate to existing surface water channels and ponds.

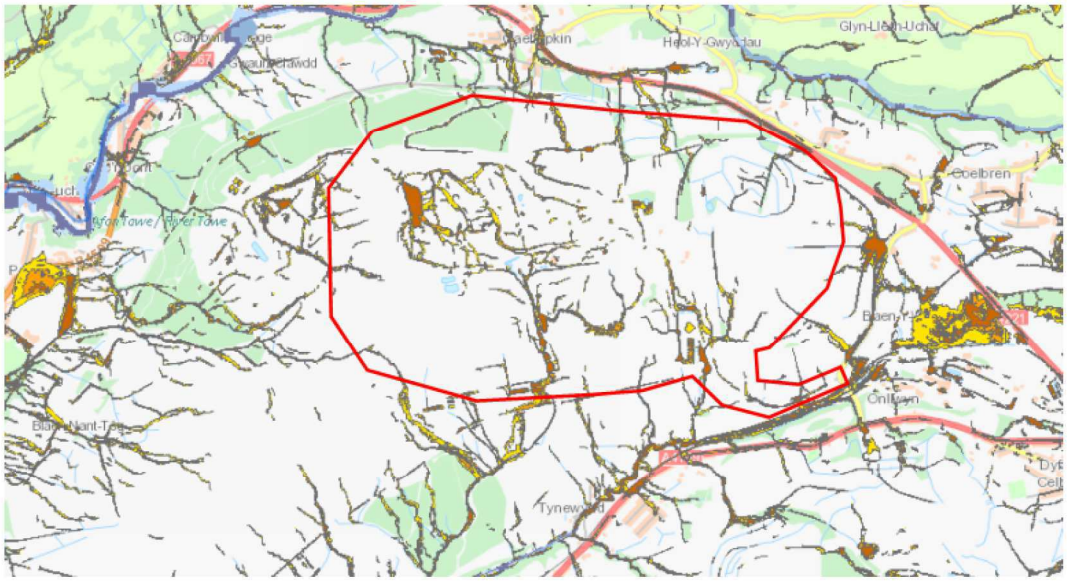

Figure 4 - Fluvial, coastal, reservoir and surface water flood risk map based on the NRW Long Term Flood Risk Maps for the Nant Helen Site (yellow and orange – surface water flooding, blue – fluvial flooding).

Figure 5 - Fluvial, coastal, reservoir and surface water flood risk map based on the NRW Long Term Flood Risk Maps for the Washeries Site (yellow and orange – surface water flooding, blue – fluvial flooding).

3 Existing Hydrology

For the analysis of the existing hydrology, the site has been split into two sections. The Nant Helen section which corresponds to Complementary Earthworks site boundary and the Washery site area.

3.1 The Nant Helen site

The proposed works to develop the Nant Helen site for the proposed GCRE use has been considered in the catchment analysis undertaken for the Complementary Earthworks Scheme.

The drainage catchments for the proposed GCRE works will remain the same as those proposed for the Complementary Earthworks. These have been summarised in the sections below.

3.1.1 Rainfall Runoff Catchments

As described in Section 2.2, the Nant Helen site encompasses a central ridgeline. This ridgeline forms the boundary between three overarching catchments. Stormwater runoff from these catchments is ultimately conveyed to three major watercourses:

- The River Tawe, to the north of the site
- The River Dulais, to the south-west of the site
- The Afon Pyrddin, to the east of the site

Within the site, these larger catchments are separated into a number of smaller sub-catchments which are served by ditches and small watercourses. These serve as tributaries, conveying the runoff from the site to the major watercourses.

Unusually, for this site there are two different catchment scenarios to consider. The first are the natural catchment areas that were present prior to the mining operations on the site (referred to as the “Original Catchments”). The second is the catchments modified as part of the Complementary Earthworks scheme, (referred to as the “Restoration Catchments”).

3.1.2 Original Catchment Boundaries

The original catchment information for the site has been provided by Celtic Energy. This information was extracted and digitized from the Flood Estimation Handbook (FEH) 1999.

To validate these catchment boundaries, a visual comparison was undertaken with the catchment data available on the FEH Online portal. The boundaries for the sub-catchments were shown to be visually similar. The shapefile for the overarching River Tawe, River Dulais and Afon Pyrddin catchments was also downloaded and compared. The ridgeline for the site demarcating the catchment boundaries matched the information provided by Celtic Energy.

A drawing showing the original catchments has been provided in Appendix B. Table 1 below provides a summary of the existing catchments. For ease of reference, the catchment names used by Celtic Energy have been applied for the proposals.

3.1.3 Restoration Catchments

The catchments and associated discharge rates based on the restoration earthwork proposals have been provided by Celtic Energy. These are contained within Appendix C. This information highlights that the majority of the proposed catchments will have reduced discharge rates compared to the original discharge rates.

During discussions with Celtic Energy, it was highlighted that the reduction to discharge rates for the River Tawe catchments has been provided to alleviate historical flooding issues in downstream tributaries. This was mainly achieved by shifting the ridgeline north and consequently reducing the contributing catchment areas. Attenuation ponds have also been proposed in some catchments to further restrict stormwater runoff.

A reduction in discharge rate has also been provided in the restoration scheme for the River Dulais catchments. However, this is not provided to alleviate downstream flooding but due to the presence of existing settlement ponds which have been incorporated into the restoration proposals as proposed attenuation features.

3.1.4 Summary of Rainfall Runoff Catchments

Based on the above, the original catchment areas should be compared to the proposed catchment areas to ensure the natural runoff regime for the site is replicated.

However, for the River Tawe catchments only, the reduction in peak discharge rates proposed by the restoration scheme will be applied to the proposals to avoid reducing the betterment provided.

3.1.5 Greenfield Runoff Rate

A hydrological analysis has been undertaken for the three major catchments to determine the Greenfield Runoff Rate (GRR). The IH124, ReFH2.2 and FEH Statistical methods have been applied and compared to calculate the GRR for the 1:1, 1:30 and 1:100-year rainfall events.

Of these methods, ReFH2.2 was selected as the most appropriate as it is a widely accepted method for plot-scale sites and uses the updated FEH13 DDF curves. It also demonstrated a better correlation with the observed QMED at river monitoring station 58008, located downstream in the River Dulais at Cilfrew.

The GRR for each catchment was therefore calculated to be the values as shown in Table 1 below. For further details of the assumptions, calculations and conclusions, refer to the Hydrology Calculations technical note in Appendix D.

Table 1 – Greenfield Runoff Rate for the site calculated using the ReFH2.2 summer profile

Catchment	Greenfield Runoff Rate (l/sec)		
	1:1 year	1:30 year	1:100 year
River Tawe	17.8	42.2	53.0
River Dulais	19.8	46.3	57.9
Afon Pyrddin	16.9	40.5	51.0

3.2 Washery Site

3.2.1 Rainfall runoff catchments and Existing Drainage

The existing coal washery development has introduced surface water channels and site reprofiling which have impacted the natural catchments. A ridgeline is present to the east of the existing coal stores which divides the site into two catchments as shown on CG2502 and CG2503 in Appendix F. The area to the west of the ridgeline falls towards to the River Dulais to the west of the site. The area to the east of the ridgeline falls towards the A4221 and lies within the Afon Pyrddin catchment.

The topography indicates that overland flow enters the Washery site from the higher ground from the south. Surface water management information provided by Celtic Energy, show that perimeter surface water ditches intercept the flow and convey it to the River Dulais to the west and a tributary to the Afon Pyrddin to the east.

Within the eastern Afon Pyrddin Catchment, the watercourses and surface water channels converge and cross the A4221 adjacent to the Washery site access entrance from the A4221. It is thought that a culvert is present in this location to convey the flow underneath the highway, but this has not been confirmed.

Directly north of the site is a flat area shown to be at risk to surface water flooding on the NRW flood maps. The natural contours imply that this northern area drains towards the River Dulais tributaries via perimeter surface water channels around the existing Washery.

An existing surface water management strategy has been provided by Celtic Energy who currently operate the coal washery. The information, reproduced on CG2502 and CG2503 in Appendix F, shows there to be multiple surface water ditches, piped networks, ponds and settlement lagoons for the management of surface water runoff on the existing site. These all primarily outfall to the River Dulais to the west, with a small portion of access track and storage areas outfalling to the Afon Pyrddin tributary to the east. The existing ponds are also currently being used for the treatment of washery process water which is discharged to the River Dulais under an existing discharge consent. The discharge consent limits the runoff to a maximum 100l/sec and no more than 5000m^3 per day.

Two settlement lagoons are shown on the eastern boundary however, these lagoons are not shown as in use on the surface water management information provided by Celtic Energy.

The proposed section of track connecting the Washery site to the test track on Nant Helen site also lies within the River Dulais catchment.

3.2.2 Greenfield runoff rate

The Greenfield runoff rates for the River Dulais and Afon Pyrddin catchments have been used as calculated for the Nant Helen catchment in Section 3.1.5.

For further details of the assumptions, calculations and conclusions, refer to the Hydrology Calculations technical note in Appendix D.

Table 2 - Greenfield Runoff Rates for the Washery site catchments

Catchment	Greenfield Runoff Rate (l/sec)		
	1:1 year	1:30 year	1:100 year
River Dulais	19.8	46.3	57.9
Afon Pyrddin	16.9	40.5	51.0

4 Proposed Stormwater Drainage

4.1 Introduction

The Nant Helen Complementary Earthwork Scheme provides a 17.5m wide plateau to facilitate the infrastructure for the GCRE scheme. As such, the Complementary Earthworks Scheme considered the impact of the cuttings and embankments on the existing drainage catchments and flow paths whilst making an allowance for the drainage requirements of the proposed GCRE scheme.

The GCRE rail and access track will require a dedicated storm water drainage system. This infrastructure will be located on the 17.5m flat plateaus created by the Complementary Earthworks. The track drainage will replace the ditches proposed on the plateaus however, the outfall locations and overarching strategy will remain the same as that detailed in the Complementary Earthworks Drainage Strategy report.

The private access road realignment though the GCRE site will also require a dedicated storm drainage system.

The development of the Washery site will require a surface water network to serve the maintenance facilitiy including buildings, track sidings, storage areas and general infrastructure. Any new track infrastructure including the connecting track to the Nant Helen site and the proposed sidings on the approach to the Washery, will also require drainage provision.

This section outlines the drainage strategy for each catchment area on both the Nant Helen and Washery sites and the proposed attenuation and conveyance features.

The proposed drainage drawings for the Nant Helen site can be found in Appendix E and the Washery site in Appendix F.

4.2 Schedule 3 of the Flood and Water Management Act

Schedule 3 of the Flood and Water Management Act 2010 establishes SABs (SuDS Approving Body) in local authorities. Since the 7th January 2019, developments greater than 100m^2 or developments containing more than one building will be required to submit a SAB application. This application requires developers to utilise Sustainable Drainage Systems (SuDS) in their surface water management for a development.

SuDS aim to manage rainfall on site using methods that mimic natural processes, by making use of the landscape and vegetation to control the flow, volume and quality of the surface water runoff. In addition, SuDS also provide amenity benefits by providing aesthetically pleasing and natural landscapes, and biodiversity benefits by creating habitats for wildlife and vegetated areas.

The Welsh Government's Statutory Standards for Sustainable Drainage Systems contains six standards, which details the requirements for the surface water drainage. The standards are as follows:

S1. Runoff destination

S2. Hydraulic control

S3. Water quality

S4. Amenity

S5. Biodiversity

S6. Construction, operation and maintenance

These form a set of principles which must be considered in the design of the SuDS features in order to obtain approval by the SAB.

4.3 S1 - Runoff Destination

The Welsh Government's SuDS Standard S1 provides a discharge hierarchy for surface water from developments, as well as exemption criteria for each level that must be met before the next level can be considered. The discharge hierarchy is shown below:

- Level 1: Surface water runoff is collected for use;
- Level 2: Surface water runoff is infiltrated to ground;
- Level 3: Surface water runoff is discharged to a surface water body;
- Level 4: Surface water runoff is discharged to a surface water sewer, highway drain, or another drainage system;
- Level 5: Surface water runoff is discharged to a combined sewer.

The aim of this is to encourage developments to use runoff as a resource and ensure that runoff is sustainably managed to avoid any negative impacts from the development, such as increased flood risk.

4.3.1 Level 1 - Collected for Use

The GCRE track infrastructure does not require non-potable water to be used therefore this does not provide a viable discharge point for the site.

There is an opportunity in the proposed rail maintenance facility to utilise harvested rainwater, particularly for lavatories, and this should be adopted where possible. The frequency of use of these facilities compared to the site area however will mean that only a small proportion of the total volume of rainfall and runoff can be reused. Additionally, rainwater harvesting tanks may be already full after successive storms and not be sufficient to cater for larger return period events. Therefore, rainwater harvesting is not considered a suitable primary outfall for the surface water strategy.

4.3.2 Level 2 - Infiltrate to Ground

For the Nant Helen site much of the current area has been previously open casted, whilst other areas have remained unaffected. Both the natural and restored ground are within material of low permeability. Therefore, infiltration is not a viable outfall source for the site.

Soakaway tests have not yet been undertaken for the Washery site at this stage, however it is anticipated that the ground material will be similar to the Nant Helen site, and soakaways are likely to not be viable. Open source British Geological Survey (BGS) superficial records indicate peat to be present in the area. This further indicates that the use of a soakaway solution as the primary outfall would not be feasible.

Additionally, the large presence of water bodies and surface water channels indicate that the ground is of low permeability, this should be confirmed through soakaway testing in future design stages.

However, some infiltration is likely to occur and may be suitable to provide infiltration of the first 5mm of rainfall and prevent discharge in small return period events. This is discussed further under Standard S2 - Hydraulic Control.

4.3.3 Level 3 - Discharge to a Surface Water Body

There are a number of existing ditches and watercourses within the Nant Helen site extents as well as drainage features associated with the Complementary Earthworks scheme to convey and attenuate the flow. These form the pathways for surface water runoff to communicate to the downstream watercourses. As such, it is proposed to outfall runoff from the site to the receiving watercourses using these existing features, albeit with some ditches/swales relocated to suit the proposed works.

The existing Washery works discharge into lagoon features on the western boundary which capture runoff and attenuate/treat it before outfalling to the River Dulais to the west. It is also assumed that the lagoons on the eastern side boundary perform a similar function and attenuate/treat flow before outfalling into an Afon Pyrddin tributary to the east, however this has not been confirmed. For the maintenance facility, it is proposed that storm runoff is directed to the eastern and western boundary and discharged into the same receiving watercourses as the existing works, mimicking the current hydraulic regime.

Discharging to a waterbody will provide the runoff destination for all the sites, as such, Level 4 and 5 have not been considered.

4.4 S2 - Hydraulic Control

Standard S2 details the requirements for hydraulic runoff from the site. The existing GRR for the Nant Helen site including the original and restoration catchment areas and the Washery site have been assessed and compared in Section 3 of this report.

4.4.1 Nant Helen Site

The proposed test track and rail infrastructure are contained on the 17.5m plateaus created by the Complementary Earthworks. The attenuation features proposed for the Complementary Earthworks, described in the Complementary Earthworks Drainage Strategy Report, have been designed to accommodate the GCRE proposals and as such will retained and utilised for the proposed scheme. The hydraulic control measures and attenuation ponds have been designed to control additional impermeable area, above that of the natural catchments, for storm events up to and including the 1 in 100 year return period event including a 40% allowance for climate change. The attenuation requirements for the GCRE Nant Helen site are shown on drawings CG3050 to CG3053 in Appendix E.

The proposed catchment and discharge rates for the GCRE Nant Helen site in comparison to the original catchment areas is summarised in Table 3.

Table 3 - Summary of the original and proposed catchment areas and discharge rates for the GCRE Nant Helen for the 1:100-year event.

Catchment	Original Catchment Area (ha)	Proposed Catchment Area (including track area) (ha)	Original 1:100 year Discharge Rate (m^3/s)	Proposed 1:100 year Discharge Rate (m^3/s)
1B	9.5	0.0	0.5	0.0
1C	7.5	3.0	0.4	0.2
1D	55.2	25.4	2.9	1.3
1E	39.6	41.0	2.1	1.9
1F	42.3	44.3	2.2	2.1
1G	36.2	16.4	1.9	0.3
1H	24.6	8.3	1.3	0.4
1I	0.0	26.3	0.0	1.4
River Tawe	**214.9**	**164.7**	**10.9**	**7.7**
2A	33.0	28.8	1.9	1.7
2B	55.7	115.3	3.2	3.2
2C	77.6	72.7	4.5	4.2
River Dulais	**166.2**	**216.8**	**9.6**	**9.1**
3A	34.8	34.4	1.8	1.7
Afon Pyrddin	**34.8**	**34.4**	**1.8**	**1.7**
Total	**415.9**	**415.9**	**22.3**	**18.5**

For the River Tawe catchment, the reduction in contributing area coupled with the reduction in discharge rates proposed as part of the restoration scheme results in a

total 30% reduction in peak flow to the River Tawe, which includes a 40% allowance for climate change for future impermeable areas.

Conversely, the River Dulais Catchment has an overall increase in impermeable area, particularly attributed to Catchment 2B. To mitigate the associated increase in site runoff, a series of ponds have been proposed within the catchment to attenuate stormwater to the original peak discharge rate.

The Afon Pyrddin also has a small increase in catchment area, resulting in the flows being attenuated to match the original discharge rate.

A portion of the impermeable area of GCRE track connecting the testing loops to the mainline has not been accounted for in the Complementary Earthworks Scheme drainage. Attenuation and hydraulic control for the additional 4.1ha of impermeable area will be provided adjacent to the existing railway to the south and detailed further in Section 4.4.2.

The GCRE track, ballast and access track along the 17.5m plateau will require its own dedicated drainage features which will outfall into the Complementary Earthworks drainage features or for the connecting track to the Washery, a dedicated attenuation feature before the receiving watercourse.

The realigned access road could be drained through swales running adjacent to the highway which then connect to the Complementary Earthworks drainage and outfall into the relevant catchment. As the road is being aligned and similar cross section installed, there is no change in the impermeable area.

4.4.2 Washery Site

It is anticipated that the earthworks and levels for the proposed maintenance facility will not differ significantly from those of the existing Washery due to the need to tie into the existing rail infrastructure. Additionally, much of the area previously supported additional rail sidings and infrastructure in its former historic use. Earthworks modelling will be undertaken in further design stages however, it is not expected for the proposed gross drainage catchment areas to differ markedly from the existing.

Increases in impermeable area are expected due to the positive drainage of additional rail track, hardstanding areas, buildings and access tracks. It is proposed to attenuate the flows to the greenfield rates outlined in Section 3 prior to outfalling into the existing watercourses. Similarly, to the Nant Helen Site, attenuation and hydraulic control will be provided for storm events up to and including the 1 in 100 year return period event plus a 40% allowance for climate change.

The proposed sidings on the approach to the Washery site will require surface water network and attenuation due to an increase in impermeable area.

As discussed in Section 3.2, areas to the south and north of the existing Washery's area are thought to produce overland surface water runoff towards the Washery site. As per the current hydraulic regime, the cut off ditches that currently intercept the overland flow will be maintained to convey the flow to the existing

watercourses. This minimises the risk of surface water flooding for the development from the upper natural catchments. Attenuation of such flows are not proposed as the runoff is from green areas only.

The attenuation requirements for the Washery site are shown on drawings CG2504 to CG2505 in Appendix F and summarised in Table 4.

Table 4 - Washery's Site Attenuation Volume Estimates

Area	Catchment Ref	Imp. Area (ha)	100 yr GRR (l/s)	Estimated Attenuation Vol. m^3
Maintenance facility	2D	15.72	910.2	7830
West Approach Sidings	2E	3.70	214.2	2130
Eastern Sidings	3B	1.05	60.8	600
Main loop Connection	2C	4.10	237.4	2340
Access Track	2C	1.70	98.4	970

4.4.3 Drainage Features

To facilitate conveyance of flow around the Nant Helen and Washery site, a number of drainage features are proposed. These are detailed briefly in the following subsections.

For the location of these drainage features, refer to drawings CG3050 to CG3053 in Appendix E and CG2504 to CG2505 in Appendix F.

4.4.3.1 Rail track drainage

Rail track drainage will be provided in the rail ballast in the form of perforated pipe filter drains. The surface water runoff within the 17.5m plateaus will be directed into the filter drains which will run parallel to the rail track. An indicative arrangement of the plateaus can be found on CG3024 in Appendix E. Drainage of the cuttings will also be provided by the filter drains.

For the Nant Helen site, the longitudinal gradient of the track is such that the low points are aligned with the embankment sections of the Complementary Earthworks. This allows the track drainage to connect to either cut off ditches or cascades located at the base of the embankments.

Track drainage will also be provided for the rail network in the Washery site. Similarly, to the test track, filter drainage will be used to drain the track ballast running parallel to the track. The filter drains will then discharge into ditches and ponds at appropriate locations downstream.

4.4.3.2 Swales/ Cut-off Ditches

In the Nant Helen site, to collect and convey runoff from the base of embankments and top of cuttings, cut-off ditches have been proposed. These will capture sheet runoff from upland areas and convey them to the low points within the catchments.

Swales and cut off ditches will be used to capture runoff from the realigned private access road with runoff directed to the ditch network associated with the Complementary Earthworks.

Within the Washery site, swales and cut off ditches will be used to convey flow from the track filter drainage and proposed buildings to the attenuation features. The gentle site gradients and linear nature of the rail maintenance facility lends itself for the use of swales as an effective and sustainable drainage solution.

Three types of ditch profile are currently proposed:

- In areas of low flow, low velocity and shallow longitudinal gradients (less than 1 in 35), grass lined channels will be used. These will generally be towards the start of the ditches where runoff will be less concentrated.
- Where higher flows are anticipated or for longitudinal gradients steeper than 1 in 35, stone bedded channels will be proposed. This will provide channels with long-term stabilisation and erosion protection. The stone size will be determined based on the anticipated flows in the ditch.
- Finally, at longitudinal gradients steeper than 1:12 or where flow would become supercritical (Froude number > 1), the ditches will be rock reinforced bedded on a concrete bed. Longitudinally, these would be stepped with slight ponding on each step to dissipate energy from the water.

4.4.3.3 Culverts

Water collected by cut-off ditches at the base of the embankments on the Nant Helen site will need to be conveyed under the plateau at discreet low points. To do this, a number of culverts will be installed as part of the scheme.

Culverts should be designed in accordance with CIRIA C689 - "C*ulvert Design and Operation Guide*". Culverts should be sized to accommodate flows from the 1:100-year event including a 40% allowance for climate change.

At the inlet and outlet for the culverts, a headwall will be required. These are likely to be precast or in-situ concrete headwalls. However, for smaller diameter culverts alternative soft engineered options may be considered.

The outfall from the Washery site is anticipated to connect to the River Dulais tributary upstream of the culvert under Onllwyn Road.

Culverts may also be required in and around the development to maintain the natural flow paths and existing surface water channels which may be severed by proposed rail and access road infrastructure.

4.4.3.4 Cascades

At a number of locations on the Nant Helen site, the cut-off ditches are required to flow down the side of the proposed engineered slopes. To do this, cascade features will be required.

These will be designed to have sufficient capacity for the 1:100-year event (+40% climate change) and dissipate energy from the flow as required.

4.4.3.5 Attenuation Ponds

The attenuation ponds specified in the Complementary Earthworks will be retained for the proposed GCRE development. The existing lagoons on the Washery site will be removed, where required, to allow for the new track infrastructure however, new attenuation ponds are proposed. Ponds will also be required for the new track sidings and the track connecting the Nant Helen site to the Washery.

All ponds have been sized for the various catchments as described in Section 4.4. A 300mm freeboard will be provided above the highest water level for each pond.

The attenuation ponds will be lined to provide a permanent wet base and increase the amenity and biodiversity value to the scheme. An access track has also been provided around the Nant Helen ponds to provide an area for inspection and maintenance.

Access to all ponds will be required to facilitate inspection and maintenance.

Hydraulic control will be provided on the pond outfalls to attenuate the discharge rate to the GRR.

4.4.4 Further Considerations

For the Nant Helen site, the GCRE infrastructure is predominantly permeable. An impermeable access track is being introduced however runoff from this track is being slowed as it percolates through the ballast. Generally, stormwater falling on the catchment will infiltrate and evapotranspirate at the same rate it does in the existing case. Therefore, it is not proposed to review the Complementary Earthworks proposals to reduce discharge from the site for rainfall events less than 5mm.

This will also be the case for the relocated private road which will be served by vegetated cut off ditches and swales offering interception.

The proposed maintenance facility on the Washery site will have a number of impermeable surfaces, including the access roads and associated buildings. Interception of the first 5mm of rainfall will be required for these areas. It is anticipated that this will be provided by the swales, ditches and green infrastructure for the scheme. Further consideration of this element will be required during subsequent design stages.

For each sub-catchment, the runoff rate will be controlled to the GRR to mitigate any increase in flood risk and prevent morphological and ecological damage downstream. For the River Tawe catchments, the betterment provided as part of the restoration scheme has been incorporated into the proposals, resulting in an overall reduction from the GRR.

Volumetric control will also need to be considered for each catchment based on the potential future impermeable area. This will be achieved through long-term storage areas discharging at a reduced discharge rate within the attenuation ponds.

4.5 S3 - Water Quality

The Welsh Standard S3 covers the necessary water quality requirements for a scheme.

During construction, it is likely that silts will be mobilised by rainfall which if uncontrolled will be conveyed to the downstream watercourses. Celtic Energy have noted this and propose to use a combination of settlement ponds and Siltbusters to capture silt during the earthworks. This will be detailed in the Contractor's method statements.

Following completion of the earthworks, the engineered slopes will be grass seeded. Once the roots have taken, the site will be effectively green and therefore no dedicated treatment train is required at this stage. However, it is noted that the grass lined channels and attenuation ponds will provide water quality benefits for the scheme.

The predominant mechanism for potential surface water pollution is anticipated to be derived from the mobilisation of contaminants from the rail network during storm events, particularly in the siding areas where carriages may be stationary for some time. Appropriate stages of treatment, often referred to as 'treatment trains' will be required to ensure adequate pollution mitigation is provided.

The current proposed treatment train, in order, consists of; trackside filter drains, ditches/swales and attenuation/bio retention ponds prior to discharge into the natural watercourses. For the maintenance facility area, sediment/oil forebays may be required upstream of the ponds to capture and contain any potential contaminants which have not been treated by the upstream networks.

Additionally, specific maintenance areas such as carriage washing and fuel handling areas etc, may require their own dedicated pollution control systems prior to connecting into the wider surface water network.

4.6 S4 - Amenity

The Welsh Standard S4 states that the surface water management systems should maximise amenity benefits.

The proposed use of grass lined ditches will provide a more natural looking drainage on the site which will be visually appealing. Similarly, the ponds can be shaped to look visually appealing and provide provision for additional flora, fauna and wildlife habitats.

4.7 S5 - Biodiversity

Standard S5 requires that surface water management systems also maximise biodiversity benefits.

The use of grass lined ditches and attenuation ponds will provide a diverse range of habitats for flora and fauna.

4.8 S6 - Construction, Operation and Maintenance

Standard S6 requires that the proposed surface water drainage systems are designed such that they can be constructed, operated and maintained easily, safely and cost effectively for the whole design life of the systems. They should also aim to minimise the use of natural resources and embedded carbon.

The Complementary Earthworks scheme will be completed before the GCRE scheme is installed which will provide suitable access to all areas. Utilising the drainage installed as part of those works will minimise the amount of work required and therefore natural resources.

The use of green features will also assist in offsetting carbon and the nature of the ballast will offer a filtering effect and to a degree keep contaminants within the ballast rather than discharging them into the watercourse.

The drainage proposals minimise the requirement for hard engineering solutions by utilising ditches for conveyance and attenuation ponds for storage. Stone for the ditches will likely be from site won material rather than being imported.

An access track has been provided around each of the attenuation ponds to facilitate an area for inspection and maintenance. To provide access to each pond, a proposed maintenance access track route has been determined around the GCRE, this is shown in drawing CG3075 in Appendix E.

5 Foul Drainage

No existing or proposed foul drainage is currently required for the Nant Helen Site. The existing Washery site is served by foul drainage and the proposed maintenance and research facilities will require foul drainage provision as detailed in the following sections.

5.1 Existing Foul Drainage

Asset record information obtained from Dŵr Cymru Welsh Water (DCWW) show a public 150mm foul sewer enters the western portion of the Washery site from the north. The records show the sewer converts to a 230mm diameter combined drain within the site before exiting the site. After the public combined network that serves Onllwyn connects to this combined network it continues in a south westerly direction down the valley.

Information provided by Celtic Energy shows an existing private foul drainage network present in the Washery site. The network collects flows from various buildings before heading in a westerly direction and outfalling to the existing 230mm diameter combined sewer.

Celtic Energy have advised that trade effluent is not currently discharged from the site into the DCWW foul or combined network.

5.2 Proposed Foul Drainage

Foul drainage will be generated from the site from staff facilities such as canteens, toilets and welfare facilities. Based on a staff population of 118, the estimate submitted in the economic business case, the proposed peak flow is estimated to be 1.87 l/s.

A pre planning application was made to DCWW to ascertain if sufficient capacity exists within the local network to facilitate the proposed development based on the above peak flow. DCWW have subsequently advised that sufficient capacity exists within the combined sewer to cater for the development. Therefore, it is proposed to convey the foul drainage from the development to the existing connection to the DCWW combined sewer. The pre planning response letter can be found in Appendix G.

5.3 Proposed Trade Effluent

It is anticipated that the maintenance facility works will also produce trade effluent from train carriage washing facilities. The quantity and flow rates for such facilities are currently unknown at this stage of the scheme. As part of the pre planning application to DCWW, it was highlighted that discharge of pre-treated carriage wash may require a connection to the DCWW network. DCWW have advised in the pre planning response that a discharge consent would be required.

Should an agreement on the discharge of trade effluent to the DCWW sewer not be reached with DCWW, storage and removal of trade effluent may be required.

6 Conclusion

The surface water drainage strategy has been considered in accordance with the Welsh Government's Statutory Standards for Sustainable Drainage Systems. Consideration has been given to the proposed runoff destination, hydraulic control, water quality, amenity and biodiversity for the scheme.

The proposed Nant Helen rail testing tracks will be located on the 17.5m earthworks plateaus provided by the previously submitted Nant Helen Complementary Earthworks Scheme.

The drainage strategy for the Complementary Earthworks considered and made allowance for the proposed GCRE development. Minor changes have been proposed which include; the replacement of the drainage on the earthworks plateaus for dedicated track drainage, additional drainage for the rail link between the testing loops and the existing mainline and the drainage for the GCRE access road.

The Complementary Earthworks Scheme will result in modifications to the original catchment and restoration catchment areas. For each sub-catchment, to ensure the runoff rate from the site is not increased, the catchment areas for the original and proposed catchments were compared. Where the proposed catchment is larger, flows have been attenuated to the GRR for the smaller catchment area. In addition to this, for the River Tawe catchments, the betterments to the GRR proposed in the Celtic Energy Restoration Plan have been adopted. Further details are contained with the previously submitted Complementary Earthworks Drainage Strategy Report. Attenuation and flow control will be provided to GRR for storm events up to and including the 1 in 100 year return period event including a 40% allowance for climate change.

Rail maintenance and research facilities are proposed on the site of the existing Onllwyn Coal Washery. The existing surface water catchments and drainage strategy have been evaluated and used to inform the proposed strategy. It is proposed to control, treat and convey the surface water from the proposed impermeable areas to the GRR prior to discharging to existing watercourses. The majority of the site is proposed to outfall west into the River Dulais mimicking the existing hydraulic regime. The eastern portion of the site is proposed to outfall to a tributary for the Afon Pyrddin to the east. Attenuation and flow control will be provided for storm events up to and including the 1 in 100 year return period event including a 40% allowance for climate change.

The principles of the stormwater conveyance have been discussed. The rail track will be primarily drained by filter drains within the ballast. Elsewhere, the stormwater runoff will be captured and conveyed within the catchments utilising engineered cut-off ditches, swales, culverts, cascades and attenuation ponds. The sequential drainage elements will provide treatment of the storm water prior to discharging to existing watercourses. The ditches and attenuation ponds will also

provide both amenity and biodiversity value by blending into the natural landscape and providing a contrast between dry and wet areas.

The proposed rail maintenance facility at the Washery site will require a foul drainage connection for the site buildings. Based on an occupancy of 118 staff and estimated peak flow of 1.87 l/s, DCWW have confirmed that sufficient capacity exists within the existing connection to the combined sewer to facilitate the proposed development.

Carriage washing facilities will generate trade effluent which will need to be disposed of accordingly. The discharge of trade effluent to the combined DCWW sewer would require a trade discharge agreement with DCWW. Should an agreement on the discharge of trade effluent to the DCWW sewer not be reached with DCWW, storage and removal of trade effluent may be required.