

Ffos-y-Fran Final Restoration Strategy

Environmental Statement (ES)

ES Volume 1 – Technical Report

for

MERTHYR (SOUTH WALES) LTD

January 2025

3274-11

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1 Introduction

1.1 Environmental Statement (ES)

1.1.1 This document is an Environmental Statement (ES) prepared by Richards Moorehead and Laing Ltd (RML) on behalf of Merthyr (South Wales) Ltd. The ES contains four key documents: -

1. ES Volume 1 – Technical Report (this document)
2. ES Volume 2 – Figures
3. ES Volume 3 – Technical Appendices
4. Non-Technical Summary

1.1.2 The purpose of the ES is to report the findings of an Environmental Impact Assessment (EIA) that has been requested by the local planning authority Merthyr Tydfil County Borough Council (MTCBC) to assess the likely significant environmental effects that would result from the implementation of the final restoration strategy of the former surface mine and land reclamation scheme at Ffos-y-Fran, Merthyr Tydfil, South Wales.

1.1.3 The mine ceased coaling operations at the end of November 2023 and has since entered a period of care and maintenance until a final restoration strategy can be agreed with the Local Planning Authority (LPA), Merthyr Tydfil County Borough Council (MTCBC).

1.1.4 The final restoration strategy will be an alternative to the scheme that has previously been approved planning permission by MTCBC. The aim of the former restoration strategy was to return the land to its former use as an urban common, with a simple landform and landscape which is characteristic of the area and void of dereliction. The remainder of the land was to be restored predominantly to agricultural use with certain areas protected for nature conservation, archaeological or local heritage interests. A footpath and bridleway network was to be provided to complement the public right of access for air and exercise over the urban common and additional footpaths would be created over the areas that are not common land to complete the proposed network. To deliver the Ffos-y-Fran Reclamation Scheme, 123 million cubic metres of overburden was needed to be removed in order to extract 10.8 million tonnes of high-quality steam coal.

1.1.5 The alternative and final restoration scheme would deliver many of the same features as the previously approved scheme. The main difference is that instead of restoring the landform to previous levels, the main void from where most of the coal was extracted, would remain with a permanent ground water lake as a landscape feature. The overburden mounds would be retained with some re-

profiling of the earthworks around the side slopes. Existing waterbodies developed as part of the surface mine operations would also be retained because over time, these have shown signs of nature recovery. Some contain evidence of being used by great crested newts. Other areas of the site that are showing signs of nature recovery with developing natural habitats, would also be retained, protected and enhanced. The alternative scheme is described in more detail in **Chapter 4** of this ES.

- 1.1.6 The consented scheme has been partially implemented as part of the progressive restoration of the site. Phase 1, which lies on the western flank of the site, has been restored progressively from as early as 2007 with the initial diversion works of the Bargoed Taf around OB3 and other areas of Phase 1 restored progressively by mining and backfilling operations on the western flank of the site between 2013-2019. Cultivation work ceased temporarily during the Covid pandemic but restoration of Phase 2A (adjacent to and east of Phase 1), was also approved by MTCBC and progressed during 2024 and is scheduled for completion in 2025 which should result in the final restoration of around 50 hectares of land. The intention is to submit a further application for the consideration of the LPA, and to implement a further Phase 2B in 2025 prior to the progression of Phase 3, the final phase of the proposed final restoration Scheme. Phase 2B will fall within the parameters of the previously approved scheme.
- 1.1.7 In accordance with article 6 under the provisions of the Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017, hereinafter referred to as the EIA regulations, a determination must be made to confirm whether a proposed project constitutes an EIA development i.e. if an EIA is required, and if this must be reported in a statutory Environmental Statement to accompany the consent process for a proposed development. MTCBC has directed that having regard to the scale and nature of the proposed restoration strategy (i.e. the development and the environmental sensitivity of the site and complexity of the effects on the environment), that an EIA is required.¹
- 1.1.8 In accordance with regulation 17(3) Schedule 4 of the EIA Regulations², information required for inclusion in environmental statements is presented in this document: -
1. Description of the development, including, and in particular:
 - a) a description of the proposed development comprising information on the site, design, size and other relevant features of the development;

¹ MTCBC Screening Opinion – 4th December 2023

² The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017

- b) a description of the likely significant effects of the proposed development on the environment;
 - c) a description of the main characteristics of the operational phase of the development (any production process), for instance, energy demand and energy used, nature and quantity of the materials and natural resources (including water, land, soil and biodiversity) used;
 - d) an estimate, by type and quantity, of expected residues and emissions (such as water, air, oil and subsoil pollution, noise, vibration, light, heat, radiation) and quantities and types of waste produced during the construction and operational phases.
2. A description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the applicant or appellant which are relevant to the proposed development and its specific characteristics and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects.
3. A description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort based on the availability of environmental information and scientific knowledge.
4. A description of the factors specified in regulation 4(2) likely to be significantly affected by the development: population, human health, biodiversity (for example fauna and flora), land (for example land take), soil (for example organic matter, erosion, compaction, sealing), water (for example hydromorphological changes, quantity and quality), air, climate (for example greenhouse gas emissions, impacts relevant to adaptation), material assets, cultural heritage, including architectural and archaeological aspects, and landscape.
5. A description of the likely significant effects of the development on the environment resulting from, inter alia—
- (a) the construction and existence of the development, including, where relevant, demolition works;
 - (b) the use of natural resources in particular land, soil, water and biodiversity, considering as far as possible the sustainable availability of these resources;

- (c) the emission of pollutants, noise, vibration, light, heat and radiation, the creation of nuisances and the disposal and recovery of waste,
- (d) the risks to human health, cultural heritage or the environment (for example due to accidents or disasters);
- (e) the cumulation of effects with other existing and/or approved projects, considering any existing environmental problems relating to areas of environmental importance likely to be affected or the use of natural resources;
- (f) the impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change;
- (g) the technologies and the substances used.

1.1.9 The description of the likely significant effects on the factors specified in regulation 4(2) should cover the direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the development.

1.2 The definition of development

1.2.1 The Ffos-y-Fran final restoration strategy and the subject of this ES, involves the restoration and aftercare of the former surface mine and land reclamation scheme at Ffos-y-Fran. It is therefore clarified here, that for the purposes of this ES, the 'development' referred to is the post operational phases of restoration and aftercare, and not the construction of a new development. The final restoration strategy is hereinafter referred to as the 'Scheme' or the 'final restoration proposals'. The final restoration strategy is a variation to a previously approved scheme that has been implemented in part and progressively restored following surface mining activities.

1.3 Progressive Restoration

1.3.1 Approximately 115 hectares (29%) of the former surface mine that lies within the parameters of the approved Scheme has already been, or will have been by the end of 2025, progressively restored under Phase 1 (62 hectares) and Phase 2A (53 hectares). This means that the final restoration strategy referred to as Phase 3, will apply to the remaining 285 hectares (71%) of the site area. Of the remaining area, not all will be subject to further earthworks operations. These will be limited largely to the areas surrounding the main void and the overburden tip of OB1. The scheme proposals are described further in **Chapter 4** of this ES and in a separate document the Ffos-y-Fran Final Restoration Strategy Report.

1.4 Structure of this Environmental Statement (ES)

1.4.1 This ES is structured as follows:

Chapter	Content
1. Introduction	A description of the context and background to the final restoration scheme
2. Policies and Plans	Key policies and plans relevant to the scheme proposals
3. Baseline Conditions	An overview of the baseline conditions
4. Description of the Development	A description of the final restoration strategy and components of the restoration and aftercare proposals.
5. Approach to the EIA	Approach to the EIA including screening and scoping
6. Alternatives considered	A description of the original scheme proposals and the need for an alternative restoration strategy.
7. Geology and Soils	Geotechnical considerations and slope stability
8. Hydrogeology	Ground water discharge and sub-surface drainage
9. Hydro-Geochemical	Acid and Metalliferous Drainage (AMD) risk assessment and water quality
10. Hydrology	Surface water catchments and flood risk
11. Biodiversity	Ecological considerations and mitigation measures
12. Landscape and Visual	Effects on landscape character and visual amenity
13. Cultural Heritage	Effects of final restoration strategy on remaining heritage assets
14. Air Quality and Greenhouse Gases	Assessment of likely effects resulting from restoration and aftercare – comparisons between alternatives considered
15. Population and Human Health	Potential long-term effects on health and well-being
16. Climate Change	A narrative surrounding potential climate change issues
17. Cumulative Effects	Inter and intra cumulative effects
18. Environmental Management Plan (EMP)	An outline EMP that describes the responsibilities for the restoration and aftercare process and contents of a Construction Environmental Management Plan (CEMP)

1.5 Site Location

- 1.5.1 The Ffos-y-Fran site lies approximately 1.5 kilometres east of Merthyr Tydfil town centre (refer to **ES Volume 2 - Figure 1.1 - Site Location Plan**). It is an extensive area of former surface and underground mining operations covering circa 400 hectares. The surrounding area is characterised by signs of previous mining activity with spoil heaps and old tips that are now vegetated. Prior to surface mining, the area formed part of the Gelligaer and Merthyr Common, an upland area of rough grassland grazed by sheep, cows and horses. The Common still exists although grazing rights were suspended for the duration of mining and restoration operations. However, parts of the earlier restored Phase 1 land and remains in use by agreement with MSW, by several Commoners with rights on the land for grazing sheep as part of the aftercare strategy of those areas

1.6 History of the Ffos-y-Fran Land Reclamation Scheme (FLRS)

- 1.6.1 The development of Merthyr as an industrial area commenced in the 18th century and deep coal mining in the area was carried out until the 1980s. Over two centuries of mining left a legacy of dereliction and degraded landscapes. The East Merthyr Reclamation Scheme (EMRS) was launched by the Secretary of State for Wales in the mid-1980s with the objective of reclaiming the despoiled land and removing remaining hazards. The EMRS was a project conceived by Merthyr Tydfil Borough Council and Mid Glamorgan County Council and progressed with support from the Welsh Development Agency.
- 1.6.2 Mid Glamorgan County Council granted planning consent in 1988. The scheme was made up of 3 phases.
- 1.6.3 EMRS Phase I was the Incline Top scheme which was completed in 1993.
- 1.6.4 The Dowlais Great White Top was EMRS Phase II and was completed in 1997. These two phases restored over 100 ha of derelict land to provide space for residential and light industrial development and use for recreation and amenity. Phase II also facilitated the development of the realigned A4060 dual carriageway. Overall, the total area planned for restoration amounted to over 360 hectares. Much of this area would eventually be returned to upland grazing.
- 1.6.5 EMRS Phase III, the final phase, was the Ffos-y-Fran Land Reclamation Scheme, incorporating the extraction of coal by surface mining methods as there was a proven reserve of some 10.8 million tonnes of recoverable coal. The plan was to comprehensively extract the coal, avoiding the sterilisation of approximately half the reserve, using surface mining methods and then complete restoration and aftercare of some 367 ha of derelict and unsightly land identified in the local plan.

The coal at Ffos-y-Fran was ideally suited for power generation and extraction would have then ensured the future of Aberthaw Power Station.

1.6.6 In working the coal reserves, excavations would encounter and remove the concentration of dereliction, including 46 known shafts and 39 known adits, all previously associated with iron ore and coal workings that occurred across the western flank of Ffos-y-Fran.

1.6.7 A revised scheme for Phase III, known as Phase IIIA, was prepared and submitted in 1994 to enable the comprehensive removal of all coal reserves. The revised proposals were intended to recover a larger coal reserve, in line with government guidance at the time. This application was withdrawn in 1999. In 2003 a new scheme, proposed by the new developers and operators Miller Argent (South Wales) Limited (MASW), which resolved access rights issues was submitted to MTCBC which included an Environmental Statement. Following a legal challenge and an appeal, the scheme was finally approved in 2005 (Appeal ref. A-PP 152-07-014). MASW commenced enabling works and surface mining operations in 2007 with the intention of extracting over 10 million tonnes of coal over approximately 15 years.

1.7 Restoration Strategies

1.7.1 The restoration and aftercare of a mine, be it below ground or a surface mine is a requirement of any post mining operation. The Town and Country Planning (Minerals) 1981 Act enabled mineral planning authorities to impose an aftercare condition requiring that *'the restored land is planted, cultivated, fertilised, watered, drained or otherwise treated for a specified period to bring it to a required standard for agriculture, forestry or amenity use. Detailed advice on restoration and aftercare conditions will be given in the forthcoming MPG 'The Restoration of Mineral Workings'.'*³

1.7.2 The Reclamation of Mineral Workings (MPG7) uses the term reclamation to mean *'operations which are associated with the winning and working of minerals and which are designed to return the area to an acceptable environmental condition, whether for the resumption of the former land use or for a new use'.* It also states that *'reclamation'* includes both restoration and aftercare and *'may also include operations after extraction such as filling and contouring or the creation of planned water areas.'*⁴

³ Minerals Planning Guidance – MPG2 - Department of the Environment - Welsh Office 1988

⁴ Minerals Planning Guidance – MPG7 - Department of the Environment - Welsh Office 1989

- 1.7.3 In 2014 Welsh Government commissioned a report by ERM⁵ that looked at the issue of failure to restore surface mine coal sites across South Wales, including the Ffos-y-Fran site. Amongst other conclusions, the report states (para 5.3.1) that: -
- ‘Major reconfiguration of the ‘form’ of restoration for the site. Usually, the dominant cost component of restoring an opencast site is the bulk earthmoving needed to replace the excavated overburden back into the void, usually to create a landform somewhat like the ‘natural state’ of the site. This cost can be reduced significantly by partially refilling the void and reducing and softening the shape of the overburden mounds. The acceptability of such a change obviously depends on the extent and effectiveness of any revised restoration, and the quality of the final surface treatment, aftercare and re-vegetation. The costs of void filling and surface finishes will of course be further reduced if parts of the void are retained as water features.’*
- 1.7.4 This is of direct relevance to the Ffos-y-Fran site that was identified in the report as a site with potential risk due to insufficient funds being set aside to undertake the full restoration as consented (para 4.3.3). The report states of the Ffos-y-Fran site that: -
- ‘Although there is as much progressive restoration taking place as the site permits, there are very large overburden mounds which will finally need to be returned to the excavated void. Based merely on the likely cost of bulk earthmoving of those overburden mounds, and the final restoration and treatment of the surface of the 400 ha site, it is likely that the fixed bond of £15 m held by the LPA, Merthyr Tydfil County Borough Council, falls well short of a worst case restoration cost which could be more than £50 m based on the collected information.’*
- 1.7.5 Some other restoration schemes in South Wales were also identified in the report as having potential risks. Both East Pit and Margam sites (also referenced in the 2014 report at para 4.3.3) have employed similar alternative restoration strategies to reduce bulk earthworks, whilst incorporating a permanent body of water within the former surface mining void. These schemes were the subject of discussions with key stakeholders and planning authorities, following which planning applications for alternative restoration schemes were approved by the respective local authorities who considered the final restoration plans were acceptable and offered an alternative biodiverse landform.
- 1.7.6 The Ffos-y-Fran Final Restoration Strategy follows a similar approach to that of East Pit and Margam by avoiding bulk earthworks that would be financially

⁵ Research into the failure to restore surface mine coal sites in South Wales – Welsh Government – April 2014

prohibitive and potentially causing significant adverse environmental effects and avoidable usage of carbon. This Environmental Statement reports the likely significant effects that the final restoration strategy may have on the environment and the remaining area of land that will be restored as part of the Scheme.

1.8 Cessation of Mining – November 2023

1.8.1 In November 2023, the extraction of coal at Ffos-y-Fran came to an end with the expiration of the extant planning permission and enforced changes to Welsh Government policies addressing climate change. This was a symbolic year when a traditional coal mining industry, historically so important to the working culture and identity of the South Wales valleys ended, with over 100 employees facing redundancy. At the peak of its operations, the site employed over 200 full time employees and sub-contractors and has contributed positively to the economy of Merthyr Tydfil and the surrounding areas for over 15 years.

1.9 Care and Maintenance Period

1.9.1 Since the cessation of the mining operation in November 2023, MSW continues to manage the Ffos-y-Fran site to ensure it complies with Health & Safety Executive guidelines under The Quarries Regulations 1999 and other statutory and environmental requirements.

1.9.2 Following closure of the mining operation the Company selected personnel with combined experience of 250 years of surface mining to form the core of the site's Care & Maintenance (C&M) team. The C&M team are responsible for routinely inspecting and monitoring all safety and environmental aspects of the site, including water levels in the void and water quality both in and around the site boundary.

1.9.3 The C&M team complete regular checks of the water quality to ensure the water discharges are within consent limits set by NRW (Natural Resources Wales). This is supported with a quarterly water testing programme, as required by a planning condition which was agreed with both MTCBC and NRW at the start of mining operations. Water samples are tested by an accredited laboratory for a comprehensive suite of determinants. Results are regularly reviewed against site environmental standards and actions taken if required. All analytical data is analysed and recorded and is available either for submission to NRW or is made available for inspection on routine site visits as requested.

1.10 Interim Restoration – Phase 2A

(Refer to **ES Volume 2 – Figures 1.3, 1.4 and 1.5**)

- 1.10.1 In April 2024, MSW prepared a submission for the consideration of MTCBC to carry out some interim restoration works referred to as Phase 2A. These works included the progressive restoration of around 50 hectares of land to the west and south-west of the water body in the current void on previously backfilled areas to join at the interface boundary with the previous Phase 1 restoration works. The FLRS Phase 2A Scheme falls within the parameters of the conditions and schemes agreed under the originally consented scheme A-PP 152-07-014.
- 1.10.2 The FLRS Phase 2A Scheme was discussed by the LPA along with the financial aspects of the works and approved by MTCBC on 17th April 2024 at a full Planning Committee meeting. The scheme was commenced by MSW during the summer of 2024. By the end of summer 2025 (subject to weather and other issues), the scheme will result in the restoration of approximately 50 hectares of land. In comparison, the area of land restored to date in Phase 1 is approximately 62 hectares, so the Phase 2A Scheme will be a sizeable addition and will offer significant landscape benefits to views and visual amenity of the site from areas around Dowlais, Merthyr Town and along sections of the A4060.

2 Policies and Plans

2.1 Context

2.1.1 The purpose of this chapter is to provide a flavour of the changes in Welsh Government policies since the original scheme and environmental statement was published in 2003 and how these have influenced the approach to the final restoration strategy. As reported above in **Chapter 1**, the original Ffos-y-Fran Land Reclamation Scheme (FLRS) was subject to an Environmental Impact Assessment (EIA) and Environmental Statement (ES) prepared in 2003 over more than twenty years ago. Since then, numerous new policies and plans and supplementary guidance have been published, some of which have been referred to in the introduction.

2.1.2 This section of the ES highlights some of the more recent policies and plans that could be relevant in considering the final restoration strategy for Ffos-y-Fran. Some of these are also referenced in the specialist environmental topic chapters.

2.1.3 The Welsh Government has implemented various environmental policies and regulations to address the impacts of surface mining and to promote sustainable practices.

Minerals Planning Policy Wales (MPPW)

2.1.4 This sets out the framework for sustainable mineral extraction, ensuring environmental protection and adherence to regulations. It emphasizes the need for a balance between mineral extraction and environmental sustainability.

Minerals Technical Advice Note (MTAN) 2: Coal

2.1.5 The guidance includes specific recommendations for the management and reclamation of surface mine coal mines. It stresses the need for restoration to occur in a timely manner and for the final land use to be clearly defined in planning applications. It also promotes the reuse of materials from mining operations and encourages biodiversity enhancement through restoration efforts.

Environment (Wales) Act 2016

2.1.6 Enacted in 2016 by the National Assembly for Wales, the Environment (Wales) Act 2016 provides an iterative framework that ensures that managing natural resources sustainably will be a core consideration in decision-making. Natural Resources Wales are the principal organisational body to help deliver the aims of the Act and are required to prepare several documents, which include: -

1. State of Natural Resources Report;
2. National Natural Resources Policy; and

3. Area Statements.

2.1.7 These documents will help inform the design of schemes so that they can be delivered in a way that manages natural resources sustainably. The Act also includes provisions to tackle climate change, through statutory emission reduction targets and carbon budgeting to support their delivery.

2.1.8 Section 6 under Part 1 of the Environment (Wales) Act 2016 introduced an enhanced biodiversity and resilience of ecosystems duty (the S6 duty) for public authorities in the exercise of functions in relation to Wales.

2.1.9 The S6 duty requires that public authorities must seek to maintain and enhance biodiversity so far as consistent with the proper exercise of their functions and in so doing promote the resilience of ecosystems

Well-being of Future Generations (Wales) Act 2015

2.1.10 The Well-being of Future Generations (Wales) Act 2015 significantly shapes planning policies in Wales, including those regarding surface mines, by promoting sustainability, community engagement, long-term planning, and an integrated approach to decision-making. The Act is a landmark piece of legislation aimed at ensuring that the needs of the present are met without compromising the ability of future generations to meet their own needs. It establishes a framework for sustainable development and requires public bodies in Wales to consider the long-term impact of their decisions. This Act requires public bodies to consider the long-term impacts of their decisions, including land restoration and ensuring that future generations can benefit from the land and environment. The need for sustainable restoration practices is also emphasised.

Climate Change (Wales) Act 2006

2.1.11 As part of Welsh Government's commitments to reducing emissions and mitigating climate change, restoration practices must consider climate resilience and the long-term ecological benefits of restored sites.

Planning Policy Wales 12 (PPW 12) February 2024

2.1.12 PPW provides guidance on mineral extraction and management, including coal tips. It emphasises the need for any mineral development including coal tip restoration to be carefully assessed for its environmental and social impacts. Restoration should aim to return land to a beneficial use, integrate with the landscape, and manage potential hazards.

2.1.13 PPW also advocates a stepwise approach that provides a structured methodology for addressing planning proposals and decision-making in Wales, focusing on sustainable development and effective land use. It is integral to promoting

consistency, transparency, and accountability in the planning process while encouraging sustainable development. The stepwise approach seeks to avoid and minimise any adverse effects on habitats and species and encourages net benefits for biodiversity recovery through mitigation, restoration and enhancements. Tailoring the approach to the specific context of the land in question is crucial for successful restoration efforts.

- 2.1.14 This duty requires public bodies to promote biodiversity and ecosystem resilience in all their functions, which includes planning for the restoration of coal tips to enhance natural habitats and biodiversity.

3 Baseline Conditions

3.1 EIA Regulations

- 3.1.1 The EIA regulations require a description of the physical characteristics of the development and a description of the location of the development, regarding the environmental sensitivity of geographical areas likely to be affected. In general terms, this process applies to new development proposed on a particular site that will result in an adverse effect on the environment. In the case of the Ffos-y-Fran Land Reclamation Scheme, this is reversed, and the proposals are likely to have a positive effect on the existing environment, particularly around the main void and pit lake.
- 3.1.2 In the context of EIA, the condition of the existing environment is referred to as the baseline condition prevalent prior to development. In the case of Ffos-y-Fran, the establishment of the baseline conditions prior to mining operations commencing could not be accurately reported and would be dependent on previous reports on the condition of the site and surrounding area pre-2007. The baseline conditions prior to the surface mining operations commencing, are understood to have been of an environment heavily despoiled by previous mining activity.
- 3.1.3 For the purposes of this EIA, the baseline conditions at the site are generally taken as those present when coal extraction ceased at the end of November 2023. However, where appropriate, site conditions recorded before the open cast operation commencing are used to further inform the baseline conditions.

3.2 Overview

- 3.2.1 This chapter presents an overview of the existing baseline conditions of the site at the end of November 2023 and the operational period of coal extraction. Further baseline conditions are described under each environmental topic in the respective chapters of this ES.

Site Location

- 3.2.2 The site lies to the south-east of the A4060 that connects the A470 at Pentrebach, south of Merthyr Tydfil, to the A465 Heads of the Valleys Road at Dowlais Top. To the north of the site lies Trecatti Landfill site (operated by Biffa Waste Services) and to the east, a minor road that serves the nearby villages of Fochriw, Pontlottyn, and Pentwyn to the south.
- 3.2.3 Bogey Road, a minor road, runs through the central section of the site in an east-west direction connecting Cwmbargoed to the A4060 at Mountain Hare. The Bogey Road effectively divides the site into two forming the northern and southern sections of the site. South of the site runs another minor road and beyond to open moorland and wooded river valleys of Nant Gyrawd and Taff Bargoed. An overhead 400 kW power line supported by pylons crosses the central section of the site and the Bogey Road in a north-east to south-west direction between overburden mounds of OB1 and OB2.

Cwmbargoed Disposal Point (CDP)

- 3.2.4 The Cwmbargoed Disposal Point including a coal washery and rail head, lies on the eastern boundary and central section of the site, south of the Bogey Road and was also the entrance to the operational surface mine. It contains several buildings associated with the Ffos-y-Fran mining operation such as a coal washery, rail head, site offices and welfare facilities. The CDP site continues to be used as the operational base of the site and is currently occupied by the C&M team. The facility is likely to be closed, or an alternative use found following completion of the final restoration. It should be noted that this area falls outside the red line boundary of the current planning application and is therefore not considered further in this ES. The majority of CDP also lies outside the jurisdiction of Merthyr County Borough Council and within the boundary of Caerphilly County Borough Council (CCBC). As such, any future change of use would be subject to a separate planning application to CCBC.

Pit Lake

- 3.2.5 Surface mining operations in the main void in the northern section of the site ranged from around 60 metres deep in the north-west to a maximum of approximately 175 metres deep against the south-eastern high wall which was the final excavation profile to enable the extraction of the coal reserves from deep lying seams. During the operational phases of the mine, water was pumped from the void to keep the surface mine sufficiently dry to enable the extraction of coal from these lower seams. Towards the end of the operational phase the base of the void in the south-east was backfilled with overburden (to a height of circa

250m AOD) and the pumps were removed. Further tipping took place in the southern half of the void to a level of around 267m AOD at the base of the backfill slope before coaling operations finally ceased in November 2023. As a result of the cessation of all mining and pumping operations, the void naturally filled at a controlled rate with a combination of direct rainfall, groundwater and surface water run-off. The levels of water have been regularly monitored by MSW since the pumps were removed, and the pit lake continued to rise over the winter of 2023/24 before it finally stabilised around a height of circa 281 metres AOD in April 2024, which is within the same range as previous groundwater levels before mining operations commenced in 2007. The water levels of the pit lake continue to be monitored by MSW as part of the C&M phase with the water levels reducing throughout the summer of 2024, again at a steady controlled rate, reaching a minimum level of around 275m AOD in September 2024.

Overburden Mounds

- 3.2.6 There are three main tips or overburden mounds within the site formed by the recent surface mining operations that began in 2007. The three overburden mounds, referred to as OB1, OB2 and OB3, contain a total of approximately 37 million cubic metres of overburden excavated and placed during the surface mining operations. OB1 lies adjacent to the main void, OB2 to the east of OB1, the power lines and north of the Bogey Road, and OB3 south of the Bogey Road in the southern section of the site.
- 3.2.7 OB3 is the largest of the overburden tips containing approximately 24 million cubic metres of material. OB3 has been formed by tipping excavated rock in layers with graded side slopes and a large flat plateau around 410m AOD in elevation with an area of approximately 35 hectares (86 acres). The intention of the final restoration strategy would be to return this area to upland grassland with wetland scrapes to encourage marshland vegetation to colonise.
- 3.2.8 It should be noted that the plateau on top of OB3 plateau has recently been developed (by MSW) as a motocross facility (known as 'Monster Mountain') and hosts regional and national motocross events that can attract around 1,000 participants and spectators. It is the intention of MSW to retain OB3 as a motorsport facility, subject to agreement and approval with MTCBC and develop it further as an international motocross circuit. This will be subject to a separate planning application and therefore if consented, this may result in the omission of the current restoration proposals for OB3 from the final restoration strategy. However, for the purposes of this ES and the final restoration strategy, the working assumption is that the plateau of OB3 would be returned to rough grassland and grazed as part of the urban common land.

Ponds and Watercourses

- 3.2.9 The site forms the upper part of the river catchments of the Bargoed Taff and Nant Gyrawd which flow south towards the Afon Taff. Historically, the site has drained via a network of surface water drainage ditches, ponds, reservoirs, and leats, some of which form part of historic workings on the site from previous mining activity. These workings are known as the Dowlais Free Drainage System (DFDS) which provided water to the Dowlais Ironworks. The system also acted to drain several coal seams and eventually drained into Tyle Dowlais Pit located within the western flank of the site. Some of these features are reservoirs and leats that form part of a wider drainage system and are now designated Scheduled Ancient Monuments (SAM's). These include SAMs such as Sarn Howell Pond, Penydarren Pond and Isaac Morgan Pond that formed part of the DFDS which lie in the central section of the site. Many of the historic workings such as the Tyle Dowlais Pit Building, discovered in 2017, were carefully uncovered by mining operations and recorded by GGAT before operations continued.
- 3.2.10 An area known as the Central Ecological Area also lies in the centre of the site south of Bogey Road, but outside the site operational and restoration boundary. This area includes the Isaac Morgan Pond and is now incorporated into the LDP as the Merthyr Common Central, a Site of Importance for Nature Conservation (SINC).
- 3.2.11 There are several ponds and settlement lagoons that were constructed as part of the FLRS and that remain on site today. These lagoons were used to contain water during periods of inclement weather to ensure suspended solids were settled out before discharging clean water back into the surrounding watercourses in accordance with NRW consents to discharge. Some of the ponds are lined to prevent water loss. These waterbodies are managed by a combination of small dams and penstock valves. Most of the ponds are fenced off to prevent access by grazing animals and to deter trespass by the public. It is the intention to retain and improve these ponds and surrounding habitat as part of the final restoration proposals some of which have tested positive for presence of great crested newts.

Ecology

- 3.2.12 The Ffos-y-Fran surface mine lies within an area of upland moorland east of Merthyr Tydfil. The surrounding land is open and exposed and includes extensive areas of old tips and land reclaimed from the coal industry over long periods of time. Much of the site and surrounding area also lies within the Gelligaer and Merthyr Common, a vast area of upland with secondary heath and dry acid grasslands primarily grazed by sheep, cattle, and horses.

- 3.2.13 The current surface mining operation associated with the FLRS commenced in 2007 when the baseline conditions were comprised of the following main habitats:
- Mineral Spoil habitat, including coal tips, iron workings and reclamation sites. Major areas within the proposed site had suffered the effects of prolonged industrial activity and were of poor quality.
 - Various types of open grassland including dry acid grassland and marshy grassland
 - Upland heath, modified through sheep grazing into different grassland types including semi-natural acid-grasslands and semi-improved, more neutral grassland.
 - Degraded mosaic habitats comprising swathes of acid grassland and wet dwarf-shrub heath mosaic, with a limited dwarf-shrub component.
 - Small areas of dry dwarf-shrub heath dominated by heather, or Bilberry, confined to cuttings, embankments, natural cliffs, and valley sides.
 - Flushed areas and soakaways, associated with springs and seepages, often grading into marshy grassland.
 - Several man-made ponds and reservoirs with associated marginal habitats.
 - Ffridd – upland pasture fringe with a mosaic of habitats including heath, bracken, acid grassland, scrub, and mineral workings.
- 3.2.14 In November 2023, surface coal mining ceased leaving the ecological status of some areas of the site with some areas devoid of vegetation associated with mining activity past and present with patchy recolonisation. Some areas overlooking the town have been restored and progressively reclaimed under Phase 1, approved by MTCBC in 2016. The overburden tips (OB2 and OB3) have consolidated and are now partially vegetated and many of the waterbodies at the base of the tips are showing signs of recovery with nascent willow carr and marsh habitats developing around the margins of ponds and former reservoirs.
- 3.2.15 In the centre of the FLRS but outside the site boundary, lies the 'Central Ecological Area' to the south of the Bogey Road. Now incorporated into the LDP as the Merthyr Common Central Site of Importance for Nature Conservation (SINC), it comprises the retained part of a larger, former candidate SINC. The site benefits from a mosaic of interconnecting habitats, notably; acid grassland, dwarf shrub heath, small woodland, short ephemeral vegetation, wet flushes, and ponds. The vegetation, whilst characteristic of acid environments is nonetheless interesting

and includes plants such as lesser skullcap and marsh speedwell and Southern marsh orchids.

- 3.2.16 Despite its location, the SINC supports several protected species; barn owl, bats, great crested newts, reptiles including common lizards, and amphibians such as palmate newts, toads, and frogs. The site also offers foraging and breeding potential for birds such as lapwing and reed bunting. The ponds are also productive in terms of invertebrates including rare damselflies as well as more common species of moth and dragonfly.

4 Description of the Development

4.1 Ffos-y-Fran Final Restoration Strategy

- 4.1.1 The Scheme involves the final restoration of 285 hectares of land that had previously been part of the surface mine operations at Ffos-y-Fran. The Scheme is a variation to an existing planning permission that is in place, and which was consented in 2011 and subsequently revised and updated. Since that time, the approach to the restoration of former coal tips has adopted a more sustainable approach (refer to 1.8.5). The traditional approach to dutifully pursuing bulk earthworks in the restoration process is now considered outdated and unsustainable and more pragmatic alternatives involving less earthworks are also more affordable. Less bulk earthworks also vastly reduce potential environmental risks associated with such activities on air quality and noise sensitive receptors and the use of carbon in the process. Less bulk earthworks can also present opportunities to restore and deliver a more interesting and naturally biodiverse landscape. Alternatives to this final restoration strategy are described in **Chapter 6**.
- 4.1.2 Many areas of the Ffos-y-Fran site have already been progressively restored or have remained dormant and undisturbed for some time. These areas are starting to show signs of nature recovery. Wetland habitats have developed around the margins of ponds and watercourses. Evidence of great crested newts has been recorded (in 2024) in over half the ponds on site, southern marsh orchids have colonised in some of the wetland and peregrine falcons have been seen flying over the site.
- 4.1.3 To implement the original and consented scheme would require significant bulk earthworks, the removal of existing ponds and wetlands and inevitable potential disruption to the local environment. An alternative approach has therefore been adopted that embraces more recent Welsh Government policies and approach to climate change and biodiversity such as Planning Policy Wales (Edition 12) and DECCA. The approach to these policies and plans and the approach taken to the EIA described in **Chapter 5**.

4.2 Restoration and Aftercare

4.2.1 The Scheme (refer to **ES Volume 2 – Figure 4.1 Restoration and Aftercare**) will involve the following restoration and aftercare operations: -

- a) Retention of existing pit lake and formation of shallow banks and margins around the shores of the lake where possible.
- b) Re-profiling of existing backfill and landform surrounding the pit lake.
- c) Re-profiling overburden mound to the east of the pit lake (OB1).
- d) Retention of some rock exposures on eastern wall.
- e) Demolition and removal of existing buildings associated with the operational mine such as workshops used for vehicle maintenance and storage of materials such as fuel and machinery.
- f) Retention and enhancement of existing ponds and settlement lagoons.
- g) Return of land to urban common for use as rough grazing by sheep and cattle.
- h) Habitat creation to include species rich grassland, broad-leaved and mixed woodland, open cliff, acid wetland and flushes and heath.
- i) Construction of watercourses
- j) Restoration of land adjacent to A4060 with the potential for future light industrial use
- k) Creation of a network of footpaths and Public Rights of Way (PRoW)

Geology

4.2.2 Since operations began in 2007, the surface mine at Ffos-y-Fran has seen the extraction of approximately 11 million tonnes of coal from a total of 18 multi leaved seams. The seams that have been worked include the basal Lower Four Feet, Lower Leaf, Little Vein Three Coals, Bute, Rhaslas, Red, Big, Black, Upper Four Feet and Two Feet Nine Seams and the residual coal extracted from the old mine workings which was recovered through the barrel wash.

4.2.3 The final restoration proposals include covering the remaining and exposed coal seams at the base of the sidewalls, already completed at the cessation of coaling operations, whilst retaining several sections of the sidewalls exposed by the surface mining operations as geological features. These features would otherwise remain hidden or be lost under other more traditional restoration proposals in which they would be completely buried. As happened during mining operations, it is considered there is significant benefit in preserving these unique landscape

features to be used as an educational resource and to aid in the interpretation of the site and general area of the South Wales Valleys to future generations. The open cliffs also have potential to support lichens and provide suitable locations for breeding birds such as Peregrine, Raven and possibly Sand Martin depending on the nature of the exposed rock.

Landform

(Refer to **ES Volume 2 Figures 4.1 – 4.6**)

- 4.2.4 The current proposals (subject to more detailed design and geotechnical assessments) are to selectively reduce the height of OB1 and re-profile the western slopes and upper reaches to form an undulating ridge line, which would have a more naturalistic profile, especially when viewed from the residential and publicly accessible areas to the north and north-west around Dowlais Top, Galon Uchaf and the Heads of the Valleys Road.
- 4.2.5 Much of the exposed sections of sidewalls and highwalls above the main void would be retained (as described above) and some local stabilisation works undertaken if required for geotechnical or health and safety reasons. Some of these works have already been completed on the advice of the Geotechnical Specialist at the end of coaling operations in November 2023. The top of the exposed cliffs would be graded down and fenced off and planted with dense vegetation to deter members of the public accessing the upper levels and more exposed sections of the face. The bottom of the sidewalls would contain areas of scree and dense woodland planting to deter access to these walls from the base.
- 4.2.6 The slopes leading down to the base of the void below the sidewalls (to the east and south) and on the current western backfill slope would be re-profiled in accordance with recommendations from a geotechnical specialist and are likely to be formed from loose tipped or dozed material (i.e. pushed using large earthmoving bulldozers). On the steeper and north facing slopes, the intention would be to plant these slopes with mixed woodland. The less steep slopes on the western side of the void and elsewhere would be returned (subject to further geotechnical assessment) to rough grazing and pasture i.e., Common. Some of these works on the upper part of the backfill slopes are currently the subject of the agreed interim restoration proposals referred to as Phase 2A.
- 4.2.7 Some of the existing haul road routes would be retained as narrow plateaus and grassed tracks for future access and public amenity.
- 4.2.8 The overburden mounds of OB2 and OB3 would remain largely as they appear today although some minor earthworks to soften the engineered profiles may be

undertaken subject to geotechnical and operational considerations, with the lower slopes being planted and/or hydroseeded with a woodland mix.

Hydrogeology

- 4.2.9 The hydrogeology of the site is complex and heavily influenced by the underlying geology including the Dowlais and Penydarren Faults, previous mine workings and drainage systems including the 'Merthyr Free Drainage System' and the 'Dowlais Free Drainage System'. Five underground drainage courses are known to exist in the vicinity of the site. The Black Ball Watercourse, Penyrheol watercourse and Penydarren Water Level, discharge to the west of the site which eventually drains to the river Taff. The free drainage Rhas Las Level and the Big Coal Free Drain discharge to the Bute and Nant Llesg watercourses which flow eastwards to the River Rhymney near Pontlottyn.⁶ The final restoration proposals would not affect any of these underlying hydrogeological networks.

Hydrology and Drainage

- 4.2.10 The current surface water drainage regime is likely to change significantly because the final restoration proposals would provide sufficient mitigation to the Nant Morlais catchment. Much of the site would remain unchanged, apart from the re-profiling of OB1 and backfill slopes and the channelling of significant volumes of the run off from these areas into the main void.
- 4.2.11 The existing pit lake would remain and be retained as a permanent body of water known as Dowlais Lake. The lake has returned to approximately the same level as the previous groundwater levels before surface mining operations, at around 280 metres AOD. These would be subject to seasonal fluctuations which, for example, varied between approximately 281m AOD (April) to 275m AOD (September) in 2024. The lake receives water from various sources namely groundwater, natural rainfall and run off from a localised catchment area surrounding the void. It has no natural outfall or overflow with the summer water level adjusting due to a combination of seepages from the underlying drainage network and evaporation.

Archaeology and Cultural Heritage

- 4.2.12 The site and surrounding area, lies within the Merthyr Tydfil (Cadw Ref. HLW (MGL)2) landscape of outstanding historic interest in Wales. The designation (2001) is made primarily for its industrial landscape character forged from a long history of ironmaking in the early-mid 19th century as the most significant Welsh town of the Industrial Revolution. The town and its environs remain a potent example of an internationally renowned industrial landscape of the 18th and 19th

⁶ Para 12.4.11 Ffos-y-Fran Land Reclamation Scheme - ES May 2003 – Leek & Weston Ltd

centuries, and a permanent reminder of man's exploitation of the landscape. The site also lies within the Historic Landscape Character Area (HLCA 39) Ffos-y-Fran.

4.2.13 There are several sites of cultural heritage that remain within the site boundary at Ffos-y-Fran, some of which are Scheduled Monuments (SM's). Some of the old workings that have developed ecologically are also SM's such as Sarn Howell Pond, Penydarren Pond and Isaac Morgan Pond that formed part of the Dowlais Free Drainage System (DFDS) and that lie in the central section of the site and are part of the SINC. Many of the historic workings such as the Tyle Dowlais Pit Building, discovered in 2017 were carefully uncovered by mining operations and recorded by GGAT before operations continued.

4.2.14 The proposals are to retain these SM's and other remaining features of historic interest and incorporate them into the final restoration scheme. The context and setting of these heritage assets would be considered throughout the design process. For example, where it is desirable from a design and access perspective to shallow the gradients of banks surrounding ponds and reservoirs, special attention to features of heritage value such as dams and leats would be retained and preserved. The overburden tips of OB1 (in part) OB2 and OB3 would also be retained as testimony to the coal extraction industry and would be enhanced by planting or hydroseeding the base of slopes with appropriate mixed woodland species to further encourage biodiversity and landscape value.

Landscape Treatments

4.2.15 The proposals include a combination of mixed and broad-leaved woodland to be planted around the slopes of the main void and on the lower slopes of OB2 and OB3. For the trees to establish there will be a requirement for these areas to be protected by stockproof fencing. A combination of traditional tree planting techniques and hydroseeding, a planting process that uses a mixture of water, seed and mulch, will be used depending on the ground conditions and accessibility.

4.2.16 Grass Seeding will be undertaken to areas that will be returned to rough grazing and areas to be reinstated as urban common using an approved grass seed mix. As with the tree planting, it is likely grass seeding will be undertaken using a combination of traditional seeding techniques and hydroseeding.

Visual Amenity

4.2.17 The Ffos-y-Fran site lies within the context of upland moorland, an exposed and barren landscape with several features and scars of former mining activity and other industrial and heritage features such as old workings, ponds and reservoirs.

(Landmap: Visual and Sensory Area MRTHRVS355 – Ffos-y-Fran Merthyr Upper East Flank).

- 4.2.18 From the highest point of the site (i.e. top of OB1) there are far reaching views north-west across the A4060 and the residential area around Dowlais Top and Heads of Valley Road towards the Brecon Beacons National Park and peaks such as Fan-y-Big and Allt Lwyd, over 10 kilometres distant. To the east there are far reaching views across open moorland towards Rhymney and Tredegar that lie hidden from view in the valleys below the uplands of Gelli-Gaer Common and Rhymney Hill. To the south, views from the site are partially contained by the overburden mound of OB3 beyond which lies the wooded river valleys of Nant Gyrawd and Bargoed Taf with the rounded hills of Mynydd Fochriw and Pen Garnbugail rising to the south-east. To the west lies the open moorland of Merthyr Common with far reaching views towards the wooded hillside of Mynydd Merthyr and Pen-y-lan Hill.
- 4.2.19 Views from outside the site boundary towards the overburden mound of OB1 and the remaining void of the surface mining section of Ffos-y-Fran, are largely limited to from the north and north-west and the residential areas of Dowlais Top. The restoration proposals would improve the visual amenity for these local communities by reducing the height and regrading the western slopes of OB1 and re-shaping the landform around the void. Tree planting is proposed along the western flank of the site with trees such as aspen and birch providing colourful autumn foliage. The north face of the re-profiled landform and slopes that rise above the void pit lake will also be planted with trees that will contrast with the exposed geological strata of the sidewalls. As stated earlier, tree planting is also proposed along the lower sections of OB2 and OB3, designed to soften the engineered profiles of the overburden tips and to provide connectivity to the wider landscape and to the Nant Gyrawd Valley. The resulting mixed woodland is likely to develop and transform the site into a landscape not dissimilar to the nearby woodland of the Tyla-du-Plantation south-east of Fochriw in the neighbouring county of Caerphilly.

Ecology and Nature Conservation

- 4.2.20 The final restoration strategy will follow the stepwise approach as advocated in Planning Policy Wales⁷ (Edition 12) and avoid any areas of ecological value that have developed (or that has potential to develop) on site during previous phases. The proposals will also minimise any impact on sites or areas of emerging ecological value such as the ponds, settlement lagoons and wetlands that have

⁷ Planning Policy Wales – Edition 12 – Para 6.4.12

the potential to support great crested newts and plant species such as marsh orchid.

- 4.2.21 Many restoration schemes in South Wales, have seen the total removal of colliery spoil as part of the reclamation process. This is seen by some bodies as a missed opportunity to preserve some legacy features and to allow the natural regeneration of old spoil tips for biodiversity benefit. The Ffos-y-Fran final reclamation scheme will retain some areas of existing overburden and spoil to allow what can be a unique habitat to form naturally. These areas, free from human intervention and protected from grazing livestock, where necessary will be left to develop naturally on nutrient poor material. It is hoped that these areas will, over time, see a diverse and complex range of flower rich grasslands develop to attract pollinating insects such as butterflies, moths and beetles.
- 4.2.22 The proposals are to target the creation and encouragement of a wide range of priority habitat types across the final Phase 3 area. These are considered to potentially be a much more diverse habitat than the existing and consented scheme that would see most of the land returned to rough upland grazing. The target habitat types are presented in the table below.

Table 4-1 – Section 7 Priority Habitats

Section 7 Priority Habitats	Target Habitat	Location within site and final restoration strategy
Semi-Natural Grassland	Acid Grasslands	- Area currently occupied by OB1 following overburden removal for fill to segue into existing and surrounding grazing land. - Area indicated on map as 'expansion of rough grazing' and 'extended grassland.' - Regraded batters within current void.
	Dry acid heath mosaic	OB2 above the 'upper limits of enclosure' the approximate demarcation between 'upland' and 'lowland' habitats.
Wetland	Wet mire/heath flushes	- Discreet locations on OB2 and extension areas adjacent to Merthyr Common Central SINC. - Along existing leats and seepages like the habitat that has developed to the south of OB3 within Bargoed Taf because of simple but effective strategies.
	Lakes, Waterbodies and scrapes	- Permanent lake with open water with potential for fish and freshwater invertebrates (subject to water quality) - Former lagoons and works area immediately north of the SINC. (Site of Importance for Nature Conservation). - Expansion of naturally forming shallow waterbody atop OB2. - Seasonal ponds if suitable substrate is present.
Native Woodland	Tree planting and shelter belts	- Water-loving trees for screening purposes along the Bargoed Taf. - At the base of OB3 at its southern dog leg including wet flushes. - Along margins of settling ponds with a highly ochreous discharge. - Screening planting along base of southern and eastern faces of OB2. - Continuance of tree screening southwards at front entrance to site. - Potentially along the current north-western edge of OB1 following overburden removal. - Shelter belt along part of the western shoulder from Phase 1.
Inland Rock	Exposed Cliff face	At the eastern edge of the central void.
Mineral Spoil	Open mosaic habitats on previously developed land	At the south-eastern toe of the western shoulder and the north-eastern border of the western shoulder south of the lagoons.

Community Benefits

- 4.2.24 The final restoration proposals at Ffos-y-Fran will see the beginnings of a new landscape and the rehabilitation of land scarred by centuries of industrial activity. The main community benefits are improved visual amenity and habitat creation and consequently an increase in biodiversity. The scheme would also include a network of grassed tracks for open access to the urban common and that will connect to the wider footpath network. (Refer to **ES Volume 2 – Figure 4.7**)
- 4.2.25 The restored land with its blend of open grazing land and woodland, would also benefit the surface water drainage regime and intercept rainfall and slow down surface water discharge to adjacent watercourses with the wetland basin effectively acting as a large soakaway.
- 4.2.26 The landscape would take some time to develop, and a minimum of five years establishment and maintenance period would form part of the restoration proposals. During this time, areas will need to be fenced off to enable grass seeding and tree planting to establish without being grazed by livestock. These areas will be clearly defined by stockproof fencing that will have to be regularly inspected and a rolling programme of repair put in place.
- 4.2.27 The final restoration strategy at Ffos-y-Fran would see the creation of a landscape that could change and adapt to future land uses. The use of Gelligaer and Merthyr Common for rough grazing may change at some point in time, and other land uses could develop such as renewable energy in the form of solar or windfarms to provide a sustainable future for the land along with nature conservation and biodiversity.

4.3 Progressive Restoration

- 4.3.1 The final restoration strategy would be implemented progressively as a series of works packages over a period of approximately 2-3 years and be funded by the proceeds held in the ESCROW account. Once completed, the restored landform site would be subject to a five-year establishment maintenance period to enable grass seeding and tree planting to establish before returning the site to urban common for grazing and public amenity.
- 4.3.2 More details on the restoration and aftercare proposals are described in the Ffos-y-Fran Final Restoration Strategy (2024) report.

5 Approach to the EIA

5.1 Screening

5.1.1 A request for a formal EIA screening opinion in accordance with Regulation 6 of the Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017 was submitted to MTCBC by RML on behalf of MSW on 27th September 2023. The request outlined the background to the Scheme and the need to consider an alternative restoration Scheme. The request suggested several environmental topics that would be considered in developing the Scheme proposals and that these could be presented in a Non-Statutory EIA.

5.1.2 The response to the screening from MTCBC (04/12/2023) was that an EIA was required for the following reasons extracted from their response: -

‘Although the land reclamation scheme involved the removal of old mine workings by means of open cast mining, which enabled the extraction of coal, this was contingent upon a progressive restoration of the landscape being implemented throughout the course of the development. It is acknowledged that open cast mining has now ceased and as such, the development may no longer strictly fall within Part 19 of Schedule 1 of the EIA Regs (2017). Nonetheless, the development involves further works to a site, which contains a development within Schedule 1 (i.e. a site including open-cast mining on a surface area more than 25 hectares), which has been executed. The development, as changed by the proposed works, may have significant adverse effects on the environment, including matters of hydrology, hydrogeology, ecology, landscape and visual impacts, cultural heritage, human health, climate, and cumulative effects. Therefore, the proposed works would therefore fall within Part 13(a) of Schedule 2 of the EIA Regs (2017).’

5.2 Scoping

5.2.1 An EIA Scoping Report was submitted to MTCBC on 22nd July 2024 that set out the proposals for the contents and assessment methodologies of the Environmental Impact Assessment (EIA) that will accompany the Section 73 application for amending the final restoration strategy.

5.2.2 A response to the Scoping Report was received from MTCBC on 4th October 2024 along with responses from Natural Resources Wales, the MTCBC ecologist and Cadw. MSW responded in a letter dated 14th October 2024 to some aspects of the scoping report that were disproportionate and irrelevant to the scope of the EIA required for the variation of the restoration strategy.

5.3 Consultation

5.3.1 The scope of the EIA had been the subject of ongoing discussions with key stakeholders and statutory consultees in a series of Technical Working Group (TWG) meetings attended by representatives of the following organisations (in no order):

- Merthyr (South Wales) Ltd and appointed EIA consultants
 - Richards Moorehead and Laing Ltd
 - Groundwater Science (Hydrogeology)
 - Mine Environmental Management (Geochemistry)
 - Waterco (Hydrology)
 - James Associates (Geotechnical Specialists)
- Merthyr Tydfil County Borough Council (Planning, Engineering & Ecology)
- The Coal Authority
- Natural Resources Wales
- Welsh Government
- Health and Safety Executive

5.3.2 TWG meetings provided an opportunity for information to be shared and exchanged amongst the interested parties, and as the title suggests, focussed on the more technical aspects of the design development and EIA processes. To date, the TWG meetings have been held on the following dates at MSW Offices at the Cwmbargoed Disposal Point.

TWG No. 1 5th October 2023

TWG No. 2 31st July 2024

TWG No. 3 24th October 2024.

5.3.3 The TWG meetings have provided a valuable opportunity for MSW and EIA consultants to present the results of surveys and monitoring undertaken pre-and post-closure of the surface mine. The monitoring of the pit lake levels has been particularly insightful in understanding how the groundwater lake levels change in response to the seasons and rainfall events. This and other surveys undertaken over the course of 2023-2024 has assisted greatly in the preparation of this EIA and the findings presented in this Environmental Statement (ES).

6 Alternatives Considered

6.1 The Ffos-y-Fran Final Restoration Strategy

6.1.1 The EIA regulations require that any alternatives to the proposed development that have been considered should be recorded in the ES as part of the EIA process. Alternative schemes were considered as options early in the design development stages.

6.1.2 Two options were developed as alternatives to the consented scheme and presented to MTCBC in the report Ffos-y-Fran Final Restoration Strategy 2023. The two options presented in the document were for a low level and medium level restoration scheme. The two options are presented in **Table 3.1** below.

6.1.3 The preferred option of the two at that time was selected as Option 2 subject to further investigations and feasibility assessments. Option 2 medium level restoration was considered as having the most potential to deliver the scheme objectives that were to: -

- Develop a restoration strategy to leave the site as a safe environment for future generations.
- Implement a progressive, cost effective, achievable and sustainable restoration scheme by 2025/2026 (Note: these dates are now time expired).
- Deliver community benefits on site for local communities of Merthyr Tydfil and Caerphilly.
- Align with the Environment (Wales) Act 2016 and the principles DECCA (Diversity, Extent, Condition, Connectivity and Aspects of ecosystem resilience).
- Create a framework for a diverse landscape and a range of habitats that encourage long term net biodiversity benefit (NBB).

Table 6.1 – Options 1 & 2

Option 1 – Low Level Restoration	Option 2 – Medium Level Restoration
Filling of void to circa 270 metres AOD with approximately 925,000 cubic metres of fill material – potential for permanent water body to form above minimum groundwater level of 269-270 AOD.	Main void filled to approximately 300 AOD with approximately 4.2 million cubic metres – reduced height of OB1 – batters trimmed – no lake – above minimum groundwater level of 269-270 AOD.
Resulting slopes likely to be extensive and steep sided and unsuitable for rough grazing and return to common land.	Approximate level of Rhas Las Seam – minimum risk of future slippage and subsidence and well below level of Big Seam.
Areas might need fencing off for health and safety reasons depending on steepness of slope profiles.	Potential for some level areas for access/maintenance.
Alternative land for Common Land return may be required	Some areas suitable for return to Common Land.
Relatively short time-period for restoration and cessation of earthworks – less environmental impact caused by construction period.	Potentially some funding available for landscape remediation and visual amenity and 5-year establishment maintenance period.
Remaining slopes of void could provide interesting opportunities for biodiversity on sheltered slopes.	Potential to further enhance restoration of areas of Phases I & II on western flank of reclaimed tip.
Potential for lake or wetland area to form naturally	Lake or wetland unlikely to form naturally at level of 300 AOD without remediation works to form lake-bed level.
Potentially more funding available for landscape remediation and visual amenity and 5-year establishment maintenance period.	Potential for localised tree planting on OB2 and OB3 and improve visual amenity from locally public areas i.e., Bogey Road and Phase I slopes visible from Dowlais
Potential to partially restore additional slopes on OB2 and OB3 and improve visual amenity from locally public and visible areas	Potential to partially restore additional slopes on OB2 and OB3 and improve visual amenity from locally public and visible areas

- 6.1.5 It was considered that Option 2 provided potentially more land for return to Common with larger amounts of fill material used to re-profile the land to suitable gradients for return to low grade agricultural land. There was also the opportunity for the retention of many existing waterbodies used for watering livestock grazing on the Urban Common and the creation of a range of shelter belt planting and creation of wetlands, acid flushes and heathland habitats.
- 6.1.6 Notwithstanding the need to return much of the site to Common suitable for rough grazing and agricultural use, the excavations of the final coal seams exposed the underlying geology of the site in the form of open cliffs that illustrate the strata of the sedimentary formations. The retention of the upper sections of these open cliffs and scree as geological evidence was identified as a potentially valuable educational resource to illustrate the underlying geology of the site and surrounding area. The cliffs could also provide habitat for flora and fauna such as Peregrine and Chough and present a valuable opportunity for biodiversity enhancement. It also presented an opportunity to create a landscape that describes the legacy of the past and preserving a landscape with special qualities and sense of place unique to Ffos-y-Fran.
- 6.2 Option 2 - Design Development**
- 6.2.1 Option 2 was initially taken forward as the preferred option through the design development stages and its feasibility evaluated. At the time (Summer 2023), the mine was still operational with the final seams being extracted from the bottom and lower levels of the pit void. Water was being pumped out of the void in significant volumes to keep the pit void operational for coal extraction. MSW had a water abstraction and discharge licence in place for this operation to continue which was granted by NRW subject to environmental conditions.
- 6.2.2 As coal extraction was reaching an end and all remaining coals had been removed from the deepest part of the mine, there was no requirement for the base of the pit void to remain dry through extraction of water by pumping. Therefore, MSW took a commercial decision to cease pumping as this was a high-cost operation and was no longer required for the continued operation of mining activities which were still taking place at a higher level elsewhere in the void.
- 6.2.3 Following the cessation of pumping, the water levels in the void started to rise and recover back to its natural levels forming a pit lake. At this stage, backfill continued to be tipped into the base of the void above the rising water levels and a large part of the void was filled to a level of around 268m AOD before the water levels rose and submerged the backfill in this area. This made any further backfilling operations in the void impossible, unless the pumps were re-deployed,

as backfill needs to be tipped and placed in a relatively 'dry' environment to ensure its long-term geotechnical stability. Following the final cessation of mining operations in November 2023, monitoring of the lake levels continued throughout the winter months to understand the relationship between rainfall, water levels and groundwater drainage.

- 6.2.4 Lake levels continued to rise reaching a maximum level of approximately 281m AOD in April 2024 and then started to stabilise over the summer months. The only way that backfilling could recommence in the void in the future to enable Option 2 to be a viable proposal would have been to undertake a long and extremely expensive pumping operation to fully dewater the void, which would have led to lengthy delays and additional environmental disturbances. Following discussions with MTCBC, it was therefore decided that the most pragmatic and environmentally sensible approach to the design of the restoration proposals was to incorporate the existing groundwater lake into the scheme as a permanent body of water which would rise and fall seasonally in line with groundwater levels which were recorded before mining operations commenced. This would also significantly reduce the need for bulk earthworks, significantly reducing carbon emissions into the atmosphere and saving time and money that could be spent on other aspects of the restoration scheme such as planting and habitat creation.
- 6.2.5 This approach has been adopted for the final restoration proposals and has led to the proposed development as described in Section 4 of this ES. The proposed development can be seen as an alternative scheme to the consented scheme and could potentially have several environmental advantages over the consented scheme. These are identified in the following chapters of the ES and summarised in **Chapter 19**.

7 Geology and Soils

James Associates

- 7.1.1 Surface coal mining operations commenced in November 2007 and ceased in November 2023 as an integral part of the restoration scheme of an area of significant dereliction associated with a history of underground coal and ironstone mining operations.
- 7.1.2 Coal Seams extending upwards from the basal Lower Four Feet [BA] Seam up to the Black Pins[V] and Gorllwyn [T] Seam have been extracted as the operation has progressed from west to east along their surface outcrop / in crop positions.
- 7.1.3 Overburden materials comprising glacial till, colliery spoil and non-coal bearing measures are currently stored in three above ground tips identified as OB1, OB2 and OB3. The volume of materials (which represents the 'working void') contained within the above ground tips represents that generated to enable safe, logistically possible access to be made to the lowest level of extraction.
- 7.1.4 Further non-coal bearing waste materials generated during the working of the site once the 'working void' had been achieved has been routinely returned to the exhausted section of the mining void forming the backfill tip.
- 7.1.5 Extensive investigatory information was used to inform the designs for tips, excavated faces through solid strata and the operational methodology.
- 7.1.6 The site, up until the latter stages of the operation, has been un-affected by any significant instabilities either within the above ground overburden tips or excavation faces formed through the solid measures.
- 7.1.7 During operations the site intersected two large displacement normal approximately north / south orientated faults, the Penydarren Fault in the west then the Dowlais Fault in the central section of the site. Both generated very localised instability in the immediate area where they intersected the southern excavation sidewall. Latterly the eastern advance excavation faces were affected by faulting on a similar orientation which resulted in significant structural disturbance. The faulting has been fully removed by the mining operation other than at the northern end of the site where it is present in the upper levels of the final excavation faces around the Big Seam horizon.

7.1.8 Overburden mounds OB1, OB2 and OB3 have remained stable throughout their existence other than the western facing side of OB1 which on the 29th of July 2022 was affected by significant instability. Prior to their construction the ground beneath all tips was prepared by removing soils and un-suitable materials and a system of under-tip drainage was installed.

7.1.9 An integral part of the operation was a requirement to manage surface and groundwater, which necessitated the installation of an extensive network of lagoonal structures, many of which were excavated into original ground. All structures have remained stable during the operation of the site.

7.2 Scope of the Assessment

7.2.1 Initial pre-commencement Geotechnical Assessments were undertaken in accordance with the requirements of the following Codes of Practice:

- Federation of Civil Engineering Contractors (1982). Code of practice -The siting and construction of temporary spoil mounds at opencast coal sites. London.
- Federation of Civil Engineering Contractors (1989). Code of Practice- The stability of excavated slopes at opencast coal sites. London

7.2.2 These Codes of Practice have subsequently been replaced by The Quarries Regulations 1999, which came into force in January 2000. Assessments including detailed stability analyses for all tips, excavation faces, and lagoonal structure have been used to inform the designs which have been implemented on the site.

7.2.3 Throughout the operational phase of the site Geotechnical Assessments were undertaken on a 3 monthly basis with occasional intermediate assessments where necessary, which enabled a confident understanding of site conditions to be gained.

7.2.4 The mining operation has now ceased, and the site is entering its restoration phase which will involve the retention of overburden mounds OB1, OB2 and OB3, the re-contoured in-pit backfill slope, sections of rock face along the southern and eastern sidewalls and several lagoons.

7.2.5 The following assessments of the proposed final restoration landforms have been undertaken:

- The final in-pit backfill slope
- Overburden mound OB1- re-engineered due to the 2022 failure.

- Overburden mounds OB2 and OB3 - as a part of the original pre-commencement Geotechnical Assessments.
- Exposed southern rock faces
- Exposed eastern rock face
- Restoration slope adjacent to the A4060 highway. - as a part of the original pre-commencement Geotechnical Assessments.

7.2.6 The locations of the above can be seen in **ES Volume 3 – Appendix 7A)** (and duplicated in ES Volume 2 Figure 4.1 Restoration and Aftercare Plan), the final site restoration plan.

7.3 Legislation, Policy and relevant guidance

7.3.1 All excavation faces and tips have been designed, operated, and managed in compliance with the requirements of The Quarries Regulations 1999.

7.3.2 In addition to the required compliance during the active mining phase there is also a requirement for compliance with the regulations during the restoration phase. Under Regulation 6.4- General Duties of the Operator

‘The operator shall ensure that in the event of the abandonment of or ceasing of operations at a quarry, the quarry is left, so far as reasonably practicable, in a safe condition’.

7.3.3 Under Regulation 45 guidance note 353. states that :-

‘When a quarry closes, any remaining excavations or tips must be left in a safe condition [Regulation 6[4]. Tips as defined in the Mines and Quarries (Tips) Act 1969 will, on abandonment of the quarry, become Part II tips and under that Act, which is enforced through the Environmental Protection Act 1990. HSE should be notified of the quarry closure (see Regulation 45).

Furthermore, Regulation 45 guidance note 354 states ‘In the case of such tips, the abandonment notification needs to include the information gathered during geotechnical assessments. This information will be passed on to local authorities who are responsible for enforcing Part II of the Mines and Quarries (Tips) Act 1969’.

- 7.3.4 As is required in Regulation 5.31 'Duties of the person entitled to work the quarry':-

'The owner of a dis-used tip at an abandoned quarry is responsible for its safety as explained in Part 11 of the Mines and Quarries [Tips] Act 1969

7.4 Baseline Conditions

- 7.4.1 Active coaling operations ceased at the site in November 2023. During the later stages of coaling operations, and for a short period following the cessation, some of the remedial works as recommended by the appointed site geotechnical specialist were undertaken along various sections of rock face to improve long-term stability.
- 7.4.2 Details of the various works, both completed and to be completed, are illustrated in photographs 1 to 6 and schematic cross-sections 1,2,3, and 4. (**ES Volume 3 – Appendices 7L and 7K**).
- 7.4.3 The various works included the removal of sections of rock face which were exhibiting potential for the future development of rock fall from the upper sections of faces.
- 7.4.4 In addition, earthworks along accessible benches were undertaken, including the concealment of exposed coal seams and the construction of earth bunds along the toe of excavation faces designed to contain any future spalling of rock fragments. The concealment is designed to remove the potential temptation for members of the public extracting coal from the exposures.

Rock Faces

- 7.4.5 Residual rock faces of various heights will remain along the southern and eastern sides of the excavation void to be retained as a final landscape feature.
- 7.4.6 The northern sidewall, of the excavation void will be fully infilled against as a part of the final restoration. Excavation along this sidewall followed the geotechnically approved design which demonstrated that the proposed excavation profile did not compromise the structural integrity of the A4060. The subsequent infilling against the wall has further removed any potential along this boundary
- 7.4.7 The residual southern sidewall will have a maximum exposed height of approximately 100 metres and comprise a number of excavation faces separated by level benches of variable width. In places the face has been affected by localised rock spalling which is at its most significant at the eastern end.

- 7.4.8 At the eastern end of the southern sidewall above the 'Q Seam', which occurs in the upper section of the face, the strata have been affected by multiple low angle thrust fault dislocations. The result of this structural disturbance is that some of the strata have spalled from the face leaving un-supported sections where there is the potential for further instability involving disturbance in the overlying measures.
- 7.4.9 The eastern sidewall, during its latter stages was affected by significant instability which resulted in large quantities of rock falling from excavation faces which now forms the extensive scree slopes which can be observed. The instabilities were the result of a north / south orientated normal fault, the trend of which lies a few degrees divergent from that of the excavation panels. This is a geotechnically unfavourable configuration which resulted in the development of the observed disturbances.
- 7.4.10 The faulting is still present in the sidewall at its northern end where due to the southerly inclination of the strata, is at its shallowest. Remedial works undertaken towards the end of the coaling operation involved slope angle reduction by re-grading, face scaling, and buttressing have secured the residual rock face.
- 7.4.11 In the mid- to southern section of the sidewall the effects of the faulting has resulted in the formation of large scree cones formed from the rock which has failed from the face. The scree cones have developed a slope angle which represents the 'natural angle of repose' for the rock contained therein. The natural angle of repose is approximately 1 vertical to 1.5 horizontal, i.e., 33° as measured from horizontal.
- 7.4.12 Significant future movements within the scree cones are not expected to occur. There is the possibility that there may be continued random minor rock spalling from rock faces located above the scree cones in the future.

Tips

- 7.4.13 The site backfill tip (BF1), has been largely restored along its western and northern-facing flanks, which have gradients of generally less than 1 in 3. The slopes exhibit good stability, with no evidence of any current structural distress.
- 7.4.14 The BF1 Tip has exhibited stability throughout its history with no instances of any instabilities being recorded.
- 7.4.15 The eastern facing slope of the backfill tip, which currently comprises slopes of varying inclination with intermediate benches, will be re-graded to form a

continuous single slope with a gradient of approximately 1 vertical to 3 horizontal [18°]. Stability analyses copies of which are attached have demonstrated that this will produce a long-term stable structure. Computed Factor of Safety Values for large scale tip instability, all in excess of 1.3 are attained.

- 7.4.16 The three large overburden mounds, OB1, OB2, and OB3 which have been constructed above ground level will remain largely un-altered as a part of the final restoration design.
- 7.4.17 Overburden mounds OB2 and OB3 have been constructed in accordance with the geotechnically approved designs and remained stable throughout the life of the mine. The very few instabilities which have occurred have been small-scale, localised, associated with minor water seepages, and of no significance. The magnitude of failures has been such that the overall stability of the tips has never been compromised.
- 7.4.18 As noted, overburden mound OB1 which is located immediately to the east of the final eastern limit of extraction at surface has been affected by significant instability, see drawing JA-MSW-FF-1-24 (**ES Volume 3 – Appendix 7B**). In July 2022 the tip was impacted by a large-scale instability which resulted in a significant section of the western-facing slope collapsing. The instability was a result of the lower (toe) section of the tip being excavated to enable coaling lines to be achieved.
- 7.4.19 Various remedial earthworks involving dozer work to reduce the gradient have been undertaken on OB1. The failed section of the tip still has a highly irregular form which will require earthworks to be undertaken to produce a long-term stable configuration.
- 7.4.20 The quarry floor has been allowed to flood and will remain as a final restoration feature. It is estimated that the final rest water level in the lake will vary between 275 and 285 metres AOD.
- 7.4.21 One of the effects of allowing the base of the quarry to flood and form a part of the final restoration will be to isolate certain sections of excavated slope, namely along the lower section of the southern wall, and southern section of the eastern wall, thereby preventing public access. These areas of the site contain the major sections of residual high rock faces which will remain as final restoration features.

- 7.4.22 The current situation is shown in survey drawing number JA-MSW-FF-1-24. Topographic Survey and Cross-section Location Plan [Nov. 2021]. (**ES Volume 3 – Appendix 7B**).

7.5 Assessment Methodology

- 7.5.1 In compliance with the requirements of The Quarries Regulations 1999 and prior to their construction all tips (both solid and liquid) and excavation faces were geotechnically appraised and where dictated by the definitions contained in the above Regulations, Geotechnically Assessed.
- 7.5.2 The various designs adopted on the site have been based upon extensive borehole information gained by British Coal Opencast Executive, assessment of historic underground ironstone and coal abandoned mineworkings plans, groundwater monitoring data, published geological information, experience gained in similar sites in the South Wales Coalfield, and geotechnical laboratory test data for the minerals likely to be encountered during the working of the site.
- 7.5.3 During the operational phase of the site routine collection of geological data, to include strata inclination, structural disturbances, i.e., faulting and folding, the location and effects of abandoned underground mineworkings, and any groundwater inflows, was undertaken.
- 7.5.4 In addition to the collection of the above information, the site, in compliance with Regulation 34 'Operators duties in relation to excavations and tips which are significant hazards [notifiable excavations and tips]', was subject to routine quarterly geotechnical assessments undertaken by the appointed geotechnical specialist.
- 7.5.5 The geotechnical site management of the operation has enabled a firm understanding of the geological conditions and engineering characteristics of the solid rock faces and tipped deposits to be achieved which has informed the proposed final site restoration features.

7.6 Assessment of Effects

- 7.6.1 As previously noted, the initial and subsequently evolving designs for final restoration excavated faces and tips (both liquid and solid) have been based upon extensive initial investigatory works and operational experience gained during the active phase of the mining operation.

7.6.2 The only significant instabilities on the site have been in the final phases of excavation along the eastern sidewall and in overburden mound OB1.

7.6.3 Assessment of the available data has enabled designs which deliver long term stable tip slopes and excavated faces to form the basis for the aims of the required restoration scheme to be achieved.

7.7 Mitigation Measures

7.7.1 Upon the completion of coaling operations in November 2023 a detailed inspection of all tips and excavation faces was undertaken by the geotechnical specialist and site management.

7.7.2 An assessment of the potential remedial works which may be necessary to provide a long term, stable, and safe final restoration, assuming public access, was undertaken and used to inform the final site designs.

7.7.3 Since the cessation of coaling operations some of the recommended remedial works have been implemented with the outstanding items to be completed when the major restoration works commence.

7.7.4 A series of photographs numbered 1 to 6 [inclusive] along with schematic cross-sections have been produced to illustrate the proposals. (refer to **ES Volume 3 – Appendix 7L**)

Backfill Slope BF1

7.7.5 It is proposed to re-engineer the backfill slope, which currently comprises a benched profile with slopes of varying inclination, to produce a single un-benched slope with a gradient of approximately 1 vertical to 3 horizontal. (18° as measured from horizontal).

7.7.6 The re-grading will entail elements of 'cut' to remove material currently lying above the restoration profile envelope, and 'fill', to generate the proposed overall profile in areas which are currently over-steep.

7.7.7 The proposed fill area is in the lower section of the tip which currently lies beneath the final rest-water level in the lake feature. Before filling is undertaken the water level will be reduced, then the lower level constructed in compacted layers to a defined and approved specification.

7.7.8 Stability analyses have shown that the proposed design, assuming pessimistic groundwater conditions, produces a factor of Safety (minimum 1.48 for large-scale slope failure) which demonstrates that the proposed re-design will produce a long-term stable landscape feature. Print-outs for the stability analyses are appended in **ES Volume 3 – Appendix 7G**.

7.7.9 An acceptable factor of Safety value (1.34) can be achieved and is dependent upon the tipping method adopted in the area of 'fill' which will be undertaken in accordance with an approved geotechnical specification.

Overburden Mound OB1

7.7.10 OB1 has been affected by large scale full tip height instability along its western facing side which has arisen due to the lower level of the tip being re-excavated to enable the coaling limit to be achieved.

7.7.11 Slope designs for the northern, eastern and southern sides of OBM1 were geotechnically assessed, which involved undertaking a series of slope stability analyses, prior to their construction, which demonstrated that the structures would remain stable in the long term.

7.7.12 Factor of Safety values ranged between 1.19 and 1.23- see analyses 1 to 3 in Table 6C (**ES Volume 3 – Appendix 7F**).

7.7.13 The tip was constructed in compliance with the approved designs, which in addition to defined slope gradients, also involved the installation of a system of sub-tip drainage.

7.7.14 The tip was affected by instability as a consequence of which it requires re-construction of its south westerly facing slope.

7.7.15 Stability analyses have been undertaken to assess the implications of re-grading the existing slope to form a final profile of approximately 1 vertical to 3 horizontal. This will be achievable subject to appropriate engineering work being undertaken on the structure.

7.7.16 It is highly likely that there will be a requirement to secure the toe area by means of constructing a buttressed section founded on in-situ strata using suitable fill materials which, if necessary, can be accessed from sections of tipped materials which will be available from the various re-grading works.

Overburden Mounds OB2 and OB3

- 7.7.17 Prior to construction, the ground conditions in the areas in which OB2 and OB3 are located were assessed in detail and the required ground preparation works undertaken. The works included the removal of un-suitable materials and in places the installation of a system of sub-tip drainage.
- 7.7.18 Detailed slope stability analyses for all sides of the overburden mounds were undertaken which demonstrated acceptable Factor of Safety values for their long-term stability. The structures have remained stable for the duration of the site.
- 7.7.19 For overburden mound OB2 the factor of Safety Values ranged between 1.18 and 1.26 - see analyses 4 to 6 in Table 6C. (**ES Volume 3 – Appendix 7F**).
- 7.7.20 For overburden mound OB3 the Factor of Safety Values varied between 1.18 and 1.35.
- 7.7.21 Whilst global weather patterns are changing and rainfall levels remain unpredictable, the nature of the tipping operation during their formation and geometry of the tips is such that elevated 'groundwater' levels within the structures are not expected to occur other than potentially minor perched aquifers.
- 7.7.22 It can be concluded that subject to the structures not being affected by any significant groundworks / re-engineering in the future, they should remain stable as long-term landscape features.
- 7.7.23 No remedial works are required to be undertaken on either OB2 or OB3, they can be considered, in their current form, to be 'long-term stable' structures.

Liquid Tips – Flooded Quarry Void

- 7.7.24 As a part of the site restoration it is proposed to allow the quarry void to flood and naturally reach a final rest water level which is likely to fluctuate seasonally.
- 7.7.25 The anticipated final rest water level is expected to vary between 275 and 285 metres AOD. Stability analyses have demonstrated that the varying rest water level will not have any de-stabilising effect on the stability of the re-graded backfill slope

Liquid Tips – Residual Lagoons

- 7.7.26 A number of lagoons and water treatment areas will be retained and form a part of the final site restoration. The structures were all excavated into original and / or previously made-up-ground and have remained stable throughout the life of

the site. Subject to these structures being un-affected by any future engineering works, they should remain stable in perpetuity.

Excavation Faces – Northern Sidewall

- 7.7.27 The limit of excavation at its closest point to the A4060 was approximately 70 metres, varying between 70 and 110 metres. The proposed (and adopted) excavation profiles along this boundary were geotechnically assessed as a part of the original site investigations which demonstrated that there was no threat posed to the structural integrity of the A 4060. Computed Factor of Safety values for the un-supported excavated slope ranged between 1.49 and 2.74 - see analyses 9 to 18 in Table number 6A. (**ES Volume 3 – Appendix 7**). The subsequent infilling against the sidewall will have increased these values significantly
- 7.7.28 The excavation along this boundary has been successfully completed and the sidewall has been fully infilled against to create a final restoration slope with a maximum overall gradient of less than 1 vertical to 3 horizontal as is shown in cross sections E, F and G – see **ES Volume 3 – Appendix 7**.
- 7.7.29 The excavation along the northern boundary was relatively shallow reaching an approximate maximum depth of 36 metres. The top section of the excavation profile was through backfill associated with the Great White Tip Opencast Site, upon which the A4060 is located.
- 7.7.30 The adopted excavation profile along this boundary comprised a single slope through previous backfill dug to a gradient of 1 vertical to 2 horizontal, then steeply inclined excavation faces of 15 metres in height with 5 metres wide intermediate benches through solid strata.
- 7.7.31 Strata inclination along the wall is approximately 4 to 5° towards the south southeast which is insufficient to precipitate any bedding plane controlled translational sliding which had it occurred could have disrupt the stability of the wall, but highly unlikely to have any impact upon the A4060.
- 7.7.32 Restoration has involved the complete concealment of the sidewall by backfill deposits which will further enhance its stability- see cross section drawings E, F, and G. (**ES Volume 3 – Appendix 7**).
- 7.7.33 In summary, there is no potential for any geotechnical instability associated with the proposed final restoration landform which could affect the ground along this boundary either within the site or beyond it.

Excavation Faces – Southern Sidewall

- 7.7.34 The southern sidewall is the ‘highwall’ and defines the deepest part of excavation on the site, reaching a maximum depth of approximately 150 metres below original ground level.
- 7.7.35 Stability analyses demonstrated that the wall would have an acceptable level of stability with computed Factor of Safety values ranging between 1.17 and 3.18 – see analyses 7 to 12 in Table 6B. (**ES Volume 3 – Appendix 7E**).
- 7.7.36 The site restoration will involve some residual faces being retained and left exposed above the final [highest anticipated] rest-water level of 285 metres AOD, to a depth of approximately 100 metres below original ground level.
- 7.7.37 The residual faces are inclined at approximately 65° [as measured from horizontal] with intermediate 5 metres wide flat benches producing an overall slope profile of 1 vertical to 1 horizontal [45°].
- 7.7.38 As the operation progressed from west to east three NNE/SSW orientated normal faults were encountered which displaced the strata to the west. The westernmost being the Penydarren Fault and the easternmost the Dowlais Fault, with an unnamed one between the two.
- 7.7.39 The faults orientation with respect to that of the sidewall was such that only localised disturbance around the point of intersection was experienced.
- 7.7.40 All three structures have been fully concealed by the backfill deposits.
- 7.7.41 The upper section of the sidewall extending to approximately 5 to 6 metres below surface level comprises strata which have been affected by surface weathering processes resulting in a reduction in their intrinsic strength characteristics. In mitigation it is proposed to grade the upper slope sections producing a slope gradient of approximately 1 vertical to 2 horizontal [26.5°] which will produce a long-term stable feature.
- 7.7.42 Towards the eastern end of the sidewall the strata lying above the ‘Q’ Seam have been affected by multiple low angled thrust dislocations [faults] which have resulted in sections of bedding plane defined strata falling from the face leaving un-supported rock in the face. Ideally, it is proposed to remove the potential for moderately large sabs of strata spalling from the face by extending slope re-grading down to the base of the disturbance in the affected zone. The operational feasibility of undertaking this operation in a safe manner will be assessed by site management and the geotechnical specialist. If not possible, an alternative

strategy possibly involving extended isolation of the slope crest area will be assessed.

- 7.7.43 During the initial design stage detailed slope stability analyses were undertaken to identify and assess the potential modes of failure which could affect the sidewall. No significant areas of concern were identified other than in the immediate vicinity of the various faults which would be intersected. Various potential modes of failure were identified, the impact of which was determined would be localised, small-scale and only of possible significance as a safety consideration during the mining operational phase.

Excavation Faces - Eastern Sidewall

- 7.7.44 The eastern sidewall varies in height from approximately 20 to 30 metres at the northern end to over 120 metres at the southern end. Initial stability analyses demonstrated the wall to have a computed Factor of Safety of between 1.14 and 2.7- see analyses 1 to 6 in Table 6B. **ES Volume 3 – Appendix 7E.**
- 7.7.45 During the latter stages of the operation the eastern sidewall has been affected by significant instability as it has been developed towards the east due to the presence of normal faulting which had an orientation close to that of the sidewall and a displacement towards the west.
- 7.7.46 Large scale spalling of strata extending several tens of metres up the face were experienced resulting in the formation of extensive scree cones down the faces.
- 7.7.47 As the excavation advanced towards the east the fault / sidewall point of intersection migrated towards the north and can now be observed to be present around the Big Seam horizon at the northern end of the site.
- 7.7.48 At the southern end and mid- section of the east wall the fault has been removed by the advancing excavation and where it remains at the northern end various remedial stabilising works have been undertaken.
- 7.7.49 Remedial works have included the removal of any adversely inclined and dilated strata from faces and the re-grading / backfilling at the point of intersection. The works are sufficient to ensure the long-term stability of the affected section of wall.
- 7.7.50 Further remedial works have included the re-grading of a high-level corner-point along the mid-section of the wall where badly dilated strata were present which had the potential to topple forwards.

7.7.51 Where coal seams have been exposed in final sidewalls which could be accessible to the general public from the remaining benches, these have been covered with backfill material to prevent access.

7.7.52 Schematic drawings 1 and 2 provide details of the proposed remedial design, which, in addition to the concealing of seams, it is proposed to install rock-gutters to contain any rocks which may very occasionally spall from the faces.

7.8 Monitoring

7.8.1 Operations on the site during the restoration phase will be undertaken in compliance with the requirements of the Quarries Regulations 1999. Ultimately this is for the delivery of a site which is, upon the completion of the works be left in '**a safe condition**' (Regulation 6[4]).

7.8.2 It is therefore proposed that during the restoration phase the appointed geotechnical specialist undertakes periodic site inspections and remains available for the duration of the works.

Post Operational Phase

7.8.3 Following the final completion of the site restoration works the appointed geotechnical specialist will confirm that the site has been restored in compliance with the consented designs and has been left in a safe condition. A formal site completion report will be issued.

7.8.4 For the first three years following the completion of restoration works an annual site inspection by the appointed geotechnical specialist will be undertaken and the findings of the inspection submitted to the local planning authority who under Part II of the Mines and Quarries (Tips) Act 1969, assumes responsibility for the monitoring of the site.

8 Hydrogeology

By Groundwater Science

8.1 Introduction

- 8.1.1 An assessment on the potential effects of the mining operation on the hydrology of the site and surrounding area was formerly undertaken by R.G Edwards (Independent Consulting Engineering Geologist) and reported in the Environmental Statement⁸ for the original Ffos-y-Fran Land Reclamation Scheme.
- 8.1.2 The assessment found that the underground drainage of the site is controlled by an extensive system of inter-connected old mine workings and cross drives. The Penydarren, Nant Llesg, Bute and possibly the Penrhyeol Watercourses recorded on abandonment plans, were found to function as main drainage routes carrying mine water to discharge points at ground level. The Black Ball Watercourse west of the Dowlais Fault and a supplementary and deeper watercourse were found to carry the bulk of the groundwater to the Nant Morlais Valley.
- 8.1.3 The assessment concluded that post mining and following the recovery of groundwater levels, base flows in the Nant Morlais would return to those that existed prior to working of the surface mine.
- 8.1.4 Site investigations carried out from November 2023 to June 2024, and a review of data collected during site operation, do not provide any clear and obvious evidence to suggest that the mechanisms and distribution of groundwater drainage from the site have varied in a discernible manner relative to the pre-mining situation. This is thought to be due to the permeable nature of the backfill which has been emplaced where the coal measures have been mined out, and limited impact of the mining activities on the main drainage mechanisms underlying the pit. A conceptual hydrogeological cross-section of the pit void is presented in **ES Volume 2 Figure 8.1** which illustrates the main components of the groundwater flow system in the pit are primary flow pathways and main surface water receptors.

⁸ Ffos-y-Fran Land Reclamation Scheme – Environmental Statement – May 2003 – Leek & Weston (Doc Ref FLRS ES/1 – 020503) – Chapter 12 Hydrogeology

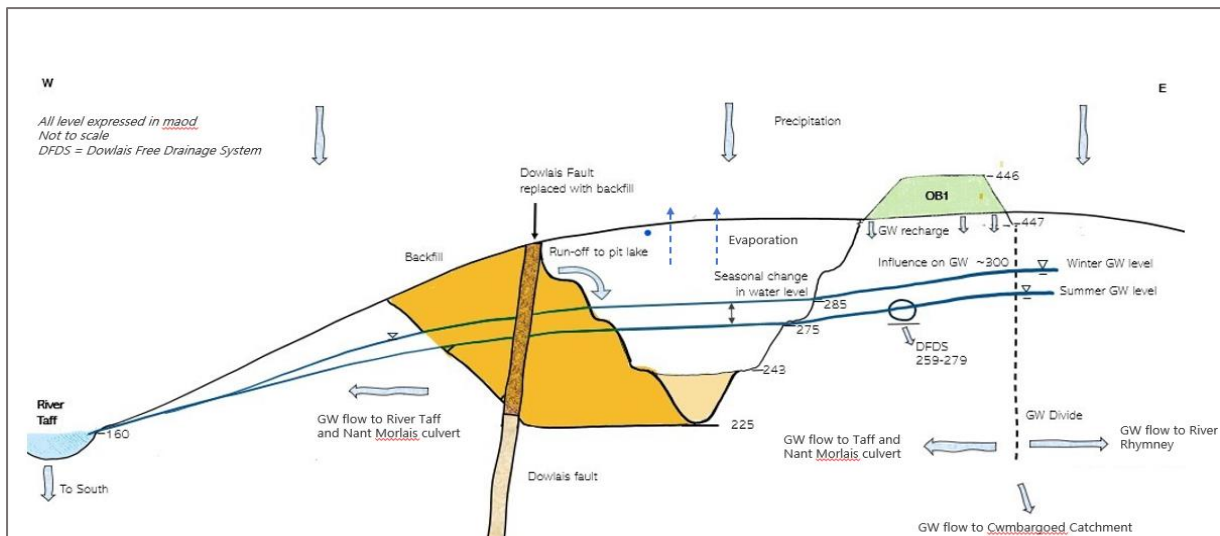


Figure 8.1: Conceptual hydrogeological cross-section of the current pit void

8.1.5 Presently, the pit lake has recovered to a stable water level in equilibrium with surrounding groundwater. It is anticipated that the water level will fluctuate seasonally in response to variations in rainfall and evaporation. The reclamation scheme in its proposed form recommends regrading of some slopes within the pit void and limited backfilling, which will reduce the total volume from the pit floor to an elevation of 280 m RL by 10%, and to the western lip of the pit at 330 m RL by 3.6%. Whilst the reduction in pit void volume will have a minor impact on the stage/volume relationship, and therefore stable pit lake water level, it is not anticipated that this will affect the hydrodynamics of the lake and surrounding groundwater body in any other discernible way.

8.1.6 The proposed restoration scheme does not currently include any applications for new groundwater or surface water abstraction licences or plans to continue with the existing transfer licence (A/057/0022/0004) held by MSW. These will be required to partly de-water the void to a sufficiently lower level (circa 267m AOD) for slope stabilisation works to allow backfill from the lower tier to be pushed down to for a stable toe to the reprofiled slopes above (i.e. reprofiled to between 1 in 2.5 and 1 in 3 as agreed with a geotechnical specialist).

8.2 Scope of the Assessment

8.2.1 The scope of the hydrogeological work to be addressed for the EIA will include both consideration of direct hydrogeological impacts that may result from completion of the proposed reclamation scheme, and provision of inputs to the

assessment of potential impacts associated with other disciplines, such as hydrology and water quality.

8.3 Legislation and Policy

8.3.1 There is no specific legislative framework in the UK for the assessments of hydrogeological impacts associated with mining activities, including closure. The legislation and regulatory regimes applicable to the EIA will depend on the possible impacts that are identified but may include:

- Water Environment (Water Framework Directive) Regulations 2017: adopted to transpose the Water Framework Directive (Council Directive 92/43/EEC) into UK law. These provide a framework for managing the water environment in England and Wales. Under the WFD Regulations, a river basin management plan must be prepared for each river basin district. In general, developments must demonstrate no deterioration in the ecological or chemical status of surface water bodies as, defined under the WFD objectives.
- 2001 Water Resources Act and 2003 Water Act amendment: Act of Parliament that regulates water resources, water quality and pollution, and flood defence. Relevant parts include Part 2, which sets out the framework for the management of water within the UK, and Part 3, which defines the expected standards for controlled waters, and what is considered water pollution.
- Catchment Abstraction Management Strategies (CAMS) for the South Valleys (2017). This document sets out how NRW manages water resources in the South Valleys river catchments.
- Conservation of Habitats and Species Regulations 2017: adopted to transpose the Habitats Directive (Council Directive 92/43/EEC) into UK law. This imposes obligation in relation to sites designated as 'special areas of conservation' by EU member states.

8.4 Baseline Conditions

8.4.1 The baseline conditions for the hydrogeological assessment are taken as the period from August 2023 to November 2024, during which time mineral extraction operations ceased and water levels recovered to equilibrium within the pit void. This interval coincides with the period during which pit lake levels have been measured on a regular basis and overlaps with both maximum (April) and minimum (September) water levels within the pit void. The core area of the site, defined as Phase 3, will be the subject of the most change during the proposed reclamation scheme. This encompasses the main void, OB1 and the surrounding

area north of Bogey Road. Other areas of the site would generally remain as they are at present, apart from minor re-profiling works and surface treatments such as ground preparation, cultivation, grass seeding, and planting/hydroseeding of trees and shrub.

- 8.4.2 Contemporaneous field studies have been carried out to characterise baseline conditions. This includes flow gauging of nearby surface water courses and mine discharges (in a repeat of the 1996 Celtic Energy spot flow survey used to quantify the site water balance for the 2002 Environmental Statement (ES)); regular monitoring of the pit lake water level; and rising heads tests to measure the hydraulic conductivity of backfill material.

8.5 Assessment Methodology

- 8.5.1 A screening process was undertaken to identify the location of environmental receptors within the groundwater EIA study area. This study area is shown in **ES Volume 2 - Figure 17.1** and is restricted to the surrounding groundwater catchment that may reasonably be expected to respond to changes in groundwater use or regime at the site, either through groundwater system continuity or receipt of groundwater dependent waters discharging from the site. These groundwater catchments are likely to be in hydraulic continuity with the major surface water occurs shown in **Figure 8.2**.
- 8.5.2 Potential receptors within the groundwater search area include groundwater users and Water Framework Directive (WFD) water bodies. Post-restoration changes to receptors were evaluated using two parallel models. These are based on historical models calibrated to existing records of groundwater levels, mine discharges and pit lake level records. The setup and calibration of this model is documented in a separate technical report Ffos-y-Fran Final Restoration Scheme – EIA Hydrogeology Technical Report (**ES Volume 3 - Appendix 8A**).
- 8.5.3 Impacts are calculated using two parallel models:
- A baseline model, in which the geometry of the pit at cessation of extractive activities in November 2023 is represented.
 - A predictive model, in which the geometry of the pit void reflects the anticipated landform post-restoration.
- 8.5.4 The climatic inputs to the model are based on a combination of publicly available HADUK rainfall (Hollis, et al., 2019) and EA Pet (Environment Agency, 2021) potential evapotranspiration data (PE) from January 1982 to June 2024,

supplemented by rainfall data from the weather station at Cwmbargoed for the period from July 2023 to June 2024.

- 8.5.5 These historical datasets (HADUK rainfall and EA PEt) were also used to generate proxy future climates, giving modelled projections of future conditions. To represent climate change, projected changes in rainfall and temperature from the UKCP18 ensemble were used to perturb the historical data, thereby maintaining short-term variability, whilst including longer term, projected trends in rainfall and PEt. Representative wet, average and dry members of the UKCP18 ensemble were used to assess the potential range of future climates and evaluate possible ranges of future pit lake level fluctuation.
- 8.5.6 The numerical groundwater model is structured in the following manner for the impact assessment:
- A one-year period where there is no pit void to generate an initial distribution of groundwater heads.
 - There is a 5.5-year dewatering simulation where the excavation is kept dry to simulate the initial impact of mining activities on the groundwater system.
 - A recovery period is then simulated for a duration of 36 years, starting midway through simulation year 6. With respect to the climate dataset, this coincides with August 2023 when dewatering activities ceased and the pit lake level began to rebound. Impact to the groundwater system is evaluated from this point of the simulation onwards.
- 8.5.7 Spatial impacts to groundwater receptors are evaluated for a dry and wet period, under the assumption that potential impacts are greatest at either of these two extremes. Dry and wet periods were selected based on the date when the lowest and highest pit lake levels are simulated by the pit lake water balance model, corresponding to months February 2056 and August 2026 respectively in the projected future climate dataset. These months reflect climatic conditions experienced in August 1984 and February 2010 from the historical dataset. Climatic change factors are applied to assess the impact of climate change.
- 8.5.8 The following, post-restoration changes to the groundwater system are assessed for known receptor locations, including WFD water bodies for:
- Change in groundwater level and availability.
 - The change in groundwater discharge to surface water receptors.

8.5.9 A water balance approach was used to simulate future pit lake level and volume fluctuations for both the current pit topology and the proposed, reclaimed landform. The potential impact of future climate change is also considered using this method.

8.6 Receptor Screening

Environmental Receptors

8.6.1 A screening process was undertaken to identify the location of environmental receptors within the groundwater EIA study area (**Volume 2 - Figure 17.1**) Receptors checked during the screening process included:

European (Natura 2000) and international designation receptors:

- Special Areas of Conservation (SAC)
- Special Protected Area (SPA)
- RAMSAR Wetlands
- Nationally designated receptors:
- Sites of Special Scientific Interest (SSSI)
- Groundwater Dependent Terrestrial Ecosystems (GWDTEs)

8.6.2 Nine SSSI receptors were identified during this process. These sites are summarised in **Table 8.1**. **Figure 8.2** shows the location of these sites in relation to the groundwater study area.

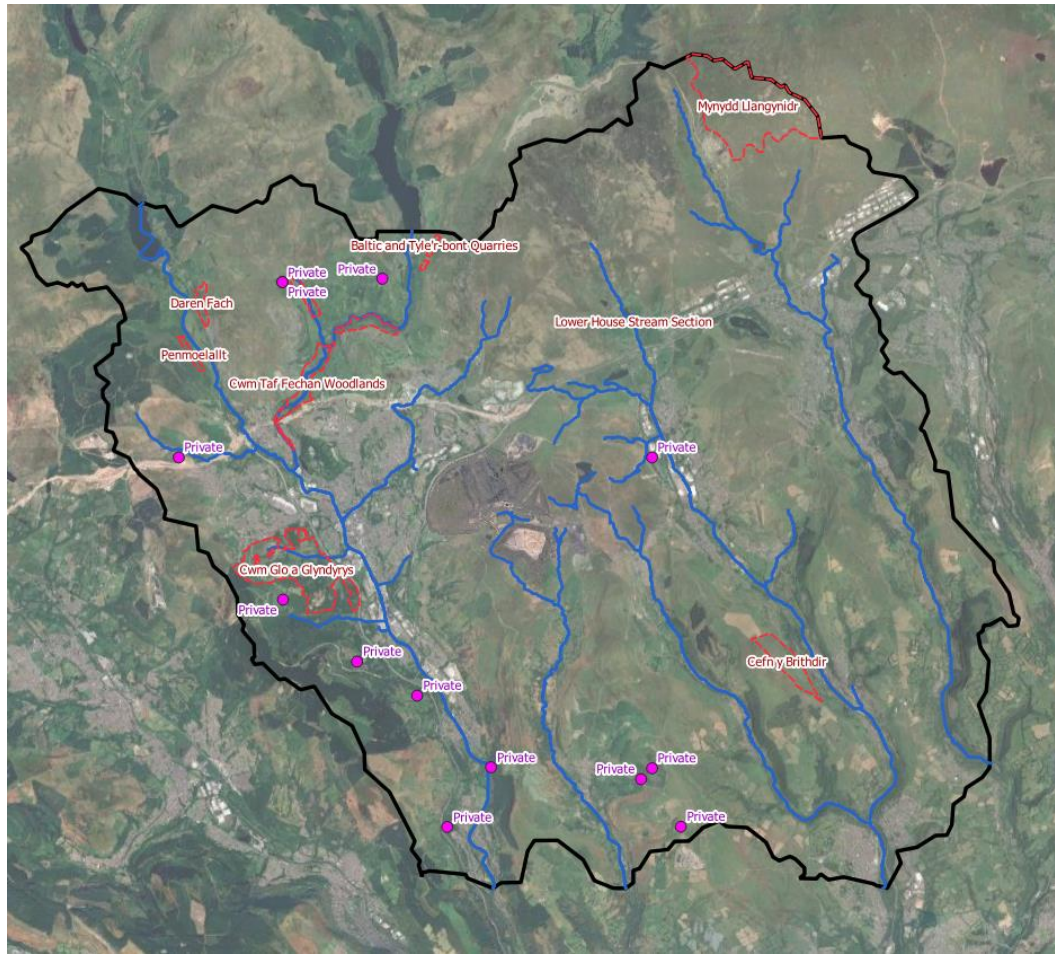


Figure 8.2 SSSI and private groundwater abstraction within the hydrogeology search area

Table 8.1: Summary of SSSI receptors within hydrogeological search area

SSSI Name	Description	Distance from mine site and location
Baltic and Tyle'r-bont Quarries	Site showing a section through the Carboniferous Limestone, here of Courceyan-Holkerian age. The section includes the Llanelly Formation, which contains an unusual clastic facies.	4.5 km to N.
Cefn y Brithdir	Hill of Pennant grit. The slopes support the best example in Mid Glamorgan of a dwarf shrub heath community in which crowberry <i>Empetrum Nigrum</i> occurs as a co-dominant species.	5.8 km to SE. Situated on the western side of the upper Rhymney Valley overlooking the town of New Tredegar.
Cwm Glo a Glyndrys	Extensive area of marshy grassland, species-rich neutral grassland and acid grassland.	3.3 km to W. To the west of the River Taff.
Cwm Taf Fechan Woodlands	Mixed deciduous woodlands cover steep slopes and spoil from quarries with one of the few Glamorgan stations for <i>Gymnocarpium robertianum</i>	4 km to NW. Associated with the Taf Fechan River valley.
Daren Fach	Open scrub on low limestone cliffs with screes and woodland on the gentler slopes. Presence of <i>Sorbus</i> spp. on the southern end of the Darren Fach crags.	6.5 km to NW. Downstream of Llwyn Reservoir.
Lower House Stream Section	Used to locate the boundary between the Marsdenian and Yeadonian stages of the Namurian. Most diverse <i>Gastrioceras cancellatum</i> Marine Band fauna known in southern Britain.	4.2 km NE. Rhymney River just to north of the A465.
Mynydd Llangynidr	Mynydd Llangynidr is of special interest for the karstic geomorphology, particular the doline field.	7.9 km NE. Situated approximately 1km north of the village of Trefil.
Nant Glais Caves	Limestone gorge of the Nant Glais and two vadose cave systems. Important for their unusually large populations of white trout.	4.8 km to NNW. To the north east of Vaynor Quarry.
Penmoelallt	A mixed woodland of ash, oak, wych elm and small-leaved lime. The rare Ley's whitebeam grows on a small escarpment within the wood.	6.2 km to NW. On the west bank of the Rhondda Cynon Taf.

Groundwater Users

- 8.6.3 Natural Resources Wales (NRW) and Merthyr Tydfil County Borough Council (MTCBC) were consulted to identify the location of public groundwater and surface water abstraction licences, as well as private groundwater users.
- 8.6.4 A total of 10 separate water abstraction licences have been identified:
- 1 groundwater abstraction licence for public water supply associated with a borehole (21/57/11/0022).
 - 1 abstraction licence for public water supply associated with a spring in the Sirhowy River catchment (20/56/65/0014).
 - 3 licences associated with public water supply from Llwyn Onn, Cantref and Taf Fechan reservoirs (21/57/21/0001, 21/57/21/0002 and 21/57/21/0004).
 - 1 surface water abstraction licence relating to abstraction from the River Rhymney (21/57/11/0001).
 - 2 licences associated with surface water abstraction from the Taf Bargoed (21/57/22/0032 and WA/057/0021/001).
 - 1 licence for surface water abstraction from the Taf Fechan (WA/057/0021/0011)
 - 1 licence relating to abstraction of surface water from the Sirhowy River (20/56/65/0028).
- 8.6.5 For asset security reasons, licenced abstractions are not included on maps in this report. In addition, grid references are not provided. Licences attributed to operations (such as dewatering or dust suppression) at the MSW mine site are not considered.
- 8.6.6 There are 14 recorded private groundwater users within the search area. These are shown in **Figure 8.2**. The closest is situated 3.1 from the centre of the excavation, with the remainder located more than 4 km away.
- 8.6.7 A single source protection zone (SPZ) was identified within the hydrogeology search area and is located approximately 2.7 km to the northeast of the mine site at the closest point. This is shown on **Figure 8.2** and coincides with the approximate catchments for public water supply abstractions.

Catchment Abstraction Management Strategy (CAMS)

8.6.8 The groundwater search area is coincident with the following CAMS (Catchment Abstraction Management Strategy) catchments (NRW, 2017):

- Taf Fechan and Taf Fawr catchments (Taff u s Cynon operational catchment)
- River Taff catchment from Abercynon to Merthyr (Taff u s Cynon operational catchment)
- River Rhymney catchment upstream of Bargoed
- River Ebbw and Sirhowy catchment

8.6.9 **Figure 8.3** shows the availability of water for consumptive licencing within the South Valleys CAMS area. It can be noted that:

- Water is not available for licencing within the Taf Fechan, Taf Fawr and River Taff catchment from Abercynon to Merthyr for Q30 to Q95 flow conditions.
- The availability of water within the Rhymney catchment upstream of Bargoed is limited to flow conditions of greater than Q50, otherwise restrictions apply.
- As surface water availability classifications are used as proxies for the underlying groundwater availability, it follows that groundwater bodies underlying these catchments where restrictions on water availability are in place are also subject to the same restrictions.

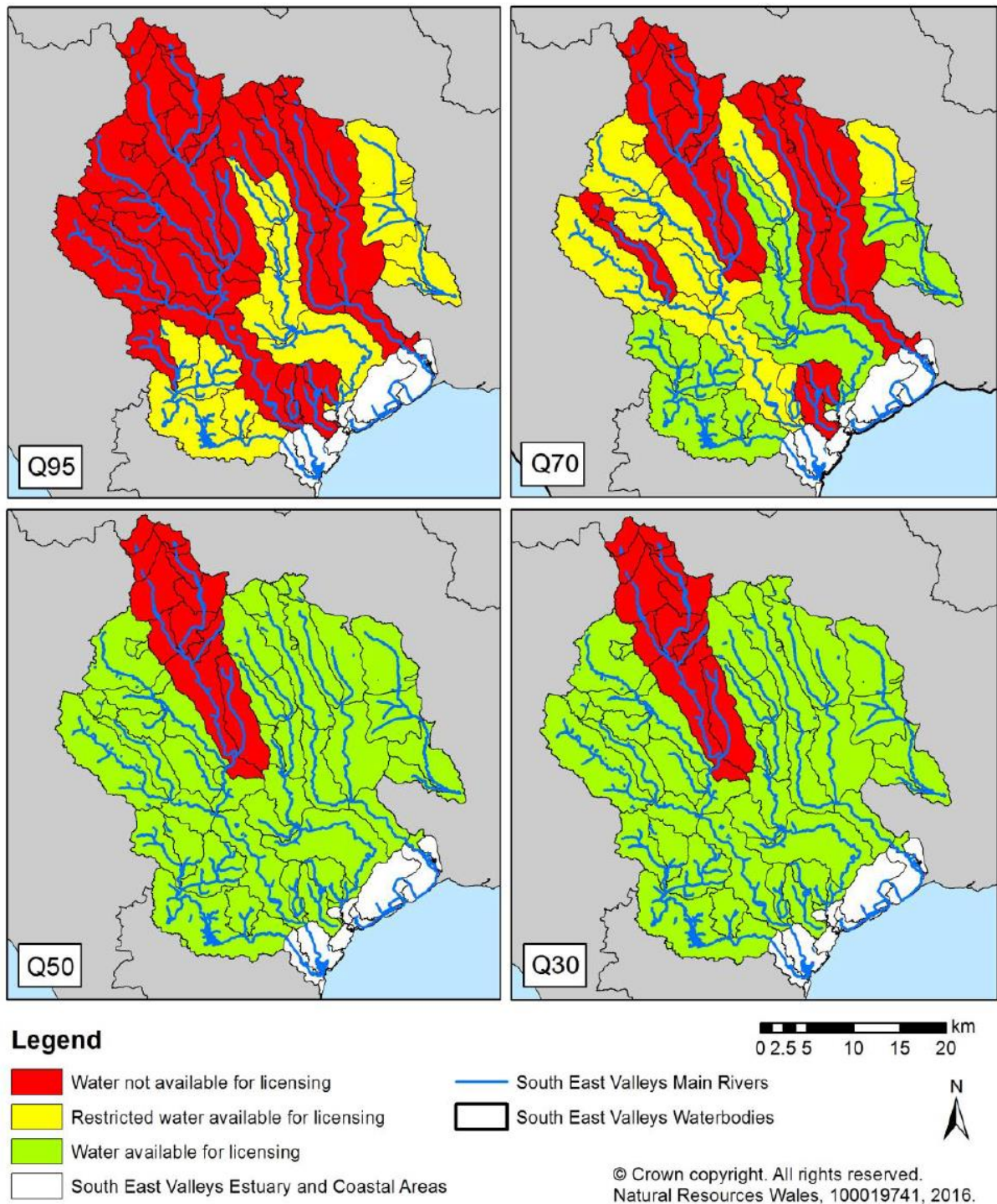


Figure 6.5: Availability of water for consumptive licensing – from NRW 2017

WFD bodies and classification

8.6.10 The groundwater search area coincides with 10 WFD surface water bodies and 4 WFD groundwater bodies. The RBMP (River Basin Management Plan) WFD cycle 3 locations, nature and classifications are summarised in the **Table 8.2**. Groundwater and surface water WFD water bodies are shown in **Figure 8.4 and 8.5** respectively.

- Most surface water bodies have been assigned an overall classification of 'Moderate'.
- The main reason cited for not achieving 'good' status is the modified and engineered nature of these water bodies and lack of mitigation to compensate for the impact on ecological and environmental factors. Ecological (primarily fish populations) and chemical factors (Phosphate, nitrate) were also cited as reasons for not achieving 'good' status.
- Southeast Valleys Carboniferous Coal Measures is the only groundwater body within the search area with a 'poor' rating. This relates to the impact of groundwater chemistry on surface water chemistry and ecology.
- The Southeast Valleys Carboniferous limestone is rated as 'good' for all quantitative elements.

Table 8.2: Summary of WFD water bodies within the hydrogeology search area

* Mit_Assmnt is the Mitigation Measures assessment which relates to water bodies that are classed as Artificial / Heavily Modified (HMAWB). This term determines the Ecological Potential of HMAWBs by evaluating whether the necessary measures are in place to reduce the impact of modifications on the water body's ecology.

WFD water body	WFD classification	Overall rating	Reasons for not achieving good
Sirhowy River - source to Rock Villas	River	Moderate	Phosphate
Taff – confluence with Taf Fechan to confluence with River Cynon	River	Moderate	Mit_Assmnt*
River Rhymney - source to confluence with Nant Bargoed Rhymney	River	Moderate	Fish
Nant Morlais - source to confluence with River Taff	River	Moderate	NH3; Mit_Assmnt
Afon Taf Fawr - source to conf Taf Fechan	River	Moderate	Mit_Assmnt*
Nant Bargoed Rhymney - source to confluence with River Rhymney	River	Poor	Fish
Taff Bargoed	River	Moderate	Mit_Assmnt*
Taf Fechan - source to conf Afon Taf Fawr	River	Moderate	Mit_Assmnt*
River Rhymney - Nant Bargoed Rhymney to confluence with Nant Cylla	River	Good	
SE Valleys Carboniferous Limestone	Groundwater	Good	
Usk Devonian Old Red Sandstone	Groundwater	Good	
SE Valleys Carboniferous Coal Measures	Groundwater	Poor	Groundwater/surface water chemistry
SE Valleys Northern Devonian Old Red Sandstone	Groundwater	Good	

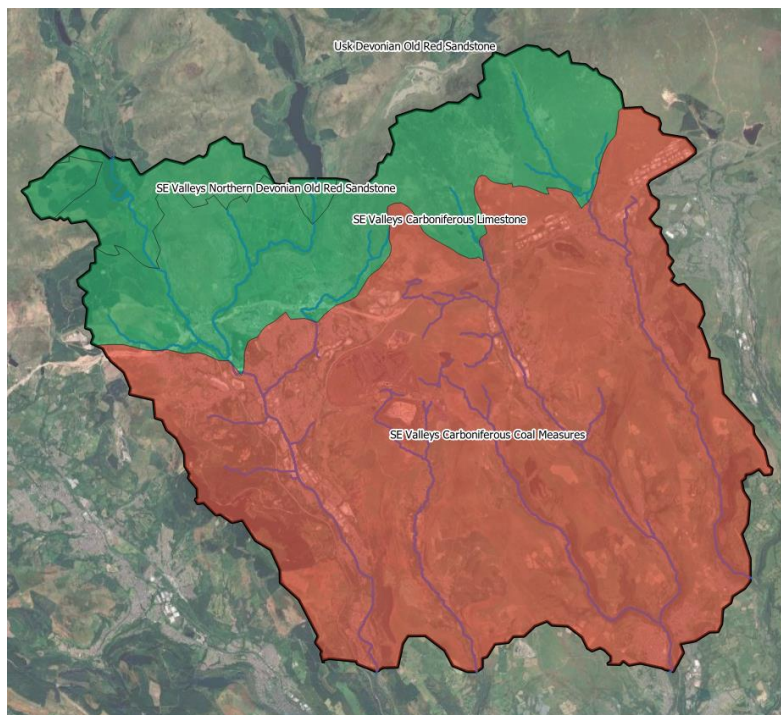


Figure 8.4: WFD Cycle 3 groundwater body classifications

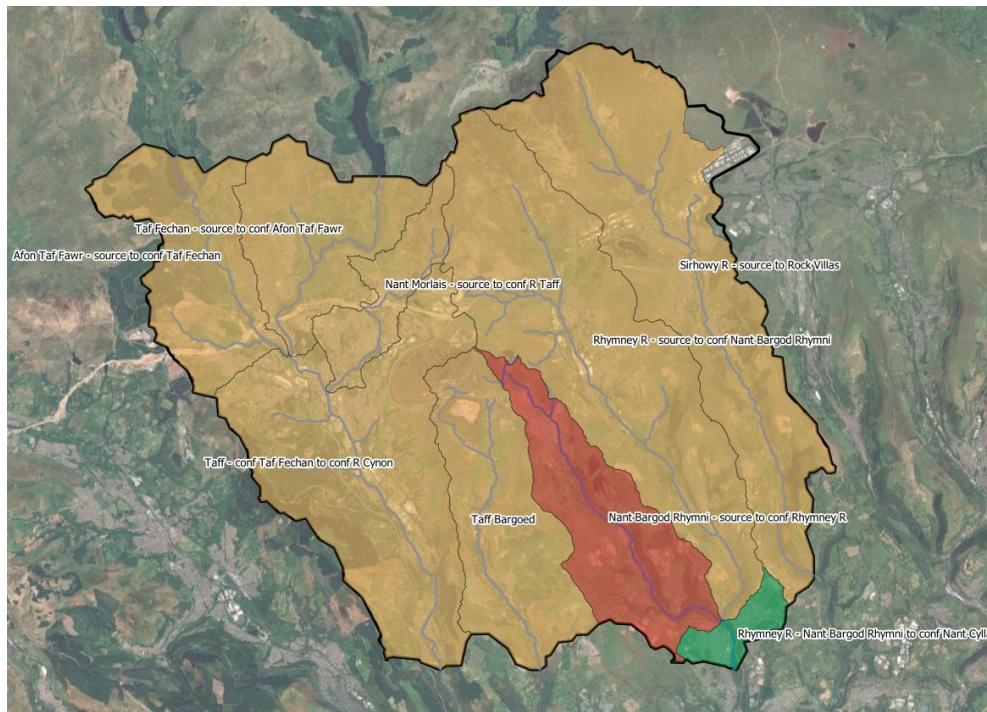


Figure 8.5: WFD Cycle 3 surface water body classifications

Summary of Receptors

8.6.11 The groundwater EIA has been evaluated with respect to the following elements:

- 9 nationally designated SSSIs
- 10 water abstraction licences
- 14 private water supplies
- 4 CAMS catchments within the search area
- 9 WFD surface water bodies within the search area
- 4 WFD groundwater bodies within the search area
- 1SPZ

8.7 Approach to characterising Effects

8.7.1 The impact of the following changes to the groundwater system post-reclamation on known receptors, including WFD water bodies, were assessed. The assessment criteria are described below:

Change in groundwater level and availability for groundwater users and WFD water groundwater bodies.

8.7.2 Any observed impact is assessed to check whether this is within the margin of error of the commonly deployed monitoring techniques, such as dip meters, or beyond the resolution of the model to practically simulate. To this assessment, this is taken as ≤ 1 cm. Impacts with a magnitude beyond this are assessed for adverse water availability effects and whether they may lead to a change in water body quantitative status on a case-by-case basis.

The change in groundwater discharge to surface water receptors through both the groundwater system and the DFDS.

8.7.3 The change in discharge of groundwater to the receiving surface water bodies is initially determined. If present, the magnitude is evaluated to assess whether this falls below the threshold of measurement error. This shall be taken as < 1 l/s or 86.4 m³/d in this instance for WFD water bodies. Changes greater than this are assessed on a case-by-case basis relative to the Q95 flow at nearby flow gauges (or summer spot flow measurements if gauges are not present) to ascertain whether they may result in a change to quantitative status of the water body.

8.9 Assessment of Effects

Impacts to regional groundwater receptors

- 8.9.1 The difference in groundwater level was calculated for both dry and wet periods and found to be restricted to the pit void. There is no recorded change or deviation in groundwater level at any point receptors or SPZ of more than 1 cm and hence impacts are considered negligible. The changes in groundwater level are highly localised to the footprint of the pit void and minor in scale (<1 m). As a result, it is highly unlikely that WFD status for groundwater and surface water bodies in the search area would be affected through the implementation of the proposed restoration scheme. The availability of groundwater for consumptive licensing within CAMS catchments, to public water supplies and private groundwater users, would similarly be unaffected.

Discharge to surface water

- 8.9.2 **Figure 8.6** shows the change in simulated discharge of groundwater to surface water bodies via the groundwater pathway, relative to baseline conditions. The largest change is observed to the Nant Morlais, where simulated discharge is predicted to increase by 0.2% (equivalent to 0.6 m³/d) relative to the current baseline shortly after cessation of dewatering (simulation year 8) and decrease by up to 0.05% (0.1 m³/d) in the period thereafter.
- 8.9.3 To place this into context, discharge rates through the Nant Morlais culvert to the River Taff measured in June 1996 and July 2024 ranged from 12,960 m³/d to 20,649 m³/d. The simulated post-restoration change in groundwater discharge to the Nant Morlais therefore represents less than 0.01% of the lowest observed stream flow. Furthermore, this represents an even lower fraction of the Q95 (63,072 m³/d) of the River Taff at the Merthyr Tydfil gauging station, which is located just upstream of the confluence with the Nant Morlais.
- 8.9.4 The magnitude of the simulated change in direct groundwater discharge to nearby surface water bodies is minimal in relation to measured flow and furthermore is well within the margins of error of typical stream flow gauging instrumentation. As such, impacts would be highly unlikely to influence any WFD criteria and therefore affect WFD status for the receiving water bodies.

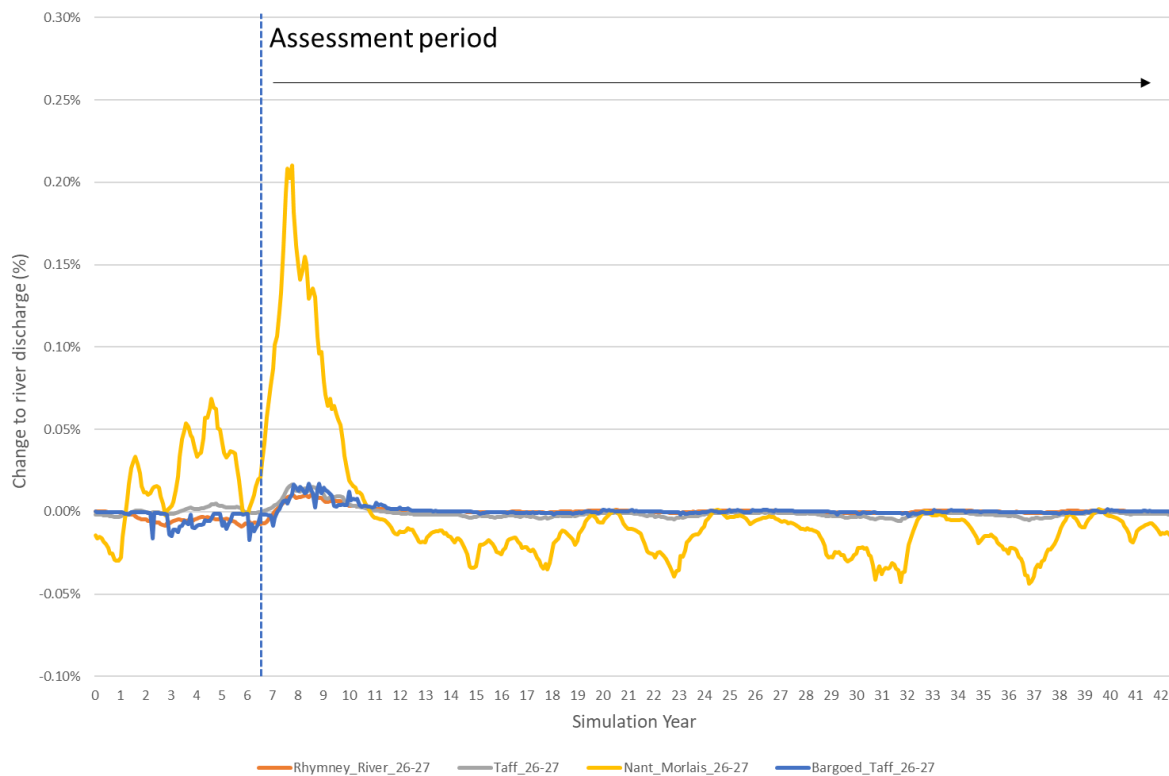


Figure 8.6: Simulated change groundwater discharge to nearby surface water bodies post-reclamation

Discharge to the Dowlais Free Drainage System (DFDS)

- 8.9.5 The DFDS comprises a network of cross-cutting drainage adits and tunnels that were collectively used to drain the mine site, enabling safe access to the historical mine workings and providing water to the Dowlais Iron works. It is assumed that much of this infrastructure remains in place, is operational to this day and has been unaffected by contemporaneous mining operations. It is understood that the DFDS drains to nearby water courses, including the Nant Morlais, River Taff and River Rhymney although the exact distribution of outflows by volume cannot be measured directly.
- 8.9.6 The 3D numerical model incorporates a 3D representation of the DFDS which was developed based upon our current understanding of the drainage system layout and invert levels. Since the DFDS is believed to drain to nearby watercourses, the impact of the restoration scheme implementation on discharge from the drainage network was evaluated to assess how the scheme may affect receiving water bodies.

- 8.9.7 The simulated change in outflow from the DFDS is shown in **Figure 8.7** relative to pre-restoration conditions. The simulation indicates a minimal effect to the discharge rates from the DFDS, with a maximum change of +0.5%, equivalent to approximately 2 l/s or 172.8 m³/d. This represents 1.3 % of the lowest measured flow (12,960 m³/d, June 1996) through the Nant Morlais culvert. This would fall within the acceptable range of flow deviation presented in the JNCC Common Standard Monitoring for Rivers (<5% deviation at <Q₉₅, <10% deviation at >Q₉₅), and furthermore represents an increase in flow.
- 8.9.8 The scale of the difference in simulated outflows suggests that the impact to receiving water courses is acceptable and should not affect WFD status.



*Figure 8.7: Simulated change in discharge from the DFDS post-reclamation
Assessment of long-term pit lake level*

- 8.9.9 An assessment of long-term pit lake level and volume fluctuations was assessed using a water balance model approach to assess the potential for overtopping of the void. The main inputs to this model include rainfall and potential evaporation derived from historical climate datasets. The model considers runoff contributions, and stage dependent groundwater inflows and outflows to and from the pit void. It is assumed that the groundwater regime is unaffected in the future and behaves in a manner consistent with the present day. The water balance model was calibrated to lake level measurements taken from August 2023, when the sump pumps were switched off, to November 2024. The development of the pit lake water balance model is documented in **ES Volume 3 Appendix 8.A**.

Predictive simulations using historical climate

- 8.9.10 The water balance model was run twice, first using the current pit topology and second, the proposed post-restoration landform. A comparison of simulated lake levels and volumes between the scenarios demonstrates the extent to which differences in the void geometry affects the seasonal variation in lake level and volume.

Level

- 8.9.11 The median, interquartile range, and minimum and maximum values for the simulated pit lake level in both scenarios are plotted in **Figure 8.8**. The maximum simulated pit lake water level (285.6 mAOD) is higher in the post-restoration landform scenario than in the current pit topography scenario (284.6 mAOD). The simulated maximum of 285.6 mAOD for the reclaimed landform is 45.9 m below the theoretical void breach water level of 333.7 mAOD.
- 8.9.12 Similarly, the simulated minimum levels and median ranges do not vary substantially between the scenarios. However, the interquartile range is greater in the post-reclamation scenario, implying more substantial seasonal variation in water level. This reflects a reduction in storage capacity within the former pit void, producing larger changes in water level for a given volume of added/removed water.

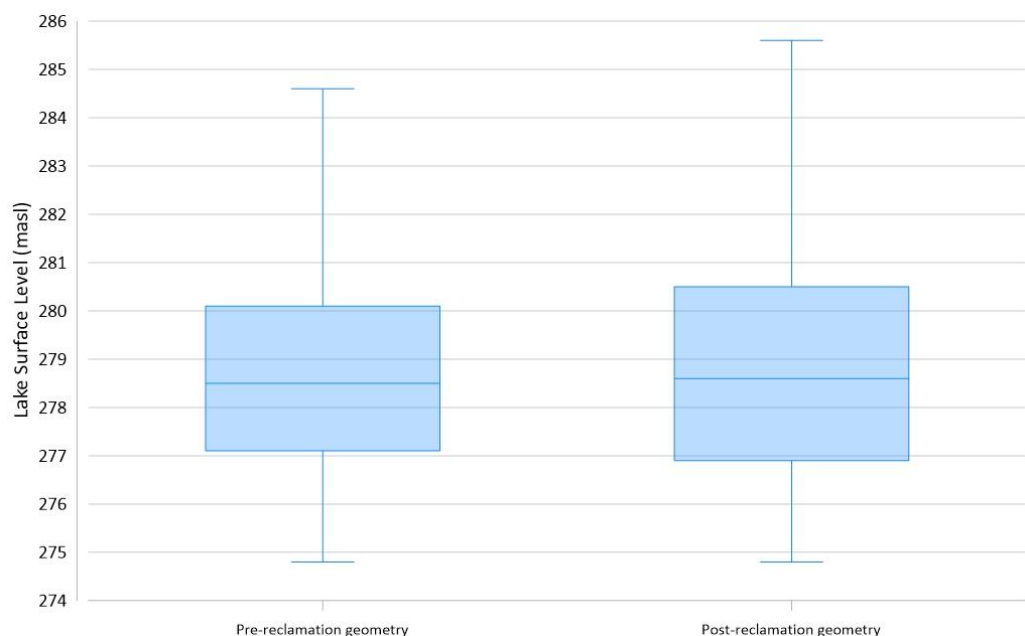


Figure 8.8: Statistical distribution of simulated lake level ranges for pre-reclamation and post-reclamation pit geometries.

Volume

- 8.9.13 The simulated statistical distribution of pit lake volumes for each scenario is shown in **Figure 8.9**. The simulated lake volume range is reduced in the post-restoration water balance model, owing to the reduced volume of the landform relative to that of the present day. Median simulated volume is reduced to 670,000 m³ from 935,000 m³, and the simulated maximum volume is reduced from 1,450,000 m³ at a lake level of 285.6 mAOD to 1,140,000 m³ at a lake level of 285.6 mAOD. The maximum simulated lake volume post restoration is 8,405,000 m³ less than the volume of the pit void at the spill elevation. Alternatively, the maximum simulated post-reclamation pit lake volume can be expressed as 12% of the total void volume.

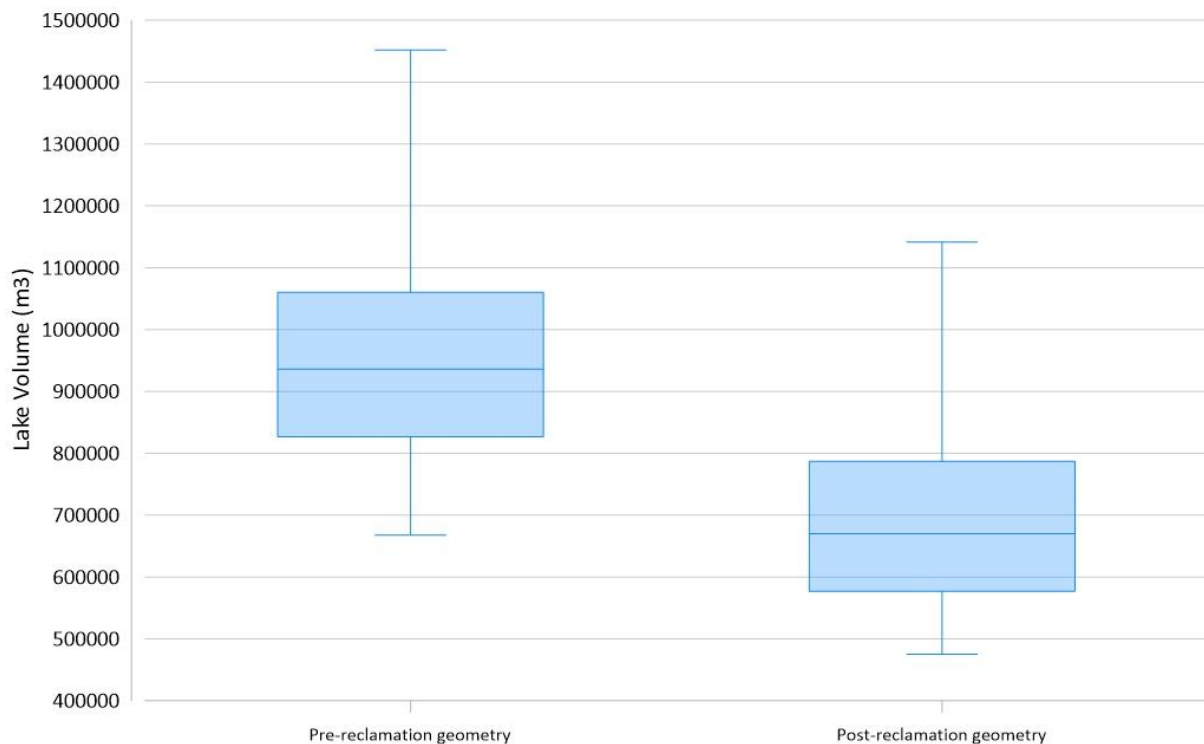


Figure 8.9: Statistical distribution of simulated lake volume ranges for pre-reclamation and post-reclamation pit geometries.

- 8.9.14 The water balance model indicates that a maximum post-restoration pit lake level of approximately 286 mAOD may be expected, with a corresponding volume of 1,140,000 m³. If the groundwater regime behaves in a manner consistent with the present day and that the surface water catchments remain unchanged relative to those associated with the current proposed landform, the findings suggest that there is little risk in the pit lake overtopping post-closure.

Climate Change Scenarios

8.9.15 The pit water balance model for the post-restoration scheme topography was run using selected synthetic climatic timeseries from an ensemble of projections; these account for potential climate change effects on rainfall and temperature in the future. The climate change projections were derived using the UKCP 18 RMP 8.5 (high emissions) ensemble as a conservative assumption. Three climate change timeseries were selected from the climate change modelling ensemble to reflect a range of conditions:

- Driest: Lowest hydrologically effective rainfall (precipitation – potential evapotranspiration).
- Average: Mid range scenario with average hydrologically effective rainfall.
- Wettest: Scenario with the most hydrological effective rainfall.

Level

- 8.9.16 The statistical distributions of water levels for these climate change water balance models are shown in **Figure 8.10** in relation to the 'historical climate' scenarios. All three future climate scenarios result in an increase in the maximum simulated pit lake level. The highest lake level of 290 mAOD is simulated in the wettest climate change projection. Whilst median pit lake levels are higher across all climate change scenarios, it is notable that both the interquartile range and minimum/maximum ranges are also increased. This reflects more variability in seasonal climatic trends (temperature, rainfall), a wider long-term range in annual rainfall and temperature due to the progressive effects of climate change, increases in the frequency and intensity of extreme rainfall events but also the increased prevalence of hot, dry periods leading to lower simulated pit lake levels than would be expected using historical climatic records.

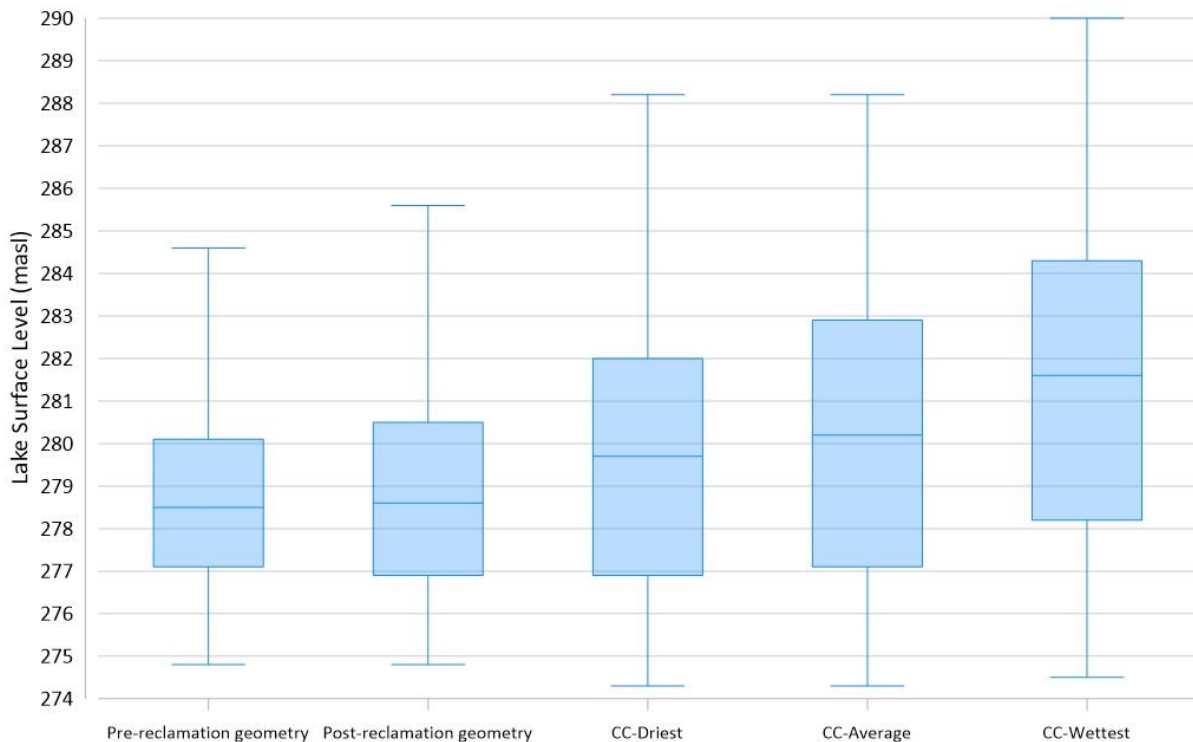


Figure 8.10: Statistical distribution of simulated lake level ranges for pre-reclamation and post-reclamation pit geometries, including climate change scenarios.

Volume

- 8.9.17 A similar picture emerges with respect to the pit lake void volume, which is apparent in **Figure 8.11**. Maximum simulated pit lake volumes are greater in all climate change scenarios relative to the post-restoration historical climate scenario, reaching a value of just over 1,500,000 m³ for the wettest projection. This represents 16 % of the available storage within the void. The range of simulated pit lake volumes is greater in the climate change scenarios reflecting greater climatic variability and increased occurrence of extreme temperature and rainfall events.

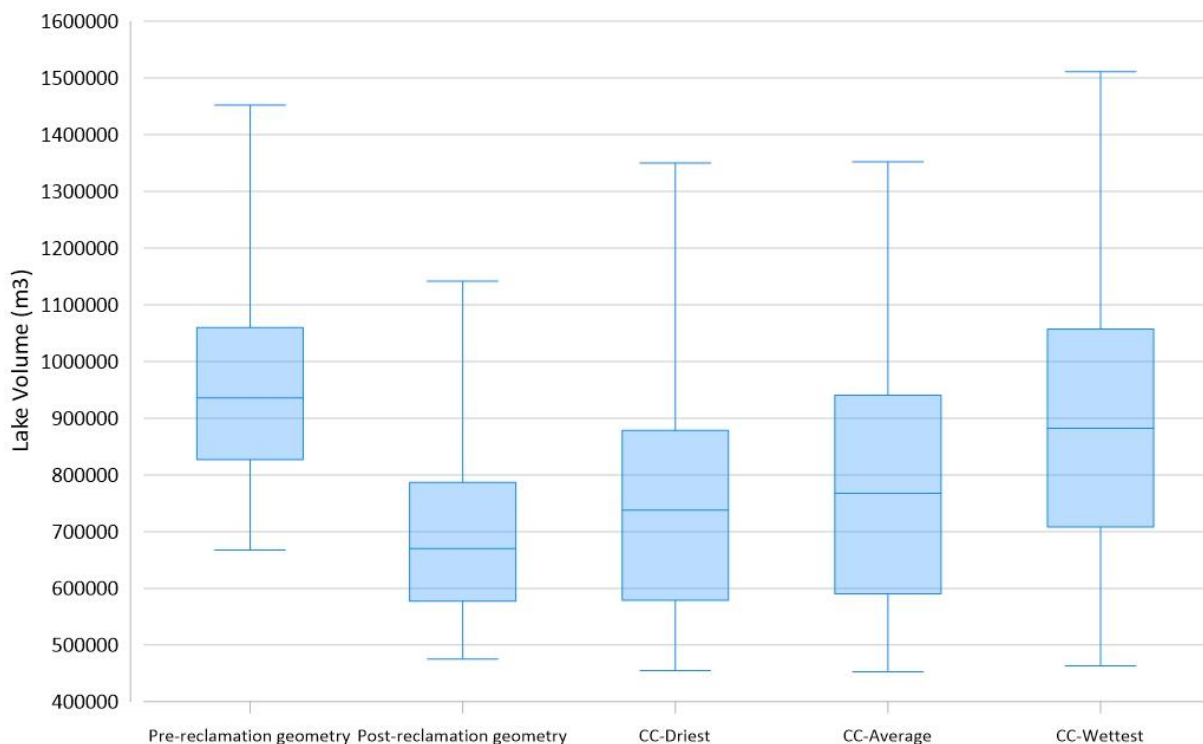


Figure 8.11: Statistical distribution of simulated lake volume ranges for pre-reclamation and post-reclamation pit geometries, including climate change scenarios.

- 8.9.18 The water balance model climate change scenarios indicate that a future, wetter climate that experiences more extreme rainfall events may result in an increase in maximum water levels and lake volumes within the void. If the assumptions made in the development of the water balance model remain valid, these findings indicate that the lake stage should remain below the spill elevation of the void, and as such that there is negligible risk of the pit lake overtopping.

8.10 Summary of Effects

8.10.1 Hydrogeological impacts and effects of the proposed restoration scheme are summarised in **Table 8.3**. The table includes an evaluation of the significance of any impacts and the risk posed by the assessment outcomes, as well as suggested actions including mitigation measures and environmental monitoring.

Table 8.3: Summary of impacts, significance and risk level, and any mitigation or monitoring that is required

Assessment	Impact	Significance / Risk	Mitigation / Monitoring required
Regional groundwater users	No effect on groundwater users or groundwater supply within the search area. Limited to the immediate pit void area and of <1m change in groundwater level for both wet and dry periods.	Insignificant	Continued monitoring of the pit lake level as a proxy for groundwater level.
WFD groundwater bodies	No change in groundwater level or aquifer dynamic resulting in change to flow that could affect quantitative WFD indicators	Insignificant	None
WFD surface water bodies	No change in groundwater discharge to surface water bodies, either through the groundwater system or groundwater pathways, that are large enough to affect quantitative WFD indicators.	Insignificant	None
Post-reclamation pit lake level	Simulated maximum pit lake level remains > 40 metres below the spill point.	Highly unlikely	Continue pit lake level monitoring through reclamation and closure. Continual validation and update of the pit lake water balance model with latest monitoring data.

Climate change effects to pit lake level	Projected climatic changes lead to higher maximum pit lake levels that are still .40 metres below the lake spill elevation.	Highly unlikely	Continue pit lake level monitoring through reclamation and closure. Continual validation and update of the pit lake water balance model with latest monitoring data.
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Cumulative Effects

- 8.10.2 Cumulative effects relevant to this assessment relate only to the compound change in groundwater discharge to surface water bodies via the groundwater pathway and the DFDS, discussed in Sections 8.7.3 and 8.7.4 respectively.
- 8.10.3 Conservatively assuming that the maximum cumulative effect can be calculated as the sum of the maximum change at any given time in the assessment period of the groundwater model simulation, it can be said that the greatest cumulative effect to groundwater discharge to surface water occurs to the Nant Morlais culvert. This involves an increase of 0.6 m³/d attributed to groundwater flow through the groundwater pathway, and an increase of 173 m³/d through the DFDS. Given that the increase in the flow through the DFDS is three orders of magnitude greater than the change simulated through the groundwater pathway, it can be said that the impact of the cumulative effect is the same as impact owing to the change to DFDS discharge in isolation. Therefore, it can be said that the cumulative impact represents an acceptable range of flow deviation as presented in the JNCC Common Standard Monitoring for Rivers (<5% deviation at <Q95, <10% deviation at >Q95).

Summary of Significant Effects

- 8.10.4 The hydrogeological impact assessment of the proposed restoration scheme implementation does not identify significant effects that require mitigation or adjustments to the proposed plans.
- 8.10.5 The pit lake level should continue to be measured and reviewed on a regular basis in the future regardless of whether the restoration scheme is implemented or not. This data, as well as climatological observations, should be used to update and validate the pit lake water balance model to increase confidence in future projections of potential pit lake level range. Furthermore, groundwater levels both within the site area and within the hydrogeological search area should continue to be monitored to confirm the absence of impact to groundwater users.

- Environment Agency (2021). Potential Evapotranspiration (PET) datasets
- Hollis, D. et al. (2019). HadUK-Grid—A new UK dataset of gridded climate observations. *Geoscience Data Journal*, 6(2), pp. 151-159
- JNCC (2016) Common Standards Monitoring Guidance for Rivers, Version September 2016, ISSN 1743-8160.
- NRW (2017) South-East Valleys Abstraction Licensing Strategy: A Licensing Strategy to Manage Water Resources Sustainably.

9 Hydro-Geochemical

By Mine Environmental Management – MEM

9.1 Introduction

9.1.1 The hydrogeochemical assessment for this site mainly focuses on potential sources of soluble parameters of potential concern (e.g. manganese) with respect to the final restoration plan. This includes exposed pit walls, backfill material within the pit void, overburden material placed in OB1, OB2 and OB3 and other sources not related to the recent mining operations such as drainage from old mine workings (adits) and offsite sources such as landfills. These sources have been identified based on the potential to produce runoff or seepage which could have elevated load of suspended/dissolved solids or parameters of potential concern which then flow into receiving hydrological and hydrogeological waterbodies identified onsite as well as those downgradient identified as receptors.

9.1.2 Several previous hydrological and hydrogeological assessments have been undertaken on the site and are described in Sections 8 and 10.

9.1.3 A hydrogeological assessment was undertaken by R.G Edwards (Independent Consulting Engineering Geologist) and reported in the Environmental Statement for the original Ffos-y-Fran Land Reclamation Scheme. The assessment found that the mine water quality was generally good with no elevated contaminants and are typically alkaline with a high capacity to neutralise any acidic issues and therefore the potential for acid rock drainage was low.

9.2 Scope of the Assessment

9.2.1 The main purpose of the hydro-geochemical assessment is to detail potential impacts that implementation of the restoration scheme may have on surface water and groundwater quality in identified receiving waterbodies. The geochemical risk of identified remaining exposed mine rock or soil is also considered, although this is assumed to be of lower concern as for the most part areas will be reseeded and revegetated.

9.2.2 One of the main outcomes of the study is presentation of a technical assessment that indicates the potential future water quality of the waterbody formed in the pit void and identification of any significant risks to receiving groundwater and surface water.

- 9.2.3 The scope of the assessment also includes development of an acid mine drainage risk assessment to cover the pit void and overburden sites. Full details of the assessment can be found in **ES Volume 3 Appendix 9A: Ffos-y-Fran Final Restoration Scheme Acid and Metalliferous Drainage (AMD) Risk Assessment**.
- 9.2.4 The restoration plan relevant to the hydrogeochemical assessment completed is described as follows:
- 9.2.5 Reduction in height and reprofiling of the western parts of OB1, which is likely to stabilise the landform further and reduce potential erosion of material. Material moved from OB1 will be used as backfill around the pit void.
- Main void has been backfilled to a level of approx. 250 metres AOD against the highwall rising to a higher shelf of approx. 267m AOD at the base of the backfill slope.
 - Following cessation of pumping the lake level rose to just over the expected minimum groundwater level. As such, and described in section 6.2 above, the lake has been incorporated into the scheme as a permanent body of water and has stabilised at an average level of around 280 mAOD.
 - Overburden and backfill areas will be revegetated by numerous methods such as cultivation & seeding, hydroseeding, natural revegetation and some areas of tree planting.
 - The eastern wall of the open pit will not be actively revegetated and is likely to remain as exposed rock with visible strata.
 - Partial restoration of lower slopes on OB2 and OB3 including planting or hydroseeding with woodland tree mixes.
 - A 5-year establishment/aftercare/maintenance period is included in the restoration plans.

9.3 **Legislation and Policy**

- 9.3.1 The legislation and policy this assessment will consider includes the following regulatory, policy and guidance documents:
- a) The Water Environment (Water Framework Directive) Regulations 2017 which commits to achieving good status water environments, where good status is based on ecological and chemical protection. The chemical status of a water body is determined by compliance with environmental quality standards for chemical substances prioritising hazardous chemicals. The aim of the water framework directive is for water bodies to achieve 'good overall status' and prevent deterioration.

- b) The Groundwater (Water Framework Directive) (Wales) Direction 2016 (2016 No. 14). Groundwater bodies are evaluated for chemical status as are those groundwater bodies which serve protected receptors, such as groundwater dependent habitats and/or public water supply abstractions. The aim of the groundwater directive to protect groundwater against pollution and deterioration and achieve good chemical condition.
- c) Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017 as described earlier are a guide to the requirements of the EIA assessment.
- d) Environmental Permitting Guidance The Mining Waste Directive (2010) also includes relevant references for prevention of pollution of soil and water and the requirements of adequate closure of mined areas.
- e) Planning Policy Wales (Edition 12), Technical Advice Notes (TANs) and Circulars (including Minerals Technical Advice Note 2: Coal, Minerals Planning Guidance: The reclamation of mineral workings, Mineral Workings – Legal Aspects Relating to Restoration of Sites With a High Water Table (60/85)) are also relevant to this assessment
- f) Directive 2006/21/EC on the management of waste from extractive industries. It is commonly referred to as the Mining Waste Directive (MWD). Although the UK is no longer in the EU, the MWD is a useful reference in absence of specific UK based mine waste legislation being produced.
- g) Relevant international guidelines include the International Council on Mining and Minerals (ICMM) Integrated Mine Closure: Good Practice Guide (2nd edition) 2009 which is a dynamic and iterative process that considers environmental, social and economic concerns.

9.3.2 In particular, the following points from the EPR mine waste permitting and guidance are pertinent to this assessment: -

- A closure and aftercare procedure, including stabilisation and minimising negative effects, for mining waste is only required if the mine waste is classified as either Category A, Hazardous or Non-Hazardous. However, a waste management plan for all mine waste should still include the closure period. The mine waste facilities at Ffos-y-Fran have not to date been classed as Category A facilities
- Requirements to prevent the deterioration of water and soil quality is required for most mine waste types, this includes a requirement for an

environmental permit for site operation (as described above for Ffos y Fran).

- Inert waste is waste that will not react, and which will not affect other matter in a way likely to rise to environmental pollution or harm human health. Overburden samples, as tested in the EMMS, were defined as inert waste. Inert waste is classified as that with low sulphide content and low risk metals and hazardous substances.
- The waste management plan requires the return of extractive waste to the void, but where it is technically and economically feasible and environmentally sound.
- The 'no potential hazard' in the above point is defined as any necessary measures would only provide a negligible contribution to meeting relevant environmental standards and preventing the deterioration of the water status (i.e. the mining waste facility would pose no potential hazard to water or soil), and any measures can be waived as the facility poses an acceptably low environmental risk.
- The quantity and quality of leachate and the overall water balance for mine waste facilities should be demonstrated for inert waste facilities for closure.
- Settlement ponds only managing clean runoff are not considered as part of the mine waste requirements.
- Monitoring and management of the mine waste should continue in the closure period until the facility no longer poses any unacceptable risk.
- If waste is placed back into a void the waste must be physically stable, pollution of soil and water prevented, and appropriate monitoring of the void and the waste takes place for as long as necessary. Contaminated leachate or water should also be collected and if necessary, treated prior to discharge in some cases. Mine waste stored in a void is not designated as a mine waste facility.
- Where waste is placed in flooded excavation voids it must be demonstrated that water and soil status deterioration and pollution is not caused. Inert waste can be placed back into such a void, should the following be possible (unless the mining waste poses no potential hazard to water and treatment of leachate is not necessary):
- Determination of the water balance of the waste facility, including evaluation of the volume and quality of leachate from the waste
- Prevention or minimising leachate generation and preventing or minimising contamination of surface water, groundwater and soil

- Collection and if necessary, of potentially treatment of contaminated leachate or water

9.3.3 The mine currently has the following permit documents pertinent to water quality and the permits relate to activities at the site during active operations with the activities listed within the permits:

- Permit number EPR/DB3131AF
- Consolidated permit number AE2013403
- Variation and consolidation application number PAN-018818, 9th August 2023 – inclusion of flocculent
- Variation and consolidation application number PAN-018819/PAN-018820

9.3.4 As part of the planning conditions for mining at the Ffos y Fran site, a groundwater monitoring scheme to protect groundwater was required to be in place as part of condition 44 and approved by the planning authority. The frequency, parameters measured and trigger levels for parameters were agreed with authorities and regulators in 2003. Water quality was originally monitored at 17 locations, surface water, culverts, boreholes and piezometers.

9.3.5 Condition 44 requires groundwater water quality samples are taken on a quarterly basis, although should trigger levels for parameters be breached sampling frequency increases to monthly. Surface water quality is monitored quarterly but also required after specific dry periods or storm events for the River Taff, Bargoed Taf, River Rhymney and culvert locations in sample points 1 – 10.

9.3.6 Pollution alert trigger values (PAVs) were derived based on baseline dataset (pre-2003) using Miller Argent, historic Environment Agency data and Celtic Energy data. These trigger alerts were designed to show where a value might be greater than the current range for the site and be an indicator of a potential pollution issue that requires investigation or mitigation. The PAVs are described in **Table 9-1**. Where trigger levels are exceeded additional monitoring and investigation occurs. Data and exceedances of PAVs are provided to the NRW. Reviews of the data with the NRW were agreed quarterly and then annually (from 2015) as the site was a low level of concern by NRW.

9.3.7 An Extractive Materials Management Statement completed in 2010 on the FLRS included some basic samples and analysis of materials on the site, and an overview of the volume of overburden in the storage areas and volume removed from the pit void. The document also describes some of the soil and geology on the site, as

well as the current water treatment areas on the site (mostly series of settlement ponds for sediment).

- 9.3.8 As required by legislation, the EMMS classified waste to be handled on site. Overall, the quantity of material to be extracted on site was expected to be 125,527,999 cubic metres (including soils). Around 80% of this material is classified as overburden, other materials included barrel wash rejects, settlement pond silts, superficial material and colliery spoil. The overburden was classified as inert based on chemical testing of the material (low sulphide and metals content) with respect to the EC Directive 2006/21/EC. Three overburden storage areas were in place.

Table 9-1 Pollution alert value (PAV) trigger parameters and levels

Parameter	Unit	Pollution Alert Value (PAV)
pH	s.u.	6.5 – 8.5
EC	uS/cm	2000
TSS	mg/L	50
BOD	mg/L	6
DO	mg/L	<5
Ca	mg/L	250
Mg	mg/L	100
K	mg/L	40
Na	mg/L	170
Fe	mg/L	1
As	mg/L	0.01
Hg	mg/L	0.001
Se	mg/L	0.01
Ba	mg/L	0.5
B	mg/L	0.3
Al	mg/L	0.5
Mn	mg/L	0.25
Cu	mg/L	0.2
Pb	mg/L	0.1
Zn	mg/L	0.1
Se	mg/L	0.01
Mo	mg/L	0.05
Cd	mg/L	0.005
Cr	mg/L	0.03
Ni	mg/L	0.1
Alkalinity	mg/L CaCO ₃	
SO ₄	mg/L	400
Cl	mg/L	250
N	mg/L	5
Ammoniacal N	mg/L	0.5
S	mg/L	0.03
F	mg/L	1.5
P	mg/L	0.2
VFA	mg/L	40
PAH (totals)	ug/L	0.2
PCB (totals)	ug/L	1
Phenols (monohydric)	mg/L	0.5
VFAs species	ug/L	5
PAHs species	ug/L	0.2
PCBs species	ug/L	0.01
OCPs species	ug/L	0.01
OPPs species	ug/L	1

9.4 Baseline Conditions

- 9.4.1 The full description of the baseline conditions is provided in the AMD assessment (**Appendix 9A**). The assessment includes a detailed analysis of previous site investigations, extensive site monitoring data, additional geochemical analysis of backfill and overburden material and further off-site monitoring of identified key discharge risk areas. The assessment also included monitoring data from the Trecatti landfill site as well as an ecological assessment of the Bargoed Taf watercourse.
- 9.4.2 A visit to site was undertaken in July 2024 to provide an initial understanding of the site and develop the conceptual understanding of the hydrogeochemical setting for the AMD assessment.
- 9.4.3 The baseline is taken as recent environmental setting, monitoring and reports for the last 3 years. However, given the length of data available for the site, older data is used to provide additional background information and comparison to potential prior baseline conditions.
- 9.4.4 The hydrogeology and hydrology of the site has been described in the relevant chapters of this ES. A short summary of these elements is included within the AMD assessment (**Appendix 9A**).
- 9.4.5 Water quality monitoring at Ffos-y-Fran has been ongoing since pre-2003 across multiple owners of the site (Miller Argent and MSW). Monitoring is completed by Socotec on behalf of MSW. An overview of the monitoring points included in the MSW dataset are shown in **Figure 9-1**.
- 9.4.6 Parameters monitored are typically those described by the Condition 44 requirements, including physico-chemical indicators (pH, TDS, TSS), major ions, metals, nutrients and organic suites. Parameters include potential risks from the operational works such as organics relating to fuel use, nitrogen (from ANFO use), sulphate and metals for AMD risk. Other parameters, such as mecoprop and tritium were added due to the proximity of the Trecatti landfill to the site, and the potential risk from this source.
- 9.4.7 Where long monitoring records are available, such as monitoring at the MA points, the records show for many parameters show little change from monitoring in 2003 to that in the present day.
- 9.4.8 A full discussion of the water quality dataset is found in **Appendix 9A**. Typically, the pH is neutral to slightly alkaline (7.5 – 8.5) and positive alkalinity is reported in

laboratory analysis of water samples. The water types are typically dominated by Mg-Ca-HCO₃-SO₄ ions. The surface water samples in the Bargoed Taf and Nant Gyrawd are characterised by high sulphate and low alkalinity. Groundwater in and around the mineralised zone of the pit void is typically higher in concentrations of magnesium, sulphate and certain metals such as iron, manganese and selenium. A number of these metals are elevated above PAVs at numerous locations, including:

- a) Mn – exceeded in discharges from MA05 and MA06, the mine void, groundwater within the pit area, Nant Morlais, Bargoed Taf, Nant Gyrawd and Rhymney (MA09 and MA10).
- b) Se – exceeded in discharges from MA05 and MA06, in pit groundwater and Bargoed Taf and Nant Gyrawd.
- c) Fe – exceeded in discharges MA05 and MA06, the mine void, in pit groundwater, groundwater away from the mining area, Bargoed Taf, Nant Gyrawd, Rhymney and Nant Morlais.
- d) Al – exceeded in discharges MA05 and MA06, in pit groundwater, Nant Morlais, Bargoed Taf and Nant Gyrawd.
- e) Ni – exceeded at discharge MA06, Nant Gyrawd, Rhymney and mine void waterbody
- f) Zn – exceeded at discharge MA06, Bargoed Taf and Nant Gyrawd
- g) Pb, Cu – occasionally exceeded in some of the groundwater locations away from the pit void
- h) As – exceeded in 5812, this is not seen as an exceedance in any other monitoring locations and may be linked to the higher ammonia potentially linked to the landfill site.
- i) Groundwater data between 2012 and 2014 show higher levels of a range of metals, however these do not appear to match the trend before or after in the dataset, therefore these exceedances may be errors in the data and are not discussed here.

9.4.9 Potential contamination (mainly as ammonia) was recorded in some of the monitoring points between the pit void and the Trecatti landfill site.

9.4.10 Overburden and backfill samples were taken as part of a site visit in July 2024. The samples were sent to Geochemic Ltd for preparation with analyses completed by

ALS OMAC Laboratories Ltd for metals, Sulphur and carbon analysis. Overall, the results indicate that samples are low risk with respect to metals based on comparisons with SGVs and low risk for acid forming risk based on sulphide content and an assessment of the balance between potential acid and neutralisation potential (acid base accounting). Based on the regulations and EMMS discussed previously herein the samples are classified as inert waste. The results of the analysis of the samples were like the original EMMS samples which were also classified as inert waste (i.e. the results provide a degree of validation of previous assessment).

- 9.4.11 It was noted during the site visit and on satellite photos that there is an area of orange (iron) staining at an overflow pipe south of OB3 (MA06), and in and around the settling ponds to the south of OB3. MSW undertook additional water sampling in this area. Monitoring included pH and major ions to allow identification of water type and comment on the characteristics of the source of the water, as well as a suite of metals/metalloids analysis to assess potential metalliferous drainage risk. Results indicate that magnesium, potassium and sulphate (as is found at MA6, MA7 and MA8) are elevated and are found above PAVs in all the samples. Iron and manganese are elevated in two and three samples respectively but are not elevated in the outfall from the settling ponds to the stream or at the downstream monitoring locations. This suggests the settling ponds are currently working effectively to reduce residual metal loads from OB3 seepage. The outfall (WF5) has a small area of wetland/boggy ground just below the outfall location which may also be helping to attenuate metals close to the outfall area.
- 9.4.12 The Trecatti landfill site is operated by Biffa and located to the north-east of the Ffos-y-Fran site. Ammonia measured in the perimeter boreholes is elevated, above the PAVs for Ffos-y-Fran. It is highest (over 10 mg/L) in GW02 which is the borehole closest to the pit void. Monitoring data available for metals tends to show relatively low concentrations, however iron occasionally shows spikes above the Ffos-y-Fran PAVs. Zinc is also elevated above the PAVs at several locations, at GW02 where the concentrations is over 2.5 mg/L. The records available for mecoprop and tritium include earlier data (2010 – 2013) which was included in Ffos-y-Fran's water quality monitoring data. This is because there was perceived to be a risk of contamination during conversations with NRW regarding monitoring. Current concentrations of mecoprop appear to be low again, however tritium is still slightly elevated in GW02.).

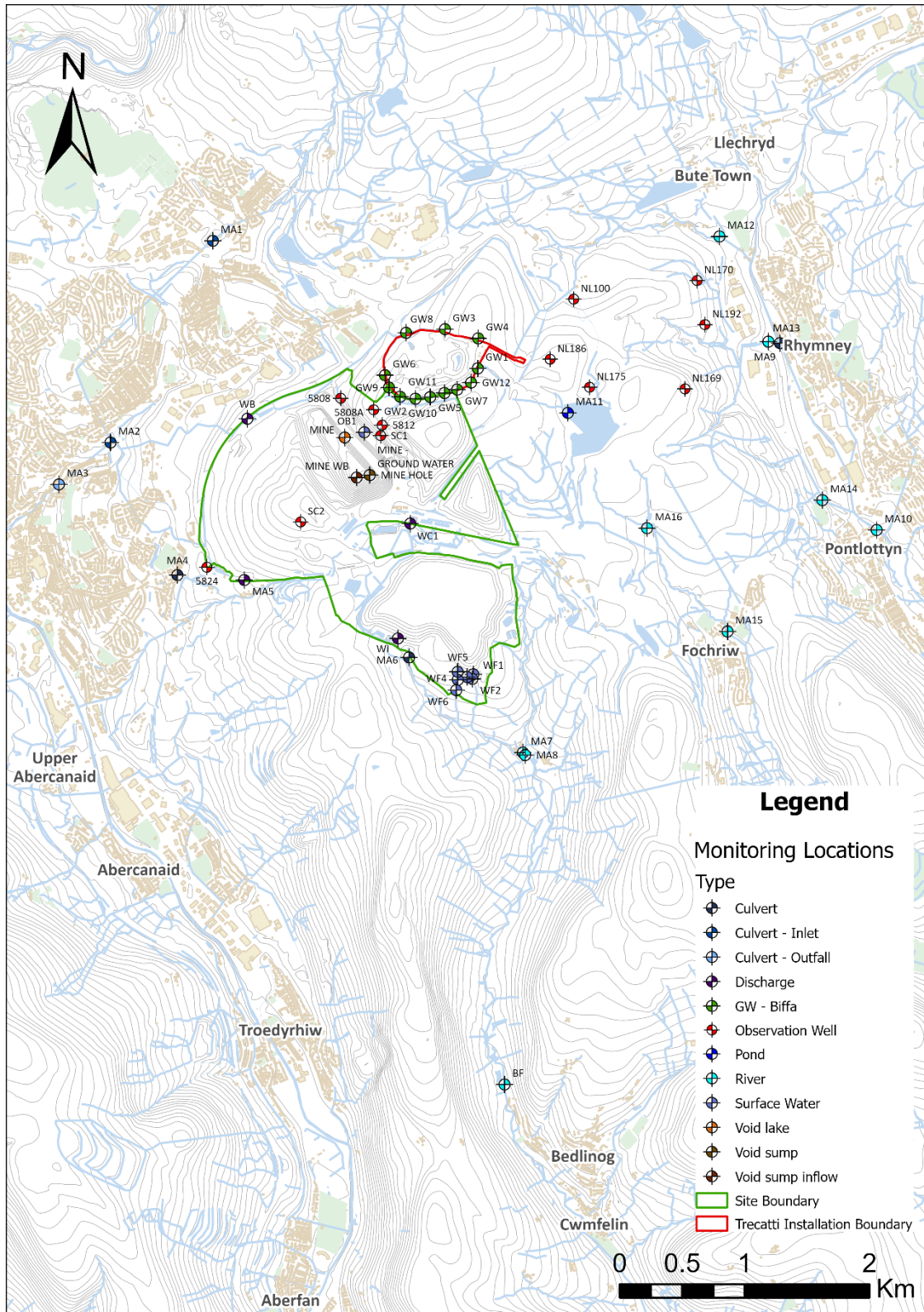


Figure 9-1 Location of water quality monitoring points

9.5 Assessment Methodology

9.5.1 The assessment has been carried out based on conceptualisation of a source-pathway-receptor methodology for identified potential sources of contamination. The pathways and receptors link into the hydrology and hydrogeology flowpaths and receiving waterbodies. The receptors currently monitored are included as the main receptors in the assessment.

9.5.2 Potential impacts are assessed as changes to water quality in onsite and/or receiving water bodies such that current discharge criteria or PAVs would not be met, or a deviation from the current baseline which would cause a change in the status of the waterbodies would occur.

9.5.3 A description of the source, pathway and receptors for the assessment are provided below. The assessment uses a buffer zone of 3 km around the site boundary and includes sources, pathways and receptors within this. The 3km boundary was identified based on the expected dilution of any sources by groundwater and surface water within/beyond this zone.

Sources

9.5.4 The key water quality risks following the restoration scheme relate to those current sources which will remain a source following restoration. As nitrogen and organics were only used during operations it is likely these were (are) relatively quickly flushed from the system. For nitrogen, it should also be considered that other sources in the surrounding land, such as the Trecatti landfill and grazing pasture are also likely to be significant sources of nitrogen. This assessment focuses on the key risks from acid and metalliferous drainage following the restoration scheme, which is essentially any risk remaining from overburden, backfill or exposed pit walls.

9.5.5 The following sources are considered within the assessment:

- Overburden areas - the material placed is considered relatively low risk as it is classified as inert based on current and previous sampling of the material. However, given the nature of the material (mine waste) the material and overburden areas will be assessed for their potential to be a source of poor-quality water for conservatism for the purposes of this assessment.
- Overburden areas – localised sources. Following site inspection and subsequent laboratory analysis of water samples, an area of poorer quality drainage was located to the south of OB3. An assessment of

this drainage is included as a potential source of impacted quality water post-restoration.

- Pit void waterbody – following cessation of mining a waterbody has formed within the pit void. This is a potential source of impacted quality water. The backfill within the pit is considered mostly low risk (based on material testing completed to date) and it is placed mostly downgradient relative to groundwater flow direction and orientation of the pit void so unlikely to be a major chemical load contributor to the overall water quality. Runoff from the pit walls and groundwater inflow may potentially be a source of impacted quality water and will be included within the pit void water body assessment.

Pathways

9.5.6 The major pathways for the movement of impacted water quality towards receptor locations is from existing surface and groundwater drainage flow paths. These are more fully described in Section 8 and Section 10 and the surface water network is shown on **Figure 9-1**. The following are the key pathways considered during the assessment:

- Groundwater flow to the south and west based on the main flowpath in the groundwater body.
- Groundwater flow via old workings and the Dowlais Free Drainage System.
- Surface water flow as the following:
 - Discharges from the DFDS into the Nant Morlais catchment
 - Discharges from the DFDS into the River Rhymney
 - Discharges from overburden areas into neighbouring surface waterbodies
 - Discharges from existing OB3 seepage and outfall area to the Bargoed Taff
 - Discharge from groundwater into the River Taff from the pit void

Receptors

9.5.7 Potential receptors were screened for the assessment and the following locations have been considered for effects analysis:

- Current locations which are being monitored or designated as permitted discharge points based on the likely pathways for the sources identified, including the following:
 - Bargoed Taf waterbody downstream of OB3

- Groundwater monitoring point at 5824 – the groundwater point in the downgradient flowpath of the pit void waterbody as the groundwater leaves the property boundary.
- Potential ecological receptors (internationally or nationally recognised) are all outside of the 3 km assessment boundary, as such these locations are screened out of the assessment.
- Water abstractions and supplies within the 3 km assessment area and downstream or downgradient of the potential sources are as follows (grid coordinates are not provided due to privacy requirements):
 - 1 surface water abstraction licence relating to abstraction for angling from the River Rhymney (21/57/11/0001).
 - 2 licences associated with surface water abstraction for angling from the Taf Bargoed (21/57/22/0032 and WA/057/0021/001)
- WFD classified surface water and groundwater bodies as outlined in **Table 9-2**.
- The pit void water body is considered as simultaneously a source and a pathway and so is not exclusively considered as a receptor. Post-restoration water quality objectives have not been defined (At the time of writing) for this water body and as such existing PAVs are used as indicative values to assess potential impacts to the water body (when considered as a receptor).

Table 9-2 WFD waterbodies within the 3 km assessment zone

WFD water body	WFD classification	Overall rating	Chemical rating	Reasons for not achieving good
Taff – confluence with Taf Fechan to confluence with River Cynon	River	Moderate	High	Mit_Assmnt*
River Rhymney - source to confluence with Nant Bargoed Rhymney	River	Moderate	High	Fish
Nant Morlais - source to confluence with River Taff	River	Moderate	High	NH3; Mit_Assmnt
Nant Bargoed Rhymney - source to confluence with River Rhymney	River	Poor	High	Fish
Taff Bargoed	River	Moderate	High	Mit_Assmnt*
Taf Fechan - source to conf Afon Taf Fawr	River	Moderate	High	Mit_Assmnt*
SE Valleys Carboniferous Limestone	Groundwater	Good	Good	
SE Valleys Carboniferous Coal Measures	Groundwater	Poor	Poor to Good (dependent on indicator)	Groundwater/surface water chemistry

9.6 Assessment of Effects

9.6.1 A full description and results of the AMD assessment can be found in **ES Volume 3 Appendix 9A**.

Overburden

9.6.2 The overburden, backfill and soil forming material has been subject to sampling and testing during the 2024 assessment and as part of the EMMS. The analyses on samples taken from both studies suggest that the material is typically inert (based on NPR, sulphide content and metal risk) and is therefore classified as low risk with respect to the potential leaching of acid and metalliferous drainage.

9.6.3 Existing impacted drainage water quality from the south of OB3 has been identified as a potential AMD risk (close to MA06). This area is deemed a potential source of poorer quality water to the receiving environment. No other areas of concern were identified during the site visits, and review of monitoring data and

studies of satellite images of the overburden areas. This area underwent additional sampling and analysis to assess the risk. The water chemistry was found to be very similar to what has been monitored and assessed at this location past (since 2011) suggesting that impacts are not likely significantly increasing over time.

- 9.6.4 Surface water quality sampling and analysis indicates that manganese, iron as well as magnesium, sulphate and potassium are elevated (relative to adopted assessment criteria) in some of the drainage from around MA6 and the settling ponds to the south of OB3. Based on assessment of reviewed water quality data the settling ponds appear to be mitigating metalliferous drainage impacts from the southern portion of OB3, reducing the metal load in receiving water to below the site guided PAVs. Water quality data suggests that the outfall around MA6 is diluted such that downstream in the Bargoed Taf watercourse much of the metal load is reduced to more acceptable levels (presumably following dilution).
- 9.6.5 Historically monitoring data from OB3 and the Bargoed Taf has shown the same or similar metalliferous drainage risk profile since around 2011 (**see ES Volume 2 Appendix 9A**). An ecological assessment was completed in the Bargoed Taf watercourse in 2014 and 2015. Based on the ecological assessment the monitoring points identified were assigned as good biological quality for the waterbody and discharges from the site in this area were assessed as having minimal impact to the waterbody.
- 9.6.6 Hydrogeological studies suggest that the volumes of interflow to surface water and recharge to groundwater are relatively similar between the pre- and post-restoration scenarios, they both increase slightly, for groundwater this is only 4%. The total volume of water entering the surface water is predicted to reduce by 17% post-restoration (as interflow and runoff).
- 9.6.7 Seepage chemistry and interflow to surface water is, as a conservative estimate, unlikely to significantly change from the current drainage chemistry. This assumes that the chemical load as seepage from the overburden areas will continue at the current condition. The waste is classified as inert, and as such is likely to have a relatively low risk for metal and sulphate drainage and is non-acid generating. The overburden areas have been in place for 15 years + and as such a proportion of any geochemical load present (or developed) within the facility will likely have drained down and been flushed through. It is not expected that the revegetation and reprofiling restoration for the overburden areas will significantly change the geochemical conditions within the overburden or the resulting chemical quality of

the drainage. Thus, current drainage quality and flows reporting as seepage to groundwater and interflow to surface water can reasonably be expected to remain similar for the post closure period.

- 9.6.8 Runoff and related potential suspended sediment load (from runoff) is assumed to be likely to reduce following revegetation. This is because revegetation typically reduces the quantity, intensity and speed of runoff (compared to bare surfaces). The vegetation can also reasonably be expected to provide a degree of protection for the soil and waste material from erosion given the potential of vegetation to stabilise the soil and material over time. These factors mean that typically after vegetation establishment the potential suspended sediment load generated during a rainfall event decreases. As such, the instances (and magnitude) of higher TSS events will likely reduce, and the risk for suspended sediment to the watercourses will reduce following restoration. As suspended sediment can at times carry chemical load, such as metals sorbed onto particle surfaces, it is likely the overall chemical load from metals/metalloids will reduce in the runoff from revegetated overburden areas
- 9.6.9 Risks from existing sources of drainage – the main surface water drainage risk recorded on site from the overburden areas is around the southern area of OB3. No other AMD risks have been identified within the water quality monitoring data. The origin of this relatively poorer quality water may not be directly from overburden however, as an alternative source is outfall of drainage reporting from local buried mine workings that lie under the waste. As a conservative approach it is assumed that the chemical load in this area will remain at current levels post closure and so will likely to continue to drain into the Bargoed Taf waterbody noting that the drainage from this point has remained broadly stable since 2011.
- 9.6.10 The main risk to downstream water quality from this location is therefore the ongoing function of the settling ponds to manage some of this chemical load. During operations monitoring data suggests that settling pond successfully reduces some of the metal load discharging to the Bargoed Taf waterbody. Management of ponds at Ffos-y-Fran has included regular sediment removal to ensure the settling ponds functioned in terms of water flows and settling time. Following restoration, the post closure strategy is to allow these ponds to naturalise to reduce reliance on ongoing maintenance. It is assumed that as part of naturalisation that sediment and vegetation will increase progressively in these ponds over time, however they are likely to still reduce chemical loads to receiving surface water as they are assumed to act as a natural wetland treatment system

(which are commonly used as a form of passive water treatment at other mine sites in the UK). The efficacy of this process will need to be monitored, and if the transition proves successful the benefits of enhancement of the system by wetland planting can be assessed as the system develops over time (i.e. this could be best described as a nature-based solution).

Pit lake

- 9.6.11 An assessment of the pit lake waterbody with regards to future water quality was undertaken by completing a model of the current and future potential water quality. The full description and results are presented in **ES Volume 2 Appendix 8A**. The model used a water balance developed by Groundwater Science (refer to **Chapter 8**) which describes the key inflows and outflows to the pit void waterbody based on the conceptual model (**Figure 8-1**). The pit void acts as a flow through waterbody, the main inflow and outflow being groundwater. The water balance was modelled for 40 years post cessation of pumping in the pit. No surface water outflows are assumed in the model.
- 9.6.12 Chemical loads were assigned to each key inflow of the water balance, based on recent average concentrations from the baseline monitoring set for the following inflows:
- Groundwater inflows – monitoring point 5812
 - Mine void water quality – mine void groundwater
 - Pit catchment runoff – one off sample OB1
 - In pit runoff – mine void water quality monitoring
- 9.6.13 The chemistry of each inflow was mixed proportionally based on the water balance volumes in an excel based mass balance model. The model was completed on a monthly time step.
- 9.6.14 Selected timestep results from this model are shown in **Table 9-3** and compared against the sites PAVs and the currently monitored mine void waterbody. The model was compared against the early monitored data to ensure it calibrated to the monitoring data.
- 9.6.15 A small number of parameters are elevated, both in the model and in the mine void waterbody monitoring data set. These include ammonia. The source of this does not appear to be in the mine void groundwater, but instead it appears to be from the northeast and the Trecatti landfill. Iron is also elevated in the early model although this reduces quickly. Sulphate, potassium and manganese are also elevated over PAVs in the modelled pit lake waterbody. Manganese (**Figure 9.2**)

is likely to be sourced from the Ffos-y-Fran geology i.e. within the groundwater and potentially found in runoff within the open pit and is likely associated with SO₄ (**Figure 9.3**). The levels are still relatively low.

Table 9-3 Summary of selected pit lake results

Parameter	Units	Average of mine groundwater	PAV	31/08 /2023	30/09/2024	28/02 /2026	31/05 /2030	31/08 /2035	31/12 /2045	31/07 /2055	28/02 /2065
Al	mg/L	0.077	0.5	0.13	0.09	0.08	0.08	0.09	0.09	0.08	0.08
Alkalinity	mg/L CaCO ₃	338		499	378	356	352	377	389	358	355
NH ₃ -N	mg/L	1.16	0.5	1.4	1.1	1.1	1.1	1.1	1.2	1.1	1.1
As	mg/L	0.0011	0.01	0.009	0.004	0.004	0.003	0.004	0.005	0.004	0.004
Ca	mg/L	132	250	115	109	109	109	108	113	107	109
Cd	mg/L	0.00009	0.005	0.00017	0.00011	0.00010	0.00010	0.00011	0.00012	0.00010	0.00010
Cl	mg/L	50.3	250	76	55	51	51	55	57	51	51
Cu	mg/L	0.002	0.2	0.005	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Cr	mg/L		0.03	0.0035	0.0017	0.0013	0.0012	0.0017	0.0017	0.0014	0.0013
F	mg/L	0.14	1.5	0.19	0.15	0.14	0.14	0.15	0.15	0.14	0.14
Fe	mg/L	0.325	1	1.3	0.7	0.6	0.6	0.7	0.7	0.6	0.6
Hg	mg/L	0.00003	0.001	0.00007	0.00005	0.00004	0.00004	0.00005	0.00005	0.00004	0.00004
K	mg/L	51	40	76	58	55	54	58	60	55	55
Pb	mg/L	0.001	0.1	0.004	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Mg	mg/L	106	100	87	88	89	89	87	90	88	89
Mn	mg/L	0.771	0.25	0.54	0.55	0.55	0.55	0.53	0.57	0.53	0.55
Mo	mg/L	0.0016	0.05	0.013	0.006	0.005	0.005	0.006	0.007	0.005	0.005
Na	mg/L	41	170	52	40	38	38	40	42	38	38
Ni	mg/L	0.083	0.1	0.04	0.05	0.05	0.06	0.05	0.05	0.05	0.05
P	mg/L	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
pH	s.u.	8.07	6.5 - 8.5	8.0	8.0	8.0	7.9	8.0	8.0	8.0	7.9
Se	mg/L	0.001	0.01	0.006	0.004	0.004	0.003	0.004	0.004	0.004	0.003
SO ₄	mg/L	455	400	458	425	420	420	419	436	415	420
Zn	mg/L	0.0185	0.1	0.05	0.03	0.03	0.02	0.03	0.03	0.03	0.03

Figure 9-2 Modelled Mn in the mine void waterbody

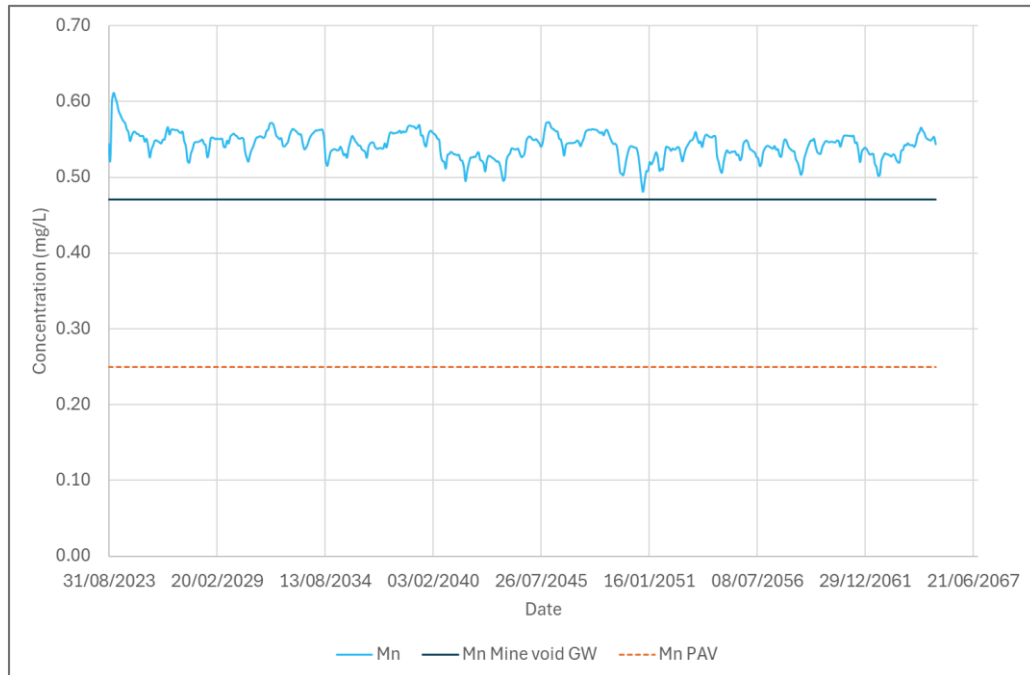
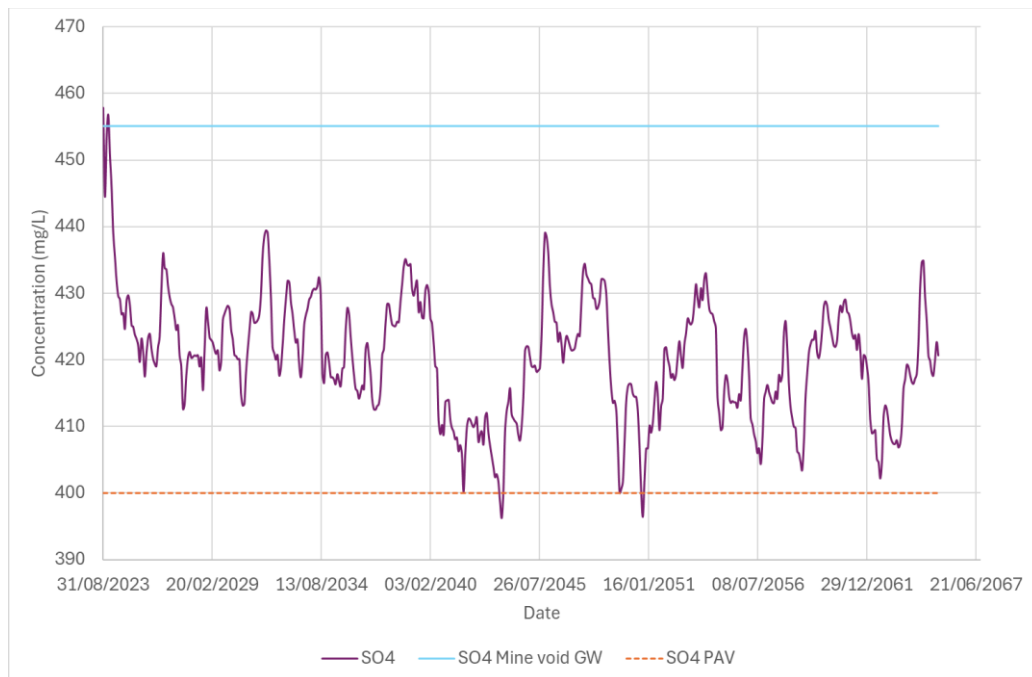


Figure 9-3 Modelled SO4 in the mine void waterbody



- 9.6.16 To assess downgradient effects of the mine void water quality a flowpath model was completed by Groundwater Science). This assessed the proportion of water from the pit lake waterbody that travelled downgradient both within the groundwater and then exited to surface water. The main flow path in the model is to the south-west towards the River Taff. A visual representation of the fraction of water on these flowpaths is shown in **Figure 9-4 and 9-5**.
- 9.6.17 The proportion of groundwater that was originally found in pit void or is discharging from the groundwater and originated in the pit void waterbody is relatively low at points which are identified as potential receptors. The groundwater monitoring location 5824 is at the south-west boundary of the Ffos-y-Fran site and it has been used a receptor location to indicate groundwater quality leaving the site. The mine void waterbody makes up 2% of groundwater at this location.
- 9.6.18 The River Taff to the south-west is also assigned as downgradient receptor based on the flowpath model. The proportion of groundwater that originated in the pit void waterbody is estimated at around 1.4%. The proportion as baseflow groundwater to the River Taff is estimated to be on average 2.5% in that reach.
- 9.6.19 These estimations show the proportion of water originating from the pit void water body that discharges to the wider ground and surface water receptors is very low. There is a large volume of dilution from the wider ground and surface water systems.
- 9.6.20 A dilution model using background groundwater and surface water monitoring data was completed using these fractions and the results are shown in **Table 9-4**.
- 9.6.21 Although sulphate, manganese and ammonia are elevated in the pit void waterbody source term model the levels within the receptor dilution location mixes are much lower, below site PAVs. Phosphorous levels occasionally similar to the PAV in the dilution mixes, however these appear to be related to background baseline groundwater quality rather than from the pit void waterbody as a source.
- 9.6.22 Overall, the dilution mixes suggest the risk to downgradient receptors from the pit void waterbody is relatively low, and only minor changes in baseline chemistry load are predicted.

9.6.23 It is noted that the pit void water body has not been considered as only a receptor as part of this assessment because it is considered a source of potential water quality impacts to downgradient receiving water bodies and simultaneously as a pathway for upgradient groundwater (and related sources) given the flow through hydrological conceptualisation of the water body with respect to groundwater. Modelling carried out suggests that upgradient groundwater quality currently (and in the future) dominates the water quality of this water body, the pit void water quality is assumed therefore to largely reflect groundwater quality. Exceedances of PAVs are noted as follows:

- NH₃-N – this is modelled to be around 1.5 mg/L. The high concentration is in particular linked to the measured ammonia concentration in upgradient groundwater.
- Fe – iron is initially elevated above the PAV but drops to below 1 mg/L within a few months.
- K – remains slightly higher than the PAV (~50 – 60 mg/L) in the model. This is similar to monitored groundwater upgradient of the pit.
- Mn – The modelled concentrations are slightly elevated above site PAVs.
- P – is around the current PAVs, modelled at around 0.1 – 0.2 mg/L. The background P concentrations in baseline ground and surface waters are generally high in the area and chemical load maybe from upgradient sources from the pit void.

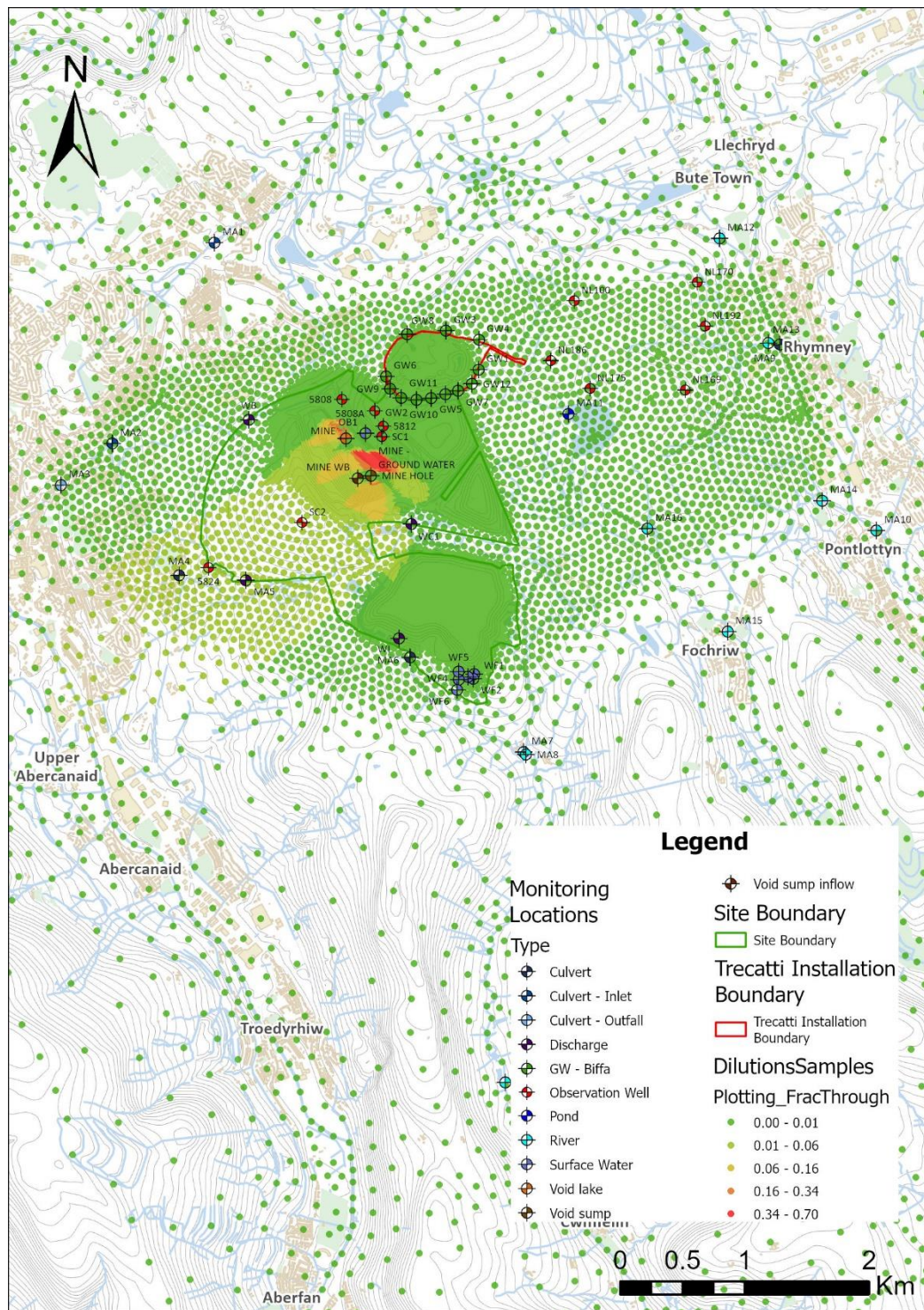


Figure 9-4 Fraction of groundwater that originated in the pit void waterbody

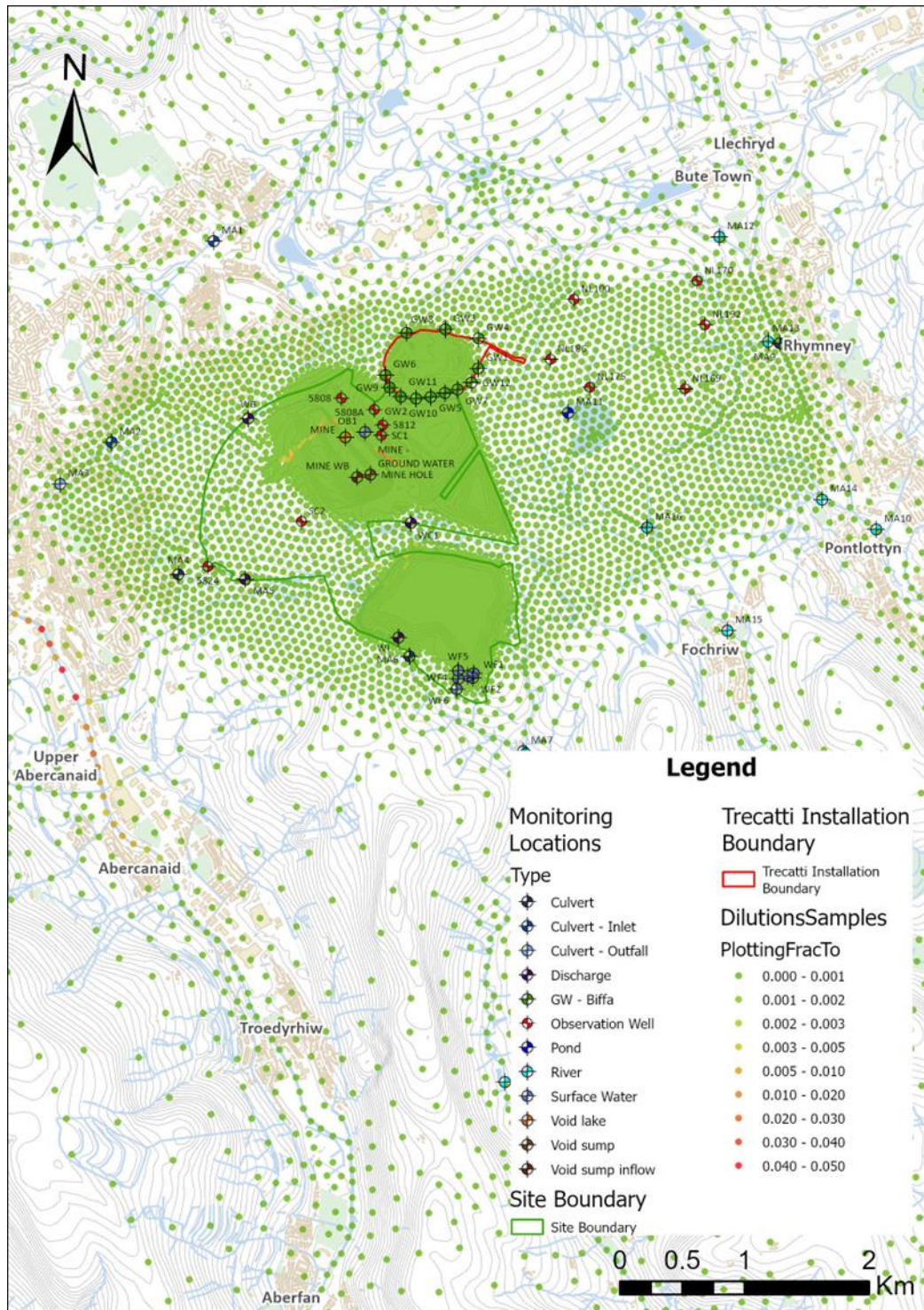


Figure 9-5 Fraction of groundwater discharging that originated in the pit void waterbody

Table 9-4 Dilution calculations for downgradient receptors of the pit void mine water

Parameter	Units	PAV	Average 5824	MA3 (proxy for River Taff)	Modelled pit void chemistry		Fraction mix – average model			Fraction mix – max model		
							5824	River Taff - GW flow fraction	River Taff - GW to SW fraction	5824	River Taff - GW flow	River Taff - GW to SW
					Average	Max	0.02	0.014	0.025	0.02	0.014	0.025
Al	mg/L	0.5	0.13	0.07	0.08	0.13	0.13	0.13	0.07	0.13	0.13	0.07
Alkalinity	mg/L CaCO ₃		263.4	188.2	364.1	364.1	498.5	264.8	192.6	268.1	266.7	195.9
NH ₃ -N	mg/L	0.5	0.16	0.39	1.09	1.39	0.18	0.18	0.41	0.19	0.18	0.42
As	mg/L	0.01	0.003	0.002	0.004	0.009	0.003	0.003	0.002	0.003	0.003	0.002
Ca	mg/L	250	23.8	84.0	108.5	117.7	25.6	25.1	84.6	25.7	25.2	84.9
Cd	mg/L	0.005	0.0003	0.0005	0.0001	0.0002	0.0003	0.0003	0.0004	0.0003	0.0003	0.0004
Cl	mg/L	250	39	37	52	76	39	39	38	39	39	38
Cu	mg/L	0.2	0.018	0.005	0.003	0.005	0.018	0.018	0.005	0.018	0.018	0.005
Cr	mg/L	0.03	0.002	0.002	0.001	0.004	0.002	0.002	0.002	0.002	0.002	0.002
F	mg/L	1.5	0.4	0.2	0.1	0.2	0.4	0.4	0.2	0.4	0.4	0.2
Fe	mg/L	1	1.4	0.2	0.6	1.3	1.4	1.4	0.2	1.4	1.4	0.3
Hg	mg/L	0.001	0.0002	0.0002	0.0000	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
K	mg/L	40	9.0	14.0	56.6	76.2	10.0	9.7	15.1	10.4	10.0	15.6
Pb	mg/L	0.1	0.007	0.003	0.002	0.004	0.007	0.007	0.003	0.007	0.007	0.003
Mg	mg/L	100	4.0	26.9	88.2	92.5	5.7	5.2	28.5	5.8	5.3	28.6
Mn	mg/L	0.25	0.06	0.10	0.54	0.61	0.07	0.06	0.10	0.07	0.06	0.11
Mo	mg/L	0.05	0.002	0.007	0.006	0.013	0.002	0.002	0.007	0.002	0.002	0.007
Na	mg/L	170	99.1	23.8	38.9	52.1	97.9	98.3	24.2	98.2	98.5	24.5
Ni	mg/L	0.1	0.006	0.015	0.053	0.058	0.007	0.006	0.016	0.007	0.006	0.016
P	mg/L	0.2	0.2	0.1	0.1	0.24	0.2	0.2	0.1	0.2	0.2	0.1
pH	s.u.	6.5 - 8.5	7.6	7.7	8.0	8.1	7.7	7.7	7.7	7.7	7.7	7.7
Se	mg/L	0.01	0.001	0.002	0.004	0.006	0.002	0.002	0.004	0.002	0.002	0.004
SO ₄	mg/L	400	39	125	420	458	46	44	133	47	445	133
Zn	mg/L	0.1	0.023	0.015	0.027	0.046	0.023	0.023	0.015	0.023	0.023	0.016

9.6.24 An overview of the outcome of the assessment for each key receptor is provided in **Table 9-5** below.

Table 9-5 Summary of assessment effects

Assessment	Potential Impact	Significance / Risk	Mitigation / monitoring required
Bargoed Taf downstream of OB3 (Current monitoring locations)	The interpretation of historical baseline data for discharges from this location, and ecological impact assessments, suggests current impacts are limited and there is unlikely to be significant change to the source discharge chemistry in the future (noting the trend in sulphate concentration is decreasing over the long term). As such water quality is interpreted to remain within a similar range to current levels following restoration. However, the current settling ponds are recognised to likely exert a positive impact on discharge water quality, as such monitoring and/or mitigation and/or maintenance is recommended for a period of time during and post restoration time to ensure this positive benefit continues following restoration (to the extent that water quality is maintained within the current/historical range).	Low risk with current mitigation measures	Continue monitoring of discharges from the south of OB3 and within the current locations on the Bargoed Taf. Determine requirements for and implementation of a programme of management/maintenance of settling ponds. Determine potential benefit of establishing nature-based solutions such as a wetland system downstream of outfall locations to provide post restoration water quality mitigation for the historical discharges. Monitoring frequency and determinants suite to be reviewed annually.
Groundwater monitoring at 5824	Future changes to the chemical loading from the pit void waterbody to downgradient groundwater are not considered to be significant. The main water quality impact in this area appears to relate to ammonia and the source for this is not interpreted to be from the Ffos-y-Fran site direct but more likely to be from the landfill or diffuse offsite.	Low under current conditions (noting that upgradient sources are outside of the control of the site and MSW)	Where possible continue to review Trecatti monitoring information of upgradient impacts from offsite sources in particular the landfill site on an annual basis.

Surface water abstractions and supplies (River Rhymney and Taf Bargoed)	Based on the results of the assessment there is not likely to be a significant change to the current baseline chemical load from the sources modelled in the assessment in these waterbodies	Insignificant	None
WFD surface water bodies	Very low likelihood of significant changes to the chemical loading of water bodies, based on direct discharges or source dilution within groundwater (discharging to surface water bodies)	Low	Continue monitoring pit void water quality. Monitoring frequency and determinants to be reviewed annually.
WFD groundwater bodies	Very low likelihood of significant changes to the chemical loading of water bodies differing from baseline data, based on direct discharges or seepage to ground (discharging to surface water bodies)	Low	Continue monitoring pit void water quality. Monitoring frequency and determinants to be reviewed annually.
Pit void water body	Based on modelling results there is not likely to be a significant change in water quality in the pit void in the post restoration period relative to current conditions as a result of the restoration program of works. It is noted that upgradient impacts from offsite sources such as the landfill may be influencing certain parameters (e.g. ammonia) and these are outside the control of the site and so remain as a risk. Modelling results suggest that some parameters (iron, manganese, ammonia and phosphorous) will be higher than PAVs during and for a period post restoration, due to the dominant influence of groundwater on water quality. The suitability of PAVs for use as water quality targets for the pit void water requires review.	Requires a review of PAV's for use as water quality targets (noting that upgradient sources are outside of the control of the site).	Continue monitoring the pit void water quality and if possible, review groundwater locations at Trecatti landfill annually. Review suitability of PAV's for use as water quality targets for the pit void. Monitoring frequency and determinants suite to be reviewed annually.

9.7 Mitigation Measures

- 9.7.1 The restoration plan includes the naturalisation of settlement ponds on the site (as a nature-based solution). As identified in this assessment, the settlement ponds to the south of OB3 are currently effectively reducing metal loads from impacted seepage in this area (e.g. iron and manganese). Should these be allowed to naturalise the settlement ponds may become less effective over time for removal of the metals from the drainage. As such, a programme of monitoring is recommended along with establishment of a plan for settling pond management/maintenance and consideration of the benefits of constructing an enhanced wetland to ensure the removal of metal load in this location continues in the time period post restoration.
- 9.7.2 The area just under the outfall south of OB3 has also been identified as a potential long-term risk for downstream water quality, noting that results of previous baseline and ecological monitoring suggests the risk is relatively low. However, it has been recognised that encouraging the formation of a larger wetland area where the outfall is located could help reduce overall metal loads to the Bargoed Taf. As such it is recommended that there would be potential benefits of enhancing the wetland area by encouraging colonisation of marginal plants with further planting (such as reeds) which may encourage settlement of metals at this location.
- 9.7.3 Modelling results for the pit void water body suggest that some parameters (iron, manganese, ammonia and phosphorous) will be higher than PAVs during and for a period post restoration, due to the dominant influence of groundwater on water quality. The suitability of PAVs for use as water quality targets for the pit void water requires review given the water body does not have direct connection to surface water bodies with established ecological function (and sensitive ecological receptors such as fish) and the ecological function of the water body itself has not been determined.

9.8 Monitoring

- 9.8.1 The following monitoring is recommended for a 3-year monitoring and maintenance period, to include annual reviews of the monitoring frequency and determinants suite, and to advise of any requirements for extensions of the monitoring period :

- a) Monitoring of pit void water body and key outfalls and seepage areas from the southern edge of OB3, including the settling ponds and wetland areas suggested.
- b) Where possible continue to monitor groundwater location(s) upgradient of the pit void at the Trecatti landfill, to establish any changes to offsite groundwater quality and review annually
- c) Downstream monitoring in the Bargoed Taf and Nant Gyrawd
- d) Groundwater monitoring downgradient of the pit void at 5824
- e) Monitoring of Nant Morlais watercourse based on discharges from the DFDS
- f) Potentially adding in monitoring in the River Taff based on assessment of the groundwater flow path

9.8.2 A review of parameters to be monitored should be undertaken but it is likely to require the inclusion of major ions (including sulphate), pH, EC, nutrients and a metals suite as appropriate to the risks identified. The amount of organics monitoring could be reduced following cessation of operations on site. It is recommended that mecoprop, tritium and ammonia are included in the pit void waterbody due to the potential impact from the Trecatti landfill. Tritium and mecoprop are not considered a risk that requires monitoring across the rest of the site.

9.9 Cumulative Effects

9.9.1 Within the assessment two main cumulative effects have been noted:

9.9.2 High concentrations of ammonia were measured in GW02, a perimeter borehole on the Trecatti landfill. This location is directly upgradient (groundwater flow) of the pit void. Groundwater monitoring has shown an increase in ammonia in some locations within the pit void, and the level of ammonia measured in the pit waterbody and modelled over a longer period is found to be elevated. (noting that the source may be from offsite sources such as Trecatti rather than exclusively from the Ffos-y-Fran site).

9.9.3 Phosphorous concentrations in the downgradient groundwater from the pit void are relatively high (similar to PAVs). These appear to be related to background groundwater levels based on information from the WFD groundwater body.

9.10 Summary of Significant Effects

- 9.10.1 The hydrogeochemical impact assessment of the proposed restoration scheme implementation does not identify a high risk of significant effects to identified downstream recipient water quality (i.e. deterioration in water quality) will occur post closure because of the proposed scheme that will require any significant adjustments to the proposed plans. Monitoring is proposed as a post closure mitigation (and assurance) measure to enable validation of the predictions made as part of this assessment and to identify any interventions that may be required.
- 9.10.2 The pit void water body has not been considered as purely a receptor as part of this assessment because it is considered a source of potential water quality impacts to downgradient receiving water bodies and simultaneously as a pathway for upgradient groundwater (and related offsite sources) given the flow through hydrological conceptualisation of the water body with respect to groundwater. Modelling carried out suggests that upgradient groundwater quality currently (and in the future) dominates the water quality of this water body, the pit void water quality is assumed therefore to largely reflect groundwater quality. Modelling results suggest that some parameters (e.g. manganese and ammonia) will be higher than PAVs during and (for a period) post restoration, due to the dominant influence of groundwater on water quality.
- 9.10.3 Existing surface water management features such as the sediment ponds downstream of OB3 are recognised to currently have a positive influence on receiving downstream surface water quality (reduction in metal loading e.g. iron and manganese). As part of a nature-based solution naturalisation of these ponds is expected to occur post restoration period, and as such a program of monitoring, management and maintenance is recommended for these ponds to determine impacts on future water quality, to be reviewed annually. The opportunity and benefits of enhanced nature-based solutions such as wetland enhancement is also recommended as part of this assessment.
- 9.10.4 Monitoring is proposed as a post closure mitigation (and assurance) measure to enable validation of the predictions made as part of this assessment and to identify any interventions that may be required. It is noted that the influence of offsite sources that may impact future water quality such as the Trecatti landfill are largely outside the control of the site. As such monitoring and annual reviews will provide valuable source of data to assess if there are any significant changes to upgradient groundwater quality that may impact water quality on the site.

10 Hydrology

(By Waterco)

10.1 Introduction

10.1.1 This chapter of the Environmental Statement (ES) presents the findings of an assessment of the likely significant effects on flood risk and drainage because of the Proposed Development.

10.1.2 For a detailed description of the Proposed Development, refer to **Chapter 4: Description of the Development**.

10.1.3 This chapter is accompanied by the following appendices:

- **Appendix 10A:** Flood Risk Assessment and Drainage Strategy (Waterco)
- **Appendix 10B:** Water Framework Directive Assessment (Waterco)
- **Appendix 10C:** Hydraulic Modelling Report (Waterco)

10.1.4 Reference to the following chapters may help the readers understanding of potential key impact interactions between flood risk, drainage and other disciplines:

- **Chapter 8:** Hydrogeology
- **Chapter 9:** Hydro-Geochemical
- **Chapter 11:** Ecology

10.1.5 The following sections of this chapter include:

- a) a description of relevant legislation, planning policy and guidance which has informed the assessment;
- b) a summary of consultation with stakeholders;
- c) a description of the methodology for the assessment, including details of the study area and the approach to the assessment of effects;
- d) a review of baseline conditions;
- e) details of the measures to avoid or reduce environmental effects, including mitigation and design measures that form part of the Proposed Development;
- f) an assessment of the likely significant effects in relation to flood risk, drainage and surface water, for the restoration and aftercare phases of the Proposed Development, considering the measures proposed to avoid or reduce effects.
- g) identification of any additional mitigation measures or monitoring required in relation to likely significant effects;

- h) a summary of the residual effects of the Proposed Development from implementation of any additional mitigation; and
- i) assessment of any cumulative effects with other proposed developments.

10.2 Legislation and Policy

Water Framework Directive 2000/60/EC

10.2.1 Published in December 2000, the Directive aims to preserve, restore and improve the water environment. It is a legal requirement within England and Wales, originally transposed into law through the Water Environment (Water Framework Directive) (England and Wales) (2003) to record data within River Basin Management Plans. River Basin Planning is managed in six-year cycles.

10.2.2 The environmental objectives of the WFD for surface waters include:

- Prevent deterioration in the status of aquatic ecosystems, protect and improve the ecological condition of waters;
- Aim to achieve 'good' status for all waterbodies by 2015. Where this is not possible and subject to the criteria set out in the Directive, aim to achieve good status by 2021 or 2027;
- Meet the requirement of the WFD Protected Areas;
- Promote sustainable use of water as a natural resource;
- Conserve habitats and species that depend directly on water;
- Reduce or phase out the release of individual pollutants or groups of pollutants that present a significant threat to the aquatic environment;
- Progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants; and
- Contribute to the mitigating effects on floods and droughts.

The Water Framework Environment Regulations 2017 (Water Framework Directive) (England and Wales)

10.2.3 The Water Environment Regulations (WER) 2017 (Water Framework Directive) (England and Wales) transpose the Water Framework Directive into UK law. The WFD protects surface waters including rivers, lakes, transitional waters (referred to in this advice as estuarine waters), coastal waters and groundwater.

10.2.4 The aims of the WFD are:

- to enhance the status and prevent further deterioration of surface water bodies, groundwater bodies and their ecosystem
- to ensure progressive reduction of groundwater pollution

- to reduce water pollution, especially by Priority Substances and Certain Other Pollutants under Annex II of the Environmental Quality Standards Directive 2008/105/EC
- to support mitigating the effects of floods and droughts
- to achieve at least good surface water status for all surface water bodies and good chemical status in groundwater bodies by 2015 (Article 4), or good ecological potential for artificial or heavily modified water bodies to support sustainable water use

Directive on Environmental Quality Standards (EQSD) 2008/105/EC

10.2.5 This Directive establishes the environmental quality standards (EQS) for priority substances and certain other pollutants in surface waters.

10.2.6 With reference to the WFD, good chemical status is achieved when a water body complies with the EQS for all the priority substances and certain other pollutants listed in the EQSD.

Water Act 2014 and Water Resources Act 1991

10.2.7 This Act governs the control of water abstraction, discharge to water bodies, water impoundment, conservation and drought provision.

Flood and Water Management Act 2010

10.2.8 This Act provides details on the management of risks associated with flooding and coastal erosion

Environmental Protection Act 1990

10.2.9 This Act provides details for identifying and dealing with waste, emissions, contaminated land and water resources

The Land Drainage Act 1991

10.2.10 This Act establishes the regulation of ordinary watercourses by Local Authorities and Internal Drainage Boards. It outlines that a watercourse should be maintained by its riparian owner so that the flow of water is not impeded. The riparian owner must accept the natural flow from upstream but does not need to carry out works to cater for increased flows which may result from works carried out upstream.

The Groundwater (Water Framework Directive) (Wales) Direction 2016

10.2.11 This Directive is on the protection of groundwater against pollution and deterioration from hazardous substances and non-hazardous pollutants.

The Groundwater (England and Wales) Regulations 2009

10.2.12 This Regulation transposes 2006/118/EC into law in England and Wales.

Environmental Permitting (England and Wales) Regulations 2016

- 10.2.13 This Regulation provides a consolidated system of environmental permitting including the discharge of water and groundwater activities.

The Environmental Damage (Prevention and Remediation) (Wales) Regulations 2009

- 10.2.14 This Regulation aims to prevent and remedy damage to a protected species, natural habitat, a site of special scientific interest, water or land.

The Environment (Wales) Act 2016

- 10.2.15 The Environment (Wales) Act puts in place a delivery framework for the sustainable management of natural resources and introduces some simple principles to underpin the way we all work.

Well-being of Future Generations (Wales) Act 2015

- 10.2.16 This act asks 44 Public Bodies in Wales to work in a sustainable way and think about the impact our work can have for people living in Wales, now and in the future.

Severn River Basin Management Plan 2021 – 2027

- 10.2.17 This report outlines the current baseline classification of waterbodies in the Severn River basin district, the objectives and targets for water quality within waterbodies of the area, challenges / issues within the catchment which have impacts on water quality and how the objectives / targets will be achieved in future.

Technical Advice Note 15 (TAN15): Development and Flood Risk.

- 10.2.18 This TAN provides technical guidance which supplements the policy set out in Planning Policy Wales (PPW) in relation to development and flooding. It advises on development and flood risk as this relates to sustainability principles (section 2.2 PPW), and provides a framework within which risks arising from both river and coastal flooding, and from additional run-off from development in any location, can be assessed
- 10.2.19 Section 9 of TAN15 details policy requirements and states that any development in Flood Zone A (applicable to this site) is considered appropriate if there is no increase in flooding elsewhere.

10.3 Assessment Methodology

Study Area & Scope for Assessment

- 10.3.1 The study area, in terms of assessment of impact of the development is consistent with the zone of influence, defined by all relevant WFD waterbodies, as requested by NRW. An extent of 15.5km will be used as to encompass all relevant WFD waterbodies.

Flood Risk

- 10.3.2 All potential sources of flooding have been reviewed as part of this assessment including fluvial (from rivers), tidal, surface water, sewer flooding, groundwater and artificial sources. The existing flood risk to the Site has been assessed using NRW fluvial, tidal, surface water and reservoir flood mapping.
- 10.3.3 Surface water flood risk, including impact of the development on flood risk elsewhere, has been further assessed through detailed hydraulic modelling undertaken by Waterco. Full details of the hydraulic modelling are provided in **ES Volume 3 - Appendix 10-1 and Appendix 10-3**.
- 10.3.4 Sewer flooding has been assessed using topographic data and sewer records. Albeit there are no public sewers in the immediate vicinity.
- 10.3.5 Groundwater flooding has been assessed using piezometer standpipes (groundwater monitoring) on site.
- 10.3.6 NRW reservoir flood mapping has been used to assess the risk of flooding from failure of reservoirs.

Surface Water Drainage

- 10.3.7 An assessment of flows (into new drainage features such as ditches) has been carried out using the Revitalised Flood Hydrograph method. This method uses an event-based rainfall-runoff model, to convert a design storm event of appropriate duration and return period into a corresponding design flood event of similar return period. As this method produces runoff hydrographs, it will provide an estimate of runoff volumes as well as estimates of the peak flow rate. Further details are included in the FCA & Drainage Strategy, provided as **ES Volume 3 - Appendix 10-1**.

Water Quality

- 10.3.8 Proposed schemes having the potential to impact on current or predicted WFD status are required to assess their compliance against the objectives defined for potentially affected water bodies. As part of its role, the Natural Resources Wales (NRW) must consider whether new development proposals have the potential to:
- Cause deterioration in the ecological, chemical or quantitative status of a waterbody or
 - Prevent the waterbody from achieving the required good status.
- 10.3.9 The assessment has been undertaken in three stages. The first stage is 'screening', the aim of which is to identify the Scheme components that could affect WFD status and exclude any activities that do not require any further assessment. The second stage is 'scoping', whereby WFD receptors that are potentially at risk from proposed activities are identified. Finally, and if required, the third stage evaluates the

potential effects of your activity, identifies mitigation measures and determines if the activity could result in a deterioration in the status of the receiving waterbody.

10.3.10 The current baseline classifications of WFD waterbodies of interest i.e. that have the potential to be impacted by the proposed scheme, have been obtained from NRW.

10.3.11 The full WFD assessment is included in **ES Volume 3 - Appendix 10-2**.

Assessment of Significance / Assessment Criteria

10.3.12 The assessment of likely significant effects will be determined using principles of the guidance and criteria set out in the Design Manual for Roads and Bridges (DMRB) LA113 Road Drainage and the Water Environment (Ref 9-55) and LA104 Environmental assessment and monitoring [Ref 6.N] and adapted to suit the specific requirements of this project. Although these assessment criteria were developed for road infrastructure projects, this method is suitable for use on any development project, and it provides a robust and well tested method for predicting the significance of effects.

10.3.13 The assessment will consider the restoration and aftercare phases. The level of significance attributed to each impact has been assessed based on the magnitude of change due to the development proposals and the sensitivity of the affected receptor / receiving environment to change.

10.3.14 There are three stages to the assessment of effects on the water environment, which are as follows:

- A level of sensitivity (low to high) is assigned to the receptor based on a combination of attributes as outlined in Table 10-1
 - The magnitude of potential and residual impact (classified as negligible, minor, moderate or major adverse / beneficial) is determined based on the criteria listed in Table 10-2 and the assessor's professional judgement.
 - Descriptions for significance are included in Table 10-3. A comparison of the sensitivity of the receptor and magnitude of the impact (for both potential and residual impacts) results in an assessment of the overall significance of effects using the matrix presented in Table 10-4. It should be noted that although the impact assessment matrix provides a good framework for the consistent assessment of impacts across all environmental parameters, there is still an important role for professional judgement and further objective assessment to play in moderating an impact's significance (where applicable). Given that the criteria represent levels of effect on a continuum, professional judgement and awareness of the relative balance between magnitude and importance / sensitivity is required.

Table 10-1: Receptor Sensitivity Criteria (adapted from DMRB LA113, Ref 9-55)

Sensitivity	Criteria	
High	Surface Water/Waterbodies	A watercourse classified as high or good in accordance with the WFD. Site protected/ designated under EC or UK habitat legislation (SAC, SPA, SSSI, WPZ, Ramsar site), Species protected by EC legislation. Critical social or economic uses (e.g. public water supply and navigation) The hydromorphology of the waterbody conforms closely to natural, unaltered state and will often exhibit well developed and diverse geomorphic forms.
	Groundwater	Source Protection Zone (SPZ) 1 or 2; Principal aquifer providing a regionally and/or locally important resource and/or supporting a site protected under EC and UK legislation.
	Flood Risk	Flood Zone 3; essential infrastructure or highly vulnerable development. High risk from non- fluvial flood sources. Floodplain or defence protecting between 1 and 100 residential properties or industrial premises from flooding.
Medium	Surface Water/Waterbodies	A watercourse classified as moderate in accordance with the WFD, or a non-WFD waterbody hydrologically linked to a WFD waterbody with moderate classification. May be designated as a local wildlife site (LWS) and support a small / limited population of protected species. The waterbody shows signs of previous alteration and/or minor flow / water level regulation but still retains some natural features or may be recovering towards conditions indicative of the higher category.
	Groundwater	SPZ 3. A Secondary Aquifer providing water for agricultural or industrial use with limited connection to surface water.
	Flood Risk	Flood Zone 2; less vulnerable property and land such as public, commercial and industrial buildings. Medium risk from non- fluvial flood sources. Floodplain or defence protecting 10 or fewer industrial properties from flooding.
Low	Surface Water/Waterbodies	A watercourse classified as poor or bad in accordance with the WFD or watercourses not having a WFD classification. Low aquatic fauna and flora biodiversity and no protected species. The hydromorphology of the waterbody has been substantially modified by past land use, previous engineering works or flow/ water level regulation.
	Groundwater	Generally unproductive strata
	Flood Risk	Flood Zone 1. Water compatible development. Low risk from non-fluvial flood sources.

Table 10-2: Magnitude of Impact Criteria (adapted from DMRB LA113, Ref 9-55)

Magnitude	Criteria	Examples	
Major adverse	Results in a loss of attribute and/ or quality and integrity of the attribute. Major change from the baseline conditions	Surface Water/Waterbodies	Significant damage to land and property users. Loss or extensive change to a fishery. Loss of regionally important public water supply. Loss or extensive change to a designated nature conservation site. Reduction in water body WFD classification.
		Groundwater	Loss of, or extensive change to, an aquifer; Loss of regionally important water supply; Loss of, or extensive change to groundwater dependent terrestrial ecosystem (GWDTE) or baseflow contribution to protected surface water bodies. Reduction in water body WFD classification; Loss or significant damage to major structures through subsidence or similar effects
		Flood Risk	Increase in flood risk offsite to residential and industrial development and/or emergency services.
Moderate adverse	Results in impact on integrity of attribute, or loss of part of attribute. Moderate change from the baseline conditions	Surface Water/Waterbodies	Damage to land and property users. Partial loss in productivity of a fishery. Degradation of regionally important public water supply or loss of major commercial/industrial/agricultural supplies. Contribution to reduction in water body WFD classification.
		Groundwater	Partial loss or change to an aquifer. Degradation of regionally important public water supply or loss of significant commercial/industrial/agricultural supplies. Partial loss of the integrity of GWDTE. Contribution to reduction in water body WFD classification. Damage to major structures through subsidence or similar effects or loss of minor structures.
		Flood Risk	Increase in flood risk offsite to undeveloped agricultural land already at flood risk
Minor adverse	Results in some measurable change in attribute's quality or vulnerability. Minor change from the baseline conditions	Surface Water/Waterbodies	Minor effects on water supplies
		Groundwater	Minor effects on an aquifer, GWDTEs, abstractions and structures.
		Flood Risk	No overall change in flood risk elsewhere
Negligible		Surface Water/Waterbodies	The proposed project is unlikely to affect the integrity of the water environment

Magnitude	Criteria	Examples	
	Results in impact on attribute, but of insufficient magnitude to affect the use or integrity.	Groundwater	The proposed project is unlikely to affect the integrity of the water environment.
		Flood Risk	No overall change in flood risk elsewhere.
Minor beneficial	Results in some beneficial impact on attribute or a reduced risk of negative impact occurring. Minor change from the baseline conditions	Surface Water/ Waterbodies	Contribution to minor improvement in water quality, but insufficient to raise WFD classification
		Groundwater	Reduction of groundwater hazards to existing structures. Reductions in waterlogging and groundwater flooding.
		Flood Risk	Creation of flood storage & minor decrease in flood risk elsewhere
Moderate beneficial	Results in moderate improvement of attribute quality. Moderate change from the baseline conditions	Surface Water/ Waterbodies	Contribution to improvement in waterbody WFD classification.
		Groundwater	Contribution to improvement in water body WFD classification. Improvement in water body catchment abstraction management strategy (CAMS) (or equivalent) classification. Support to significant improvements in damaged GWDTE.
		Flood Risk	Creation of flood storage & decrease in flood risk elsewhere to undeveloped agricultural land
Major beneficial	Results in major improvement of attribute quality. Major change from baseline conditions	Surface Water/ Waterbodies	Removal of existing polluting discharge or removing the likelihood of polluting discharges occurring to a watercourse. Improvement in water body WFD classification.
		Groundwater	Removal of existing polluting discharge to an aquifer or removing the likelihood of polluting discharges occurring. Recharge of an aquifer. Improvement in water body WFD classification
		Flood Risk	Creation of flood storage & decrease in flood risk offsite to residential/industrial properties and/or emergency services.

Table 10-3 – Significance Categories and Descriptions (DMRB LA104 [Ref 6.N])

Significance category	Typical Description
Very large	Effects at this level are material in the decision-making process
Large	Effects at this level are likely to be material in the decision-making process
Moderate	Effects at this level can be material decision-making factors
Slight	Effects at this level are not material in the decision-making process
Neutral	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

10.3.15 Where the matrix contains two significance categories, evidence should be provided to support the reporting of a single significance category.

10.3.16 Descriptions for significance are included in Table 10-4 below.

Table 10-4 – Matrix for the Calculation for Level of Significance (adapted from DMRB LA104 [Ref 6.N])

Magnitude of Impact	Sensitivity of Feature		
	High	Medium	Low
Major	Large or very large	Moderate or large	Slight or moderate
Moderate	Moderate or large	Moderate	Slight
Minor	Slight or moderate	Slight	Neutral or slight
Negligible	Slight	Neutral or Slight	Neutral or Slight

10.4 Baseline Conditions

10.4.1 The baseline conditions used for the purposes of the ES are set at the point when the operational surface mining operations ceased at the end of November 2023. By this time, water extraction from the main void had stopped and the void was gradually filling with ground and surface water. Following the termination of mining activity in 2023, groundwater levels in the void progressively rose to a maximum height of circa 281m AOD on 12th April 2024. As the weather changed seasonally drier during the months of May and June 2024 the water levels have dropped to around 279m AOD and continue to recede reaching a minimum level pf around 275m AOD in September 2024. Levels continue to be monitored by MSW.

Hydrological Setting

10.4.2 The site is intersected by a network of surface water drainage ditches and leats, some of which form part of historic workings on the site from previous mining activity and known as the Dowlais Free Drainage System, that provided water to the Dowlais Ironworks. There are also a series of ponds and lagoons on site the majority of which will be retained as part of the restoration proposals.

10.4.3 Nearby watercourses include Bargoed Taff and its tributary the Nant Gyrawd which flow southwards and are tributaries of the Afon Taff. The Afon Taff is located

approximately 1.5km west of the site at its nearest point. The Nant Cwm Blacs, which flows westwards immediately south of the site, is also a tributary of the Afon Taff. Other watercourses in the area include Cae Harris and Nant Morlais.

Cae Harris

- 10.4.4 This catchment only influences the very far north of the site and effectively intercepts runoff from entering the site from the north, routing it to a culvert under the A4060 in the far northern corner of the site.

Nant Morlais

- 10.4.5 There are ditches along westernmost boundary of the site that intercept runoff from the already restored areas of the site. These ditches were constructed as part of the East Merthyr Reclamation Scheme (Phase II) Great White Tip restoration works. They drain to two large culverts that convey runoff under the A4060 dual carriageway westwards towards the town of Merthyr Tydfil where, ultimately, it contributes to the River Taff.

- 10.4.6 An area of land in the south of the site drains to the southwest corner of the site where runoff is routed into two small culverts which are thought to be routed under the A4060 to the south of the roundabout to the immediate west of the site at this location.

Nant Cwm Blacs

- 10.4.7 The Nant Cwm Blacs catchment is relatively limited in extent. On site, the stream effectively rises at the head of the railway cutting and drains to the west, underneath Bogey Road via a small culvert, into a small wetland. From this area of wetland, surface water in the wetland either flows back under Bogey Road or out of the western edge of the wetland where it flows down slope in a westerly direction to a lagoon situated in the south of the site. The lagoon is assumed to have an outfall to Cwm Blacs watercourse.

- 10.4.8 Sarn Howell Pond has also been reported to have contributed to Cwm Blacs via overtopping in the past.

Bargoed Taff

- 10.4.9 Ditches in the eastern and south-eastern extents of the site flow south and discharge to the Bargoed Taff off site, either directly or via the Nant Gyrawd.

- 10.4.10 The Nant Morlais, Cwm Blacs and Bargoed Taff flow west and south-west eventually converging with the Afon Taff. the Afon Taff is located approximately 1.5km west of the site at its nearest point.

- 10.4.11 The hydrogeology of the site is complex and heavily influenced by the underlying geology including the Dowlais and Penydarren Faults, previous workings and mine drainage systems including the Merthyr Free Drainage System and the Dowlais Free Drainage System. Five underground drainage courses are known to exist in the vicinity of the site. These are discussed in further detail in the Hydrogeology Chapter.

Flood Risk

- 10.4.12 The Welsh Government Development Advice Map shows that the site is located within Flood Zone A – an area considered to be at little or no risk of fluvial or tidal flooding, with a less than 0.1% (1 in 1000) annual probability of flooding.
- 10.4.13 The NRW ‘Flood Map for Planning (Rivers and Sea)’ shows that the site is located within an area outside of the extreme flood extent (Flood Zone 1), meaning it has a less than 0.1% annual probability of flooding
- 10.4.14 The NRW ‘Risk of Flooding from Surface Water & Small Watercourses’ map shows that there are areas across the site shown within surface water Flood Zone 2 and 3. Surface water Flood Zone 2 is defined as ‘areas with 0.1% to 1% (1 in 1000 to 1 in 100) chance of flooding from surface water and/or small watercourses in a given year, including the effects of climate change’. Surface water Flood Zone 3 is defined as ‘areas with more than 1% (1 in 100) chance of flooding from surface water and/or small watercourses in a given year, including the effects of climate change’.
- 10.4.15 The identified surface water flood risk on NRW mapping is generally constrained to existing ditches, lagoons / ponds and topographical low points. Any surface water flows leaving the site are directed off site within formal channels (ditches).
- 10.4.16 To fully quantify the surface water flood risk to the site, Waterco have undertaken a detailed surface water hydraulic modelling study. Full details of the hydraulic model build, and hydrology estimates are included in **ES Volume 3 - Appendix 10-3**.
- 10.4.17 The water level in the quarry void (groundwater lake level) in the model has been set at 284m AOD. This is the highest groundwater level recorded in piezometers directly adjacent to the quarry void. This level is also close to the highest recorded lake level (281m AOD) since quarrying operations ceased.
- 10.4.18 A high groundwater simulation has also been considered with respect to the 1% AEP plus 40% climate change (CC) event. A starting water level in the quarry void (groundwater lake) of 311m AOD has been utilised for the high groundwater scenario. This is a conservative water level based on the highest groundwater level recorded in piezometer standpipes within and directly adjacent to the site. The groundwater level of 311m AOD was recorded immediately east of the site. The purpose of this simulation is to determine the impact on water levels within the

quarry void should a 1% AEP plus 40% CC rainfall event occur when water levels within the quarry void are high.

- 10.4.19 During the existing scenario, surface water flows are generally contained within existing drainage features such as ditches, ponds and lagoons. Water levels within the quarry void increase from 284m AOD (starting water level in the model) to 284.26m AOD during the 1% AEP plus 40% CC event. During the 0.1% AEP plus 40% CC event, the lake water level increases from 284m AOD to 284.4m AOD.
- 10.4.20 During the high groundwater simulation where the water level in the quarry void has been set to 311m AOD, water levels in the quarry void increase by 0.2m (to 311.2m AOD) during the 1% AEP plus CC event. The lowest elevation along the perimeter of the quarry void is 340m AOD. As such, there is a freeboard of 28.8m between the quarry void lake level and surrounding topography during the 1% AEP plus 40% CC rainfall event coinciding with a conservative starting lake water level of 311m AOD.
- 10.4.21 The risk of flooding from all other sources (sewer, groundwater and artificial) is considered in **ES Volume 3 - Appendix 10-1** and is very low. The water level in the quarry void is heavily influenced by groundwater levels

WFD Waterbody Classifications

- 10.4.22 The watercourses on site have the potential to be affected by works undertaken as part of the Proposed Development. These watercourses/waterbodies are not WFD classified, however there is hydrological connectivity to WFD waterbodies downstream.
- 10.4.23 The closest Cycle 3 WFD River waterbody downstream of the site is the Taff Bargoed waterbody (Water body ID: GB109057033140). This WFD water body lies within the Zone of Influence for the site and has the potential to be impacted by the proposed works. It has a length of 23.4km.
- 10.4.24 The WFD 'Taff - conf Taf Fechan to conf R Cynon' River waterbody (Water body ID: GB109057033100) is located approximately 1.5km west of the site. This WFD water body lies within the Zone of Influence for the site and has the potential to be impacted by the proposed works. It has a length of 28.4km.
- 10.4.25 The WFD 'Nant Morlais - source to conf R Taff' River waterbody (Water body ID: GB109057033150) is located approximately 830m north-west of the site. It has a length of 9.9km. This WFD water body lies within the Zone of Influence for the site and has the potential to be impacted by the proposed works.
- 10.4.26 The WFD 'Nant Bargoed Rhymney - source to conf Rhymney R' River waterbody (Water body ID: GB109057033120) is located 850m south-east of the site. It has a

length of 17.08km. This WFD water body lies within the Zone of Influence for the site and has the potential to be impacted by the proposed works.

10.4.27 The WFD 'Taff - conf R Cynon to conf Rhondda R' River waterbody (Waterbody ID: GB109057027240) is located 10.6km south of the site. It has a length of 10.14km. This WFD waterbody lies within the Zone of Influence and therefore has potential to be impacted by proposed works.

10.4.28 The WFD 'Taff - conf Rhondda R to Castle Street' River waterbody (Waterbody ID: GB109057027270) is located approximately 15.1km south of the site. It has a length of 44.08km. This WFD waterbody lies within the Zone of Influence and therefore has potential to be impacted by proposed works.

10.4.29 The WFD 'Rhymney R - Nant Bargoed Rhymney to conf Nant Cylla' River waterbody (Waterbody ID: GB109057027190) is located approximately 7.9km south-east of the site. It has a length of 12.4km. This WFD waterbody lies within the Zone of Influence and therefore has potential to be impacted by proposed works.

10.4.30 The WFD 'Rhymney R - conf Nant Cylla to Chapel Wood' River waterbody (Waterbody ID: GB109057027280) is located approximately 12.8km south-east of the site. It has a length of 52.89km. This WFD waterbody lies within the Zone of Influence and therefore has potential to be impacted by proposed works.

10.4.31 The site is located within a WFD designated groundwater body, namely the SE Valleys Carboniferous Coal Measures groundwater catchment (Water body ID: GB40902G201900) and therefore this catchment has the potential to be impacted by the proposed works. This catchment has an area of 2,141km².

10.4.32 Specific parameter classifications for the WFD waterbodies are included the associated WFD assessment, provided as **ES Volume 3 - Appendix 10-2**.

10.5 Future Baseline

10.5.1 Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 require:

'A description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge.'

Surface Water Quality

10.5.2 In the absence of the restoration scheme, it is likely that the currently exposed areas of the site would experience increased erosion, sediment runoff and potential

contamination of local water sources, leading to degraded water quality. The remaining areas of the site would remain as they stand today.

Flooding

- 10.5.3 Climate change (+40% allowance for rainfall) has been considered within the assessment of surface water flood risk to the site.

10.6 Incorporated Mitigation and Enhancement Measures

- 10.6.1 The design of the project has involved an iterative process between engineering and environmental teams, to ensure that potential impacts upon the baseline environment have been avoided or minimised wherever possible (prior to considering mitigation). Where significant effects are still likely, standard best practice measures are proposed which would be incorporated into the restoration and aftercare phases of the Proposed Development via the implementation of a Construction Environmental Management Plan (CEMP) and/or Operational Environmental Management Plan (OEMP).

Restoration

- 10.6.2 A detailed CEMP will be prepared which outlines how the project will avoid, minimise or mitigate potential environmental impacts during the restoration phase. The key components of the CEMP are detailed below:

Chemical and Fuel Spillages

- 10.6.3 A suitably experienced and competent contractor will be employed and will be expected to ensure that all method statements are prepared with due consideration to minimising the release of potentially contaminative materials / compounds such as fuel, oils and chemicals.
- 10.6.4 As implemented for the duration of mining operations at Ffos-y-Fran, best practice measures to be implemented include:
- Potentially contaminating materials should be stored correctly. Minimise the potential for accidental release but protecting from the elements (wind & rain) and from vandalism and theft.
 - Potentially contaminating liquids, such as oils and fuel, should be stored in a suitably bunded contained if present in a bulk container. Smaller container volumes should be stored on a drip tray or in a closed storage unit when not in use.
 - Equipment should be regularly checked to ensure that leakage from hydraulic lines and engines does not occur.
 - Spill kits should always be available on site and operatives should be trained in how to use them.

- Any soils contaminated during the works should be excavated and disposed of correctly in accordance with current waste disposal legislation. Where gross contamination occurs, professional advice should be sought immediately.
- Bins should be provided on site for debris.
- Cleaning of tools /equipment will be carried out in water not draining directly to the watercourse.
- Signs of wear and tear of tanks should be checked for.
- Designated areas for refuelling and care with specific procedures.

Sediment & Contamination

- 10.6.5 Restoration activities should occur away from watercourses where possible. When restoration activities, including stock piling and storage of materials, occur near a watercourse they should be separated from the watercourse with barriers (e.g. sediment fences) to prevent surface runoff from these sites entering the watercourse.
- 10.6.6 Stockpiles will be located away from the watercourses or site drainage system to prevent leaching of contaminants. Protective coverings will help prevent runoff stripping a stockpile.
- 10.6.7 Haul roads will be sprayed regularly to keep dust down. If any section of a haul road is hard surfaced, then it will be swept on a regular basis to prevent accumulation of dust and mud.
- 10.6.8 Plant and wheel washing will take place in designated locations. Dirty water will be contained in settlement ponds and will not be allowed to discharge into a watercourse or infiltrate to groundwater.
- 10.6.9 Timing of works will be carefully considered, and restoration activities will generally be carried out during periods of low rainfall where possible to reduce the risk of scour and erosion around structures and reduce runoff from the area of works.
- 10.6.10 Several water treatment areas (sediment lagoons and attenuation ponds) are located around the site, which will capture surface flows impacted by restoration activities and direct them to sediment removal treatment. After treatment the flow will leave site in accordance with consented discharge limits.

Aftercare

- 10.6.11 A CEMP will be produced to detail how environmental impacts will be managed or mitigated during the projects aftercare phase.
- 10.6.12 The new drainage channels will be excavated, and the sides and bases compacted and vegetated to minimise erosion and provide long term stabilisation in the

aftercare phase. Alternatively, some sections of the drainage channels would need to be protected from erosion by lining with a hard-wearing concrete canvas (or similar product). Blockstone cascades would be installed where the gradient down the backfill slopes towards the lake in the base of the void is steep. The channel specification are to be confirmed.

- 10.6.13 Overall, the restoration scheme will result in a net environmental benefit, enhancing biodiversity and quality within the receiving waterbodies.

10.7 Likely Significant Effects

Receptors

- 10.7.1 Receptors identified from the baseline conditions assessment which could be potentially susceptible to environmental effects from flooding and drainage during the restoration and aftercare phases of the proposed development include:

- Watercourses / waterbodies within and adjacent to the site
- Groundwater – Secondary Undifferentiated Aquifer
- Aquatic life
- Adjacent land uses
- Designated sites

- 10.7.2 Groundwater will be addressed in the ES Hydro-Geochemistry chapter. Aquatic life is addressed in the ES Ecology **Chapter 11**.

- 10.7.3 Table 10-5 below details the list of receptors applicable to this scheme and their sensitivity.

Potential Impacts - Restoration Phase

- 10.7.4 Restoration activities are likely to generate impacts which have the potential to affect the water environment in the absence of the measures which are described in the CEMP.

- 10.7.5 The following adverse impacts may occur without appropriate mitigation:

- a) Siltation and contamination of watercourses/waterbodies – mobilisation of sediment (and potential pollutants) through earthworks associated with reprofiling the sides of the main void and construction of new channels. Temporary stockpiles can also be a source of siltation and contamination (via erosion). This will increase turbidity of waterbodies and reduce water quality.
- b) Chemical / Fuel Spillages and Contaminated Runoff – accidental spillage of pollutants such as fuel oils, concrete/cement etc. Where fuels and chemicals reach a waterbody, there is a potential for effects on water quality, which can affect local flora and fauna.

- c) Changes in Flood Risk – Changes in land use may alter surface water runoff from the site. Ground compaction from heavy machinery can also result in increased surface water runoff.

Potential Impacts - Aftercare Phase

- 10.7.6 During the aftercare phase, the reprofiled surface mine void slopes and introduction of new drainage channels may alter surface water runoff patterns and localised flood risk. Detailed hydraulic surface water modelling detailed in **ES Volume 3 - Appendices 10-1 and 10-3** confirm that the proposals will not increase flood risk elsewhere and do not introduce new surface water flow routes.
- 10.7.7 There is also potential for the restoration scheme to result in positive effects during the aftercare phase. By stabilising soils and re-establishing vegetation, the restoration scheme will reduce sediment loading and contamination. Furthermore, pond margins may be reprofiled and/or coir matting could be placed around pond margins where necessary. This will encourage the growth of marginal aquatic plants and improve availability of aquatic habitats. Where it is considered necessary, seeding of existing or reprofiled banks and the use of coir mats may also help prevent soil erosion, thus limiting sediment input into the waterbodies and improve overall water quality. Overall, the proposed restoration scheme will create betterment over the existing scenario.
- 10.7.8 The potential effect on receptors during the restoration and aftercare phase are considered within **Table 10-6** below and takes account of embedded mitigation measures, detailed in section 10.6.

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Table 10.6 Effects on receptors during aftercare

Potential Impact	Receptor (Sensitivity)	Magnitude of Impact	Level of Significance
Restoration			
Siltation and Contamination of waterbodies	Ordinary Watercourses on site (Medium)	Negligible - When accounting for the mitigation proposed, which will be implemented within the CEMP, the proposed development is unlikely to affect the integrity of the water environment	Neutral - No effects or those that are beneath levels of perception
	Bargoed Taff (High)	Negligible - When accounting for the mitigation proposed, which will be implemented within the CEMP, the proposed development is unlikely to affect the integrity of the water environment	Slight - Effects at this level are not material in the decision-making process
	Nant Morlais (High)	Negligible - When accounting for the mitigation proposed, which will be implemented within the CEMP, the proposed development is unlikely to affect the integrity of the water environment	Slight - Effects at this level are not material in the decision-making process
	Afon Taff (High)	Negligible - When accounting for the mitigation proposed, which will be implemented within the CEMP, the proposed development is unlikely to affect the integrity of the water environment	Slight - Effects at this level are not material in the decision-making process
	Nant Bargoed Rhymney (Medium)	Negligible - When accounting for the mitigation proposed, which will be implemented within the CEMP, the proposed development is unlikely to affect the integrity of the water environment	Neutral - No effects or those that are beneath levels of perception

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	Nant Cwm Blacs (Medium)	Negligible - When accounting for the mitigation proposed, which will be implemented within the CEMP, the proposed development is unlikely to affect the integrity of the water environment	Neutral - No effects or those that are beneath levels of perception
	Quarry void (Low)	Negligible - When accounting for the mitigation proposed, which will be implemented within the CEMP, the proposed development is unlikely to affect the integrity of the water environment	Neutral - No effects or those that are beneath levels of perception
	Merthyr Common Central SINC (Medium)	Negligible - When accounting for the mitigation proposed, which will be implemented within the CEMP, the proposed development is unlikely to affect the integrity of the water environment	Neutral - No effects or those that are beneath levels of perception
Chemical / Fuel Spillages and Contaminated Runoff	Ordinary Watercourses on site (Medium)	Negligible - When accounting for the mitigation proposed, which will be implemented within the CEMP, the proposed development is unlikely to affect the integrity of the water environment	Neutral - No effects or those that are beneath levels of perception
	Bargoed Taff (High)	Negligible - When accounting for the mitigation proposed, which will be implemented within the CEMP, the proposed development is unlikely to affect the integrity of the water environment	Slight - Effects at this level are not material in the decision-making process
	Nant Morlais (High)	Negligible - When accounting for the mitigation proposed, which will be implemented within the CEMP, the proposed development is unlikely to affect the integrity of the water environment	Slight - Effects at this level are not material in the decision-making process

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	Afon Taff (High)	Negligible - When accounting for the mitigation proposed, which will be implemented within the CEMP, the proposed development is unlikely to affect the integrity of the water environment	Slight - Effects at this level are not material in the decision-making process
	Nant Bargoed Rhymni (Medium)	Negligible - When accounting for the mitigation proposed, which will be implemented within the CEMP, the proposed development is unlikely to affect the integrity of the water environment	Neutral - No effects or those that are beneath levels of perception
	Nant Cwm Blacs (Medium)	Negligible - When accounting for the mitigation proposed, which will be implemented within the CEMP, the proposed development is unlikely to affect the integrity of the water environment	Neutral - No effects or those that are beneath levels of perception
	Quarry Void (Low)	Negligible - When accounting for the mitigation proposed, which will be implemented within the CEMP, the proposed development is unlikely to affect the integrity of the water environment.	Neutral - No effects or those that are beneath levels of perception
	Merthyr Common Central SINC (Medium)	Negligible - When accounting for the mitigation proposed, which will be implemented within the CEMP, the proposed development is unlikely to affect the integrity of the water environment	Neutral - No effects or those that are beneath levels of perception
Changes in flood risk	Ordinary Watercourses on site (Medium)	Negligible - silt fencing and other mitigation measures will minimise the runoff into adjacent watercourses. The effect will be temporary in nature and there will be no overall change in flood risk elsewhere	Neutral - No effects or those that are beneath levels of perception

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	Merthyr Common Central SINC (Medium)	Negligible - silt fencing and other mitigation measures will minimise the runoff into adjacent watercourses. The effect will be temporary in nature and there will be no overall change in flood risk elsewhere	Neutral - No effects or those that are beneath levels of perception
	Quarry Void	Negligible - hydraulic modelling has confirmed that the quarry void would not overtop in extreme rainfall conditions.	Neutral - No effects or those that are beneath levels of perception
	Adjacent Land Use (Medium)	Negligible - silt fencing and other mitigation measures will minimise the runoff into adjacent watercourses. The effect will be temporary in nature and there will be no overall change in flood risk elsewhere.	Neutral - No effects or those that are beneath levels of perception
Aftercare			
Siltation waterbodies	of Ordinary Watercourses on site (Medium)	Minor beneficial - Contribution to minor improvement in water quality, but insufficient to raise WFD classifications (given the existing water treatment areas)	Slight - Effects at this level are not material in the decision-making process
	Bargoed Taff (High)	Minor beneficial - Contribution to minor improvement in water quality, but insufficient to raise WFD classifications (given the existing water treatment areas)	Slight - Effects at this level are not material in the decision-making process
	Nant Morlais (High)	Minor beneficial - Contribution to minor improvement in water quality, but insufficient to raise WFD classifications (given the existing water treatment areas)	Slight - Effects at this level are not material in the decision-making process
	Afon Taff (High)	Minor beneficial - Contribution to minor improvement in water quality, but insufficient to raise WFD classifications (given the existing water treatment areas)	Slight - Effects at this level are not material in the decision-making process

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	Nant Bargoed Rhymni (Medium)	Minor beneficial - Contribution to minor improvement in water quality, but insufficient to raise WFD classifications (given the existing water treatment areas)	Slight - Effects at this level are not material in the decision-making process
	Nant Cwm Blacs (Medium)	Minor beneficial - Contribution to minor improvement in water quality, but insufficient to raise WFD classifications (given the existing water treatment areas)	Slight - Effects at this level are not material in the decision-making process
	Quarry Void	Minor beneficial - Contribution to minor improvement in water quality	Neutral - No effects or those that are beneath levels of perception
Changes in flood risk	Ordinary Watercourses on site (Medium)	Negligible - Modelling results show there is negligible impact on flows to the watercourses on site and surrounding the site because of the proposed restoration scheme	Slight - Effects at this level are not material in the decision-making process
	Merthyr Common Central SINC (Medium)	Negligible - Modelling results show there is negligible impact on flows to the watercourses on site and surrounding the site, because of the proposed restoration scheme	Slight - Effects at this level are not material in the decision-making process
	Quarry Void	Negligible - Modelling results show there is negligible impact on water levels in the quarry void because of the proposed restoration scheme.	Slight - Effects at this level are not material in the decision-making process
	Adjacent Land Use (Medium)	Negligible - Modelling results show there is negligible impact on flows to the watercourses on site and surrounding the site because of the proposed restoration scheme	Slight - Effects at this level are not material in the decision-making process

10.8 Additional mitigation and enhancement measures and monitoring

- 10.8.1 Additional mitigation and enhancement measures are not required as potentially significant adverse effects are not identified.

Monitoring

- 10.8.2 It would be prudent to confirm water quality data during and immediately following completion of the works, to highlight that the restoration phase has not had a detrimental effect on water quality.

10.9 Cumulative Effects

- 10.9.1 No significant adverse effects are identified, and the development proposals will not change flood risk and hydrology off-site. The Cumulative Effects are therefore considered to be negligible.

10.10 Conclusions

- 10.10.1 This Hydrology Chapter has considered the potential impacts that may arise at sensitive receptors during the restoration and aftercare phases of the Proposed Development.
- 10.10.2 A baseline assessment of the receptors which have the potential to be affected by the restoration and aftercare phases of the Project has been undertaken. An assessment of the likely significant affects has also been undertaken.
- 10.10.3 When accounting for proposed mitigation, the potential adverse effects are predicted to be negligible and **not significant** with respect to Flood Risk, Drainage and Surface Water. No residual effects having been identified.
- 10.10.4 Minor beneficial impacts are anticipated with respect to reduced sedimentation on watercourses during the aftercare phase.

11 Ecology

By RML

11.1 Introduction

11.1.1 This chapter discusses the scoping of the assessment of potentially significant effects upon sensitive ecological receptors during reclamation and aftercare of the site.

11.2 Scope of the assessment

11.2.1 The study area for the assessment is determined by consideration of the likely significant effects, some of which extend beyond the redline boundary of the proposals. Surveys conducted in 2023 and 2024, as well as desk study information and information from existing reports provided useful data to establish the following potential effect pathways, which could include, but not necessarily limited to:

- Pre-reclamation activities: ground investigations, excavation, soil-forming material stockpiling, demolition.
- Pre-reclamation activities: Land-forming phase: redistribution of overburden, wildlife casualties, noise and vibration, hydrodynamic changes, water, and air pollution.
- Habitat creation phase: land use change, change in hydrology, run-off.
- Aftercare phase: maintenance, pollution incidents.

11.3 Legislation and policy

11.3.1 The assessment will take account of relevant legislative protection afforded to certain habitats and species, as set out in the following paragraphs.

Environment (Wales) Act 2016

11.3.2 This Act introduces a new, enhanced duty on public bodies to ensure that biodiversity is an integral part of decision-making. This known as the Biodiversity and Resilience of Ecosystem Duty, which replaces the existing Natural Environment and Rural Communities (NERC) Act 2006 Duty.

Well-being of Future Generations (Wales) Act 2015

11.3.3 One of the seven goals of this Act is to strive for a resilient Wales. Both the Environment (Wales) Act and the Well-being of Future Generations Act frame biodiversity and its contribution to achieving ecosystem resilience.

Conservation of Habitats and Species Regulations 2017 (as amended)

- 11.3.4 This Act ensures the protection of Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) in the UK which no longer form part of the EU's Natura 2000 ecological network. The amended regulations have created a national site network on land and at sea, including both the inshore and offshore marine areas in the UK. The national site network includes existing SACs and SPAs, new SACs and SPAs designated under these regulations. Any references to Natura 2000 in the 2017 Regulations and in guidance now refers to the new national site network.

The Countryside and Rights of Way Act 2000

- 11.3.5 An Act which provides for public access on foot to certain areas of land and strengthens measures to allow the management and protection of Sites of Special Scientific Interest (SSSIs).

The Wildlife and Countryside Act 1981 (as amended)

- 11.3.6 This Act allows for designation of SSSIs related to flora, fauna, physiology, or geology. The Act makes it an offence to kill, injure, take, possess, or trade in many wild animal species and to pick, uproot, possess, or trade in several wild plants. Measures are also outlined to outlaw the spread of invasive non-native species (INNS). This Act also implements certain provisions of the Wild Birds Directive (2009/147/EC).

The Invasive Alien Species (Enforcement and Permitting) Order 2019

- 11.3.7 The Order came into force on the 1st of October 2019 to allow for the enforcement of Regulation (EU) No. 1143/2014 on the prevention and management of the introduction and spread of invasive alien species in England and Wales including the relevant licenses, permits and rules for keeping invasive alien species.

Technical Advice Note 5 Nature Conservation and Planning (2009) (TAN5)

- 11.3.8 TAN 5 gives advice about how the land use planning system should contribute to protecting and enhancing biodiversity and geological conservation. This guidance note should be read in conjunction with PPW11.

Wild Mammals (Protection) Act 1996 (As amended)

- 11.3.9 This Act provides protection against certain acts of deliberate harm for 'wild mammals' (meaning any mammal which is not a 'protected animal' within the meaning of the Animal Welfare Act 2006).

Protection of Badger Act 1992

- 11.3.10 Badgers and badger setts are protected under the Protection of Badgers Act 1992. This makes it an offence to wilfully kill, injure or take a badger, intentionally or

recklessly damage, destroy or obstruct access to a badger sett, or disturb a badger when it is occupying a sett.

Planning Policy Wales 12, 2024 (PPW12)

- 11.3.11 PPW12 sets out the responsibilities of the Local Planning Authority when assessing development proposals and their impacts on biodiversity; *‘all reasonable steps must be taken to maintain and enhance biodiversity and promote the resilience of ecosystems and these should be balanced with the wider economic and social needs of business and local communities.’*

The adopted Merthyr Tydfil Replacement Local Development Plan (LDP) 2016 - 2031⁹

- 11.3.12 The plan sets out policies relating to areas in the vicinity of the proposed reclamation and their nature conservation value.

Biodiversity and Net Benefits for Biodiversity

- 11.3.13 The Welsh Government approach to net-benefits for biodiversity is intended to deliver an overall improvement in biodiversity by putting an emphasis on proactive consideration of biodiversity and wider ecosystem benefits within a placemaking context to be considered early in the design process. The aim is to design developments that positively impact ecosystem resilience¹⁰. NRW has developed a framework for evaluating ecosystem resilience based on five attributes and properties specified in the Environment (Wales) Act. This is referred to as DECCA: Diversity, Extent, Condition, Connectivity and Aspects of ecosystem resilience. These attributes would be considered as the assessment.

11.4 Baseline Conditions

- 11.4.1 To inform the baseline conditions, data was obtained from SEWBRc¹¹ which was requested on the 13th of July 2023. A review of previous ecological assessments and reports was also made.
- 11.4.2 A Phase 1 habitat survey (**ES Volume 3 - Appendix 11A**) was completed in 2023 with targeted surveys conducted for great crested newts (GCN)¹² and walkover surveys for otter and badger conducted in 2024. The survey area comprised all areas within the proposed reclamation and the redline boundary current at that time.

⁹<https://www.merthyr.gov.uk/resident/planning-and-building-control/planning-policy/#:~:text=The%20Merthyr%20Tydfil%20Replacement%20Local,excluding%20Brecon%20Beacons%20National%20Park.>

¹⁰ CIEEM Briefing Paper (September 2022). Welsh Government's Approach to Net Benefits for Biodiversity and the DECCA Framework in the Terrestrial Planning System.

¹¹ <http://www.sewbrec.org.uk/> South East Wales Biodiversity Records Centre (SEWBRc) is the Local Environmental Records Centre for the collation, management and dissemination of biodiversity data for Gwent and Glamorgan.

¹² Comprising of a Habitat Suitability Index (HSI) and GCN eDNA sampling

Review of previous ecology reports

11.4.3 A review was made of the following documents:

- S.73 Application to Vary Conditions 3 and 4. Environmental Addendum Chapter 15: Ecology. SLR (2022) for Merthyr (South Wales) Ltd.
- Preliminary Ecological Appraisal: proposed Extension to East Merthyr Surface mine Site. Pryce Consultant Ecologists (2019).
- Ffos-Y-Fran Land Reclamation Scheme Restoration Strategy: Condition 50 A-PP 152-07-014 Phase 1. Miller Argent & RPS (2015)
- Ffos-Y-Fran Land Reclamation Scheme Restoration Strategy: Final Agreed Revised Dates 22.5.07. Incorporating Extraction of Coal by Surface mine Methods Being the Final Phase of the East Merthyr Reclamation Scheme. RPS (2007) for Miller Argent.
- Ffos-Y-Fran Land Reclamation Scheme Environmental Statement. Leek & Weston Ltd (2003) for Miller Argent.
- Ffos-Y-Fran Land Reclamation Scheme Environmental Statement Appendices. Leek & Weston Ltd (2003) for Miller Argent.

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11.4.5 A summary of the ecological findings within these reports is provided in **Table 11-1**.

Table 11-1: Summary of previous ecological reports

Report	Summary of ecological findings
Miller Argent (2003). Ffos-y-Fran Land Reclamation Scheme : Environmental Statement Miller Argent (2003). Ffos-y-Fran Land Reclamation Scheme: Environmental Statement – Appendix 4: Ecology surveys	• No impacts on legally protected conservation sites. • Negligible effects on Tair Carreg Moor candidate SINC and certain bird species. • Minor adverse effects on protected bird species, UK BAP priority species, mammals, reptiles, and invertebrates. • Minor to moderate effects on Local BAP habitats, including water bodies, spoil areas, and acid grassland, as well as notable plants. • Moderate effects on EC Habitats Directive Annex II habitats and UK BAP and Welsh Assembly important habitats like upland heathland. • Heathland habitats degraded mainly due to overgrazing; negligible impact expected from the development. • Moderate effects on amphibians, especially the great crested newt, with mitigation measures planned. • No major ecological impacts identified. • Overall moderate ecological significance from the development. Proposed ecological enhancements and management expected to benefit conservation interests.
RPS & Miller Argent (2015). Ffos-y-Fran Land Reclamation Scheme Restoration Plan. Restoration Plan Restoration Strategy Condition 50. A-PP 152-07-014. Phase 1.	• The site includes areas of upland heathland, purple moor grass and rush pastures, ancient and species-rich hedgerows, and upland oakwood which are priority habitats. Some will be lost through the operations. • Ponds and standing open water bodies are present on the site, some of which are important locally. Several will be lost but new ponds will be created during operations and on restoration. • Rivers and streams flow through the site, including the Nant Gyrawd which will be avoided. Others will be lost but reinstated on restoration. • The site supports a range of breeding birds, including lapwing, skylark, linnet and reed bunting. There will be some habitat loss, but this will be mitigated through habitat creation. • Great crested newts and other amphibians are present. There will be habitat loss, but new ponds have been created, and further habitat improvements are planned. • Other protected and priority species present include bats, badgers and reptiles. Mitigation strategies are proposed for these. • The restoration strategy aims to recreate priority habitats such as acid grassland, heathland and woodland. • Habitat creation and management is proposed to maintain and enhance biodiversity.

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Report	Summary of ecological findings
	Overall, some priority habitats and species populations will be negatively impacted but this will be mitigated through avoidance strategies, habitat recreation and species translocation. The longer-term aim is an overall improvement in biodiversity.
Pryce Consultant Ecologists (2019). Proposed Extension to East Merthyr Surface mine Site. Preliminary Ecological Appraisal, Llanelli.	• Surveyed site has limited ecological value with species-poor grassland and sparse early-stage lichen/bryophyte growth. • Likely initial displacement of Skylarks and Meadow Pipits, but potential long-term ecological benefits post-restoration. • No European Protected or nationally protected species like bats or badgers detected. • Site supports a few important species like Hedgehog and certain birds, which may be affected by development in the short-medium term. • No Invasive Non-Native Species found on-site. • Ecological interest of the site isn't a significant barrier to proposed development. Low existing biodiversity offers a chance for ecological improvement through development, with recommendations for habitat enhancement.

Consultations

11.4.6 Consultations and liaison with NRW and the County Ecologist has been conducted and will continue to be carried out throughout the assessment process.

11.4.7 The County Ecologist at MTCBC has responded to draft reclamation proposals (email correspondence on the 28th of September 2023) and highlighted several concerns and queries with recommendations including for further surveys and aftercare monitoring.

11.5 Assessment methodology

11.5.1 The baseline will be described using data from field surveys, published information and from consulting with recognised nature conservation bodies.

11.5.2 The valuation of existing habitats and species will be based on professional judgement, applying published good practice guidance from the Chartered Institute of Ecology and Environmental Management (CIEEM¹³). The value of ecological features is interpreted within the context of the surrounding area, and the potential effects (positive and/or negative) of the proposed reclamation.

11.5.3 Determining the sensitivity of ecological features includes consideration of factors such as their size (area), conservation status and quality. Importance is measured

¹³ Guidelines for Ecological Impact Assessment in the UK Chartered Institute of Ecology and Environmental Management

against published selection criteria where available, and with reference to published lists. According to CIEEM (2018), ecologists may identify ecological features that are not included in lists of important sites or features but are considered important based on expert judgement, perhaps because of their local rarity or because they enable effective conservation of other notable features.

- 11.5.4 If protected species or sites could be adversely affected, regardless of the level of importance, they would be subject to detailed assessment within the ES. Non-native, invasive species listed under Schedule 9 of the Wildlife and Countryside Act would also be considered in the assessment.
- 11.5.5 The 'source-pathway-receptor' approach will be followed to identify potential significant effects on ecological features. All three (source-pathway-receptor) must be in place for a significant effect to occur.

Cumulative Effects

- 11.5.6 Cumulative effects arising from multiple sources on receptors or resources will also be considered. Cumulative effects can be defined as 'impacts that result from the incremental changes caused by other past, present and reasonably foreseeable future actions together with the project' (Hyder 1999¹⁴).
- 11.5.7 The process is described as a 'cumulative effects assessment (CEA) and complies with the requirements of the EIA Regulations 2017¹⁵. The requirement to consider cumulative effects in EIA is not a recent stipulation and has existed in its current form since the 1990s specifically within European Directive 97/11/EC. The 2017 regulations (*as amended*) offer no further guidance, except to state that an ES must provide a description of the likely significant effects of a development resulting from: 'the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources'¹⁶.
- 11.5.8 Strategies to minimise, mitigate and/or compensate would be described. Proposed mitigation would ensure the compliance of the proposed reclamation with nature conservation legislation and biodiversity policy. The proposed reclamation would also be assessed for residual impacts and their significance, which considering the scheme is for the restoration of the site, are likely to be positive residual effects.

¹⁴ Walker, L.; Johnston, J. (1999). *Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions* (Report No. NE80328/D1/3). Report by Hyder Consulting. Report for European Commission.

¹⁵ <https://www.legislation.gov.uk/uksi/2017/571/contents/made>

¹⁶ IEMA (2020). Impact assessment Outlook Journal. Vol 7. Demystifying Cumulative effects.

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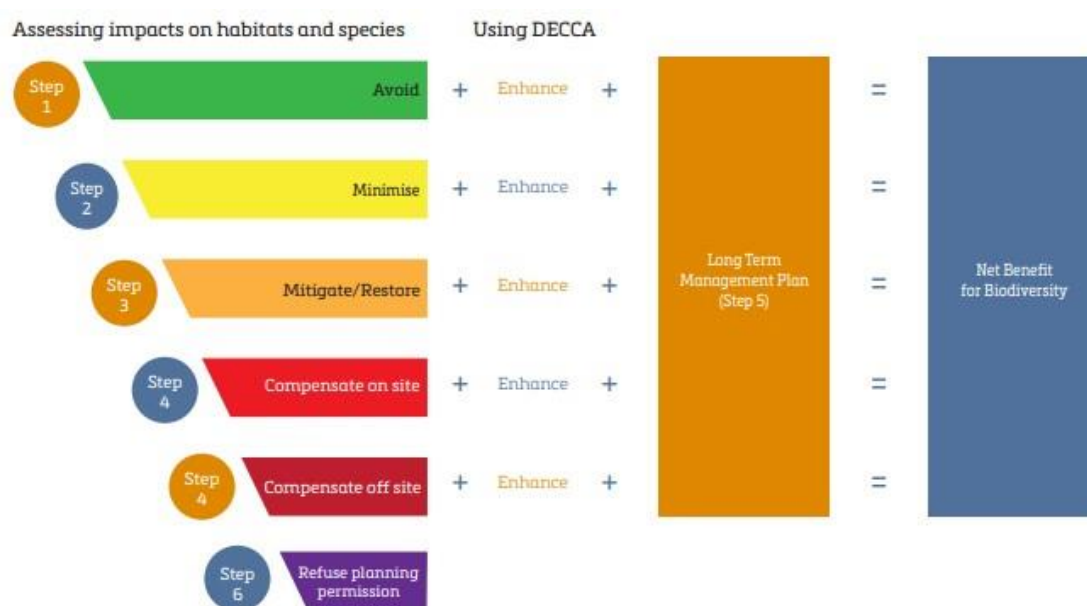
- 11.5.9 The CIEEM Guidelines (CIEEM, 2018) recommend that the technical scope of the assessment should comprise those ecological receptors that as a minimum meet the following criteria:
- be of sufficient value that effects upon them may be significant.
 - be potentially vulnerable to significant effects arising from the proposed reclamation.
- 11.5.10 Potential effects include:
- loss of important and supporting habitats, severance or fragmentation of important species commuting routes and fragmentation of landscape.
 - direct or indirect mortality of species.
 - changes in hydrology or water quality resulting in habitat degradation and/or direct mortality of important species.
 - changes in light levels or adverse effects of noise and vibration, resulting in disturbance to species.
 - Opening up or creation of new habitat.
 - Changes to the management of existing habitat.
- 11.6 Study area (Zone of Influence)**
- 11.6.1 The study area applied in any desk study for the ecology and biodiversity assessment would be established based on identified features of interest and how they may be affected by biophysical changes arising from the proposed reclamation and associated activities during site preparation, construction, operation, closure, and post closure. For consistency with the original 2003 planning application, the site boundary will remain the same. Identified features of interest and the required zone of influence for the assessment are:
- 30 km Special Areas of Conservation designated for bats.
 - 10 km Other designated sites which form the national site network (former Natura 2000 sites).
 - 5 km Nationally designated sites, such as SSSIs and Local Nature Reserves (LNRs).
 - 2 km Locally designated Wildlife Sites.
- 11.6.2 For protected and otherwise notable species the desk study area would extend to 2 km and include records within the last 10 years.

11.7 Potential mitigation, biodiversity enhancements and Net Gain

Mitigation hierarchy

- 11.7.1 The approach to mitigation is based on a hierarchy and the ‘Stepwise Approach’ advocated in PPW which places avoidance of significant impacts as the most preferable¹⁷, while compensation, which is in some circumstances, the least effective and least preferable option to compensate for losses. In between these are minimise and mitigate/restore. With regards to this scheme, the objective is to restore the site and retain/enhance/protect areas which already have a biodiversity value.

Figure 11-1 Summary of the Stepwise Approach



Avoidance measures

- 11.7.2 Sequencing of proposed restoration would be carried out calculated to avoid areas of important habitat to minimise loss. Where necessary, appropriate barriers would be installed to protect biodiversity assets.
- 11.7.3 Best practice guidelines would be followed to avoid impacts from dust, wastewater, contaminated site drainage, chemical and reagent spillage, noise, vibration, and nighttime light spillage on the surrounding environment. These would be detailed in the Construction Environmental Management Plan (CEMP).

¹⁷¹⁷ Planning Policy Wales (PPW) Edition 12 – Figure 12: Summary of the Stepwise Approach and para 6.4.11

Mitigation

- 11.7.4 Negative effects would be avoided or minimised through mitigation measures, either through the design and timing of the reclamation works or subsequent measures that can be guaranteed – for example, through a condition or planning obligation.
- 11.7.5 Mitigation measures would be proportional to the potential effect. Any significant impacts remaining after mitigation (the residual impacts), together with an assessment of the likelihood of success of the mitigation, are the factors to be considered against legislation, policy, and development management in determining the Proposed reclamation strategy. Mitigation measures likely to be required, though not exhaustive and may change upon further investigations include:
- Demarcation of areas of habitat to be protected and minimising the works footprint.
 - The exclusion and translocation of protected and notable species from impacted areas to areas outside the works footprint.
 - Sensitive timing of works.
 - Biosecurity measures to avoid the spread of INNS.

Compensation

- 11.7.6 The creation, restoration and retention of habitats forms a major part of the reclamation strategy. It is unlikely that there would be significant residual negative ecological effects, where avoidance and mitigation measures are considered. Compensatory measures would be a last resort and are unlikely to be required to compensate for habitats lost/disturbed during the reclamation, as one of the objectives of the reclamation is to create and restore and retain habitats.

Enhancement

- 11.7.7 The proposed reclamation would provide net benefits for biodiversity. This would link to the economic, social, environmental, and cultural well-being improvements which could be achieved, as set out in The Well-being of Future Generations (Wales) Act 2015. Habitat Management plans would be produced which would protect the important existing habitats and species on site, as well introducing new habitats, appropriate to the site's conditions, and enhancing existing habitats. This could include the protection, creation and/or enhancement, of acid grassland, exposed cliff faces, wetlands, ponds, heathland, and open mosaics on mineral spoil. The assessment of net gain reported in the ES would utilise the Stepwise approach as stated in PPW12 as well as the DECCA principles.

11.8 Assessment of Effects

- 11.8.1 In accordance with current CIEEM guidelines, only impacts that are likely to be significant need to be examined in detail. Impacts that are unlikely to occur, or that would likely be insignificant if they did occur, can be excluded from the assessment.
- 11.8.2 Where uncertainty exists, it is prudent to assess the potential impact to ensure thoroughness and that has typically been the case here. Furthermore, the EclA need only evaluate and report significant residual effects that remain after implementing mitigation measures. However, it is considered best practice to transparently present both the initial potential significant effects before mitigation and the remaining significant effects after mitigation has been applied. This approach ensures that the full impact of the restoration of the site is clear, while focusing on the most relevant outcomes.
- 11.8.3 Potential effects which could arise from the restoration include the following:
- Direct mortality and disturbance to protected and notable species;
 - Direct loss of and disturbance to habitats; and,
 - Noise, disturbance, and risk of pollution during restoration.
- 11.8.4 This section aims to evaluate the potential impacts of the proposed restoration on significant ecological features, or 'valuable receptors,' highlighted as important in the baseline conditions.
- 11.8.5 Each valuable receptor will be considered, along with the impacts of the restoration which could potentially have significant impacts on them. For each receptor, this is followed by a description of the mitigation measures which are known to be included in the restoration strategy and at which level of the mitigation hierarchy they exist.

Non-Statutory Designated Sites

Merthyr Common Central SINC

- 11.8.6 Of the Sites of Importance for Nature Conservation within 2 km of the redline boundary only the Merthyr Common Central SINC has the potential to be impacted by the proposed restoration as it borders the site to the north, south and west (**ES Volume 3 - Appendix 11A**). However, significant earthworks will only be taking place around OB1 and north of Bogey Road, close to the SINC at its northwest corner (**ES Volume 2 – Figure 11.1**). The remaining adjacent operations will be planting and re-seeding which are of 'neutral' impact.
- 11.8.7 There are no plans for the addition or removal of specific drainage systems which would or do feed the SINC and as such there are not expected to be any significant changes to water levels from the baseline conditions.

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- 11.8.8 The greatest potential impact is therefore likely to be because of run-off from earthworks entering those waterbodies which drain into the SINC.
- 11.8.9 The area has established and continued to support protected species, such as great crested newts and barn owls, throughout the period when mining operations were underway. As such, the comparative impact of restoration works is likely to be 'neutral'. Impacts on these species are considered separately.

Habitats*Ponds*

- 11.8.10 The potential impacts to ponds from the restoration proposals are very similar to those which might be experienced by amphibians (below).
- 11.8.11 One pond, pond 8 (**ES Volume 2 – Figure 11.2**) will be directly impacted by the proposal. This pond was used to provide a source of water for the barrel washing operations during working and is encompassed by the area to the eastern edge of the void (**ES Volume 2 - Figure – 11.3**) which is designated for reprofiling and as such is expected to be lost.
- 11.8.12 Pond 8 is currently of negligible ecological value, evidenced by a HSI score of 0.30 and absence of GCN eDNA (**ES Volume 3 - Appendix 11B**). The surrounding vegetation is sparse, consisting almost entirely of coltsfoot (*Tussilago farfara*), a pioneer plant capable of growing on very alkaline soils and often found on former open-cast mining sites¹⁸. No aquatic vegetation was observed, and it seems unlikely that it is currently capable of supporting much aquatic life.
- 11.8.13 Though pond 8 will be removed, in its current state it offers very limited value to biodiversity across the site. If left in situ for a long enough period, this pond may naturally regenerate as others across the site have done, to a state in which its loss is of greater significance. However, its removal is to be undertaken prior to a point at which this would be possible and therefore the impact is considered 'neutral'.
- 11.8.14 The remaining ponds will not be directly negatively impacted as the proposed restoration will leave these areas to continue natural regeneration, a positive effect.
- 11.8.15 Those remaining ponds closest to the earthworks will remain fenced-off from the works and this is expected to provide a sufficient buffer to any potential pollution events resulting from machinery or run-off from dust-suppression water spraying. However, these events in themselves will be significantly reduced in the proposed

¹⁸ Graeme Tobyn, Denham, A. and Whitelegg, M. (2011). *The Western herbal tradition: 2000 years of medicinal plant knowledge*. Edinburgh: Elsevier, pp317.

scheme as there will be significantly reduced plant movements required to complete the works.

- 11.8.16 Dust arising during land-forming could potentially have a 'slight' impact on ponds within 250m of these works, without mitigation and if occurring to a significant degree. When dust settles on a pond's surface, it can reduce penetration of the light essential for photosynthesis in aquatic plants and algae. This reduced light can disrupt the pond's food web, affecting organisms that rely on these primary producers. Dust can also introduce fine particles that settle on the pond bed, altering sediment composition, and potentially suffocating invertebrates and larval stages of amphibians. Additionally, dust can carry pollutants like metals or chemicals, which may accumulate in the water, leading to toxicity for sensitive aquatic species.

Running water

- 11.8.17 This habitat is primarily associated with the stream 'Bargoed Taf' running along the west and south of OB3.
- 11.8.18 The activity of machines disturbing soils during land reclamation and reprofiling works on and around the site could increase the amount of fine sediments entering the flow and settling into the streambed of nearby ditches and streams causing pollution effects and smothering. The use of heavy machinery on site could also result in the spillage of toxic fuels and oils etc. into adjacent watercourses.
- 11.8.19 The Water Framework Compliance Directive Report¹⁹ found that there could be a potential short-term increase in sediment supply during construction, but long-term improvements are expected due to reduced sediment transfer. Construction activities may temporarily affect aquatic habitats, but overall biodiversity is expected to improve post-restoration.

Acid flush

- 11.8.20 This habitat occurs in small patches in several locations across the site. In terms of proximity to areas where the most significant works will occur, only the patch toward the northern boundary at the base of OB1 has any potential to be impacted (**ES Volume 2 – Figure 11.1**). Works close to this area includes cutting of existing material to fill and reprofile the void. The direction of works would be away from this habitat.
- 11.8.21 Acid flush wetlands are typically nutrient-poor environments that support specialised plants and animals adapted to acidic, low-nutrient, and low-pH conditions. Without mitigation, runoff from disturbed soils during re-grading of the western slope of OB1

¹⁹ Williams, M (28/11/2024) Ffos-y-Fran, Merthyr Tydfil Baseline and Preliminary WFD Compliance Assessment for Merthyr (South Wales) Ltd. Waterco report number 15840-WFD-01.

could carry sediments, nutrients, and potentially alter pH levels, which could disrupt the delicate balance of this habitat.

- 11.8.22 As with previously considered receptors, this habitat has persisted over the period of active mining operations, where impacts were far more severe. As such, it seems unlikely that impacts from the comparatively minimal and short-term restoration works around OB1 would be of significant detriment. The impact is therefore considered to be 'slight'.

Amphibians –including great crested newts

- 11.8.23 Pond 8 will be removed as part of the re-profiling undertaken around the void (**ES Volume 2 – Figure 11.2**). This pond was used to contain and store water for use in the barrel washing operations during working of the site. It has minimal value to amphibians, as indicated by a low HSI score of 0.30 and the absence of Great Crested Newt (GCN) eDNA (**Volume 3 - Appendix 11B and Appendix 11C**). The surrounding vegetation is very sparse and is dominated almost entirely by the pioneer species coltsfoot.
- 11.8.24 The other ponds close to the main earthworks around the void (ponds 1 and 6), and at most risk of impact (**ES Volume 2 – Figure 11.2**), also gave negative eDNA results for GCN and had poor or below average HSI scores indicating low amphibian suitability.
- 11.8.25 In its baseline condition, the vast majority of habitat subject to earthworks/re-profiling exists as mine and associated spoil (**ES Volume 2 – Figure 11.1**). This habitat typically consists of loose, rocky, and nutrient-poor ground that lacks the water-retaining capacity essential for amphibians, which rely on moist environments to prevent desiccation. Additionally, mine spoils rarely support the dense vegetation or organic matter needed to create shaded, cool microhabitats and shelter from predators, or to support the invertebrate food sources amphibians rely on. The lack of suitable breeding sites, such as ponds or pools with clean water, further makes these areas inhospitable. Therefore, destruction of viable amphibian habitat is not anticipated at any point in the restoration proposal. Those ponds identified as positive for GCN would be retained and protected, and where required, enhanced.
- 11.8.26 While the areas subject to earthworks and associated machinery traffic appear similarly unsuitable for migration and dispersal within the wider landscape, direct mortality to any individual amphibians found in these habitats cannot be entirely ruled out. This is considered to represent a 'slight' and short-term impact during the land-forming phase.

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- 11.8.27 Dust arising during land-forming could represent a 'slight' impact on amphibian habitats within 250m, without mitigation, and if occurring to a significant degree. For example, dust settling on water can change pH, increase turbidity, and introduce pollutants, reducing water quality and disrupting processes like respiration, feeding, and breeding. Increased turbidity limits sunlight, affecting plant growth and lowering oxygen levels, which amphibians and other pond organisms rely on.
- 11.8.28 Amphibian habitat is not expected to be at risk from any pollution events potentially arising from equipment (e.g. oil, hydraulic fluid) during any stage of the proposal. All ponds within the ZOI are fenced off from the works and have sufficient buffer areas to prevent direct contamination.
- 11.8.29 Removal of temporary structures associated with the previous mining works (e.g. workshops and heavy plant storage units) will take place approximately 30m north of the eDNA positive pond 9 (**Appendix 11C**). These structures are open corrugated metal sheds, built on bare ground. The same bare ground also lies between this area and pond 9. As a result of the unsuitability of the connecting/surrounding habitat in the direction of the works, and of the structures themselves as refuges, it seems highly unlikely that amphibians would be encountered or disturbed during the removal works and therefore represents a 'neutral' risk.
- 11.8.30 Merthyr Common Central SINC likely represents the most suitable terrestrial amphibian habitat within the ZOI and would be unaffected by the proposals. It is located outside of the redline boundary and is sufficiently far from earthworks to be impacted. This area is considered separately (above).

Birds

- 11.8.31 The northeastern benches of the surface mine void are currently being used by several species of gulls, corvids, and feral pigeons, likely attracted to the area by the nearby Trecatti Landfill Site. As a result of the prevalence of such prey, individuals of the Schedule 1 species peregrine falcon have been observed hunting and feeding in this location, though there is currently no evidence of nesting. Without mitigation there exists the potential for 'slight' impacts on such bird species using the area around the void during re-profiling operations.
- 11.8.32 A pair of nesting barn owls are known to utilise one of the derelict buildings at the eastern end of the SINC. This area is outside of the redline boundary and as such no works will take place in this area, with the main restoration works taking place approximately 400m northwest at the nearest point. There exists minimal likelihood of noise-related disturbance as this species began utilising the area at a time when mining operations were still underway, and noise/vibration levels were significantly

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higher than is expect for the final restoration. This area is also approximately 30m from relatively busy road and therefore has experienced a degree of disruption from traffic for a significant period. Additionally, no works will take place at night when these birds hunt.

- 11.8.33 Risk to breeding barn owls is 'neutral' and will likely ultimately become beneficial in the long term as new planting expands hunting grounds and connectivity.
- 11.8.34 No permanent loss of breeding bird habitat is expected to result from the proposed restoration strategy as the most potentially disruptive operations (e.g. earth moving) will be restricted to areas of mine and mine spoil which, at baseline condition, have little to no value.
- 11.8.35 There exists a potential 'neutral or slight' risk of disturbance to birds during planting and re-seeding operations. This would primarily impact ground-nesting species, were they to be present.
- 11.8.36 In the absence of mitigation, dust would have the potential to result in a 'slight' impact to bird species. Dust generated by earth-moving operations can settle on vegetation and in water, reducing food quality and contaminating drinking water for birds. Dust can also impair the respiratory health of birds, particularly species that forage close to the ground.

Bats

- 11.8.37 Previous reports suggest that the Site has limited suitability to support bats, except for occasional foraging in suitable conditions (**Table 11-1**). The 2022 Environmental Statement Addendum²⁰ did, however, suggest that the Bogey Road bridge/cutting as a potential roosting/hibernation site for Pipistrelle and Myotis.
- 11.8.38 The main potential impact to bats would be because of the loss of potential roosting habitat. However, most structures considered to have low-moderate potential occur outside of the red line boundary and would not be demolished. Except for the Bogey Road bridge, structures within the red line boundary generally have negligible potential to support b. s owing to their type of construction, as such, the loss of these is a 'neutral effect' to local bat populations.
- 11.8.39 In addition, the current restoration proposals do not result in the loss of any trees, or suitable foraging and commuting habitat. No impacts upon bats are envisaged.

²⁰ SLR (2022) S.73 Application to Vary Conditions 3 and 4. Environmental Addendum Chapter 15: Ecology.

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- 11.8.40 Otters have been previously noted (from desk study data) to the south of the site, though no physical evidence has been recorded in any of the reports reviewed (**Table 11-1**).
- 11.8.41 While there is an absence of physical evidence, and reviewed reports are unanimous on the unsuitability of the habitat within the site, due to the presence of records indicating otters in the surrounding habitat and their status as a priority species, they have been considered as Valuable Ecological Receptors.
- 11.8.42 Watercourses to the south of OB3 would remain largely unaffected by the restoration proposals, as would waterbodies and associated drains with the central SINC.
- 11.8.43 No suitable habitat for commuting, foraging, resting up or breeding otters would be directly disturbed as result of the restoration proposals and all previous reports suggest that the Site is generally unsuitable even in the absence of such work (**Table 11-1**).
- 11.8.44 Potential indirect effects could include disturbance caused by plant and machinery disturbing soils on and around the Site, which could increase the amount of fine sediments entering the flow and settling into adjacent watercourses causing pollution effects and smothering potential prey and affecting the quality of the water of suitable habitat further downstream.
- 11.8.45 The use of heavy machinery on site could also result in the spillage of toxic fuels and oils etc. into adjacent watercourses/waterbodies the river, again having an indirect effect on water quality and prey abundance.

11.9 Mitigation Measures

Non-Statutory Designated Sites

Merthyr Common Central SINC

- 11.9.1 What risk may be posed to the SINC from run-off can largely be mitigated through the establishment of physical barriers, such as silt fences, at strategic points around the working area to capture sediment before it enters channels which feed the SINC. Furthermore, the site already has a well-established network of catchment ditches around the working areas to direct run-off to water treatment areas and settlement lagoons, where any solids are substantially removed before the water is discharged into off-site watercourses via consented discharge points (i.e. <50 ppm suspended solids and between 5 – 9 pH levels). A phased approach to earthworks, in accordance with a planned programme of works, would also help to reduce the amount of exposed soil vulnerable to erosion and run-off.

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- 11.9.2 The SINC itself is outside of the proposed restoration area and will therefore not experience any direct enhancements. However, as discussed previously, the creation of new habitat in the immediate surrounding area is likely to be beneficial to species using the SINC, and aid access to it by those which currently do not.
- 11.9.3 In its baseline condition the SINC is a habitat of relatively high quality, isolated by the previously degraded landscape. Such enhanced connectivity would allow wildlife to move more freely between habitats, increasing access to resources like food, water, and breeding sites. This movement is especially important for migratory species, as well as for species with large territories or specific habitat needs that may not all be met within a single site. By connecting fragmented habitats, genetic diversity is promoted as animals can find mates from different populations, reducing inbreeding and strengthening population resilience.
- 11.9.4 Additionally, improved connectivity supports species' adaptation to environmental changes, such as shifting climate conditions. As habitats change, connected landscapes provide routes for animals to migrate to more suitable environments. This is particularly valuable for species in isolated or degraded habitats, where limited connectivity could otherwise trap them in less favourable conditions.
- 11.9.5 As such, the incorporated enhancements of the surrounding habitat would be of overall benefit to the long-term management objectives of the SINC²¹, specifically relating to maintaining enhancing and creating habitats of value to protected notable species utilising the site, including bats, birds, reptiles and amphibians.

Habitats

Ponds

- 11.9.6 Dust suppression procedures will be in place during earthmoving operations, these include:
- Not conducting earthworks during periods of excessively windy and dry conditions where there may be potential to cause a dust nuisance.
 - Reduced vehicle speeds when necessary to minimise the potential to kick up dust.
 - Regular spraying of water on haul roads and working areas to bind particles and prevent them becoming airborne.
- 11.9.7 It is expected that adherence to these procedures can mitigate risk to ponds resulting from dust.

²¹ Miller Argent (South Wales) Limited. Ffos-y-Fran Land Reclamation Scheme - Central Ecological Area Management Plan 2009 – 2024. Agreed between Merthyr Tydfil County Borough Council and Miller Argent (South Wales) Limited Version 1 November 2009.

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- 11.9.8 More broadly, the proposed planting and re-seeding is likely to significantly improve soil stability across the site. This is expected to decrease the potential for longer-term pond contamination caused by run-off, dust or erosion/collapse of edges.
- 11.9.9 Three of the ponds No's 3, 6 & 9 are lined with a waterproof geotextile membrane, with the remainder sealed naturally by the superficial material in which they were originally founded (e.g. boulder clay). Enhancements of ponds No's 3 & 9, with the exposed lining, will be undertaken via the laying of coir matting down the relatively shallow banks into the water. This is expected to improve the ecological value of these ponds by providing a more natural, vegetated margin allowing a range of species to more safely transition between land and water. The large attenuation Pond at location No. 6, however, has banks which are both relatively steep and long and would require significant amounts of coir matting. It is therefore proposed that the water level here would first be reduced by pumping, before pushing soil forming material (or similar granular material) down the bank slopes to partially fill the base, until the lining is sufficiently covered before allowing the water level to rise again.
- 11.9.10 Except for improvements to the margins, where exposed lining is visible, further interventions to the immediate area of the ponds are likely to be unnecessary. As has been observed in several ponds across the site (**Appendix 11B**), with the passage of sufficient time from their operational use, natural regeneration is expected to lead to significant enhancement in ecological value.
- 11.9.11 The succession process begins when pioneer species such as algae and hardy aquatic plants colonise the pond, providing habitat and food for insects and other small organisms. As these organisms decompose, they enrich the pond's sediment, creating a nutrient base that supports more complex plant and animal species. Over time, natural filtration by plants such as cattails, reeds, and other wetland vegetation helps to clean the water by absorbing excess nutrients and trapping sediments. Additionally, as water quality improves, species such as amphibians return, further contributing to a balanced ecosystem. Seasonal cycles also play a role, as rain and wind can help oxygenate the water, disperse seeds, and introduce new species from surrounding habitats, leading to gradual but effective regeneration of the pond without intervention.
- 11.9.12 Planting and seeding of the wider habitat surrounding the ponds is also expected to be of direct benefit in the medium to long-term. Trees and grasses act as natural buffers, helping to prevent soil erosion and reduce the amount of sediment, nutrients, and pollutants that flow into the pond from surrounding land. This helps maintain clear water, limits algal blooms, and prevents oxygen depletion, which is essential for supporting diverse aquatic life.

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- 11.9.13 Woodland trees around the ponds offer shaded areas, moderating water temperature and reducing excessive evaporation in hot weather. Cooler water temperatures are beneficial for many aquatic species, such as amphibians, which rely on stable conditions to thrive. The fallen leaves and organic debris from trees will also aid in the creation of microhabitats and nutrient sources within the pond, further supporting insects, microorganisms, and other species that form the foundation of the food web.
- 11.9.14 Grass cover also plays a key role in promoting beneficial insect populations. Native grasses and flowering plants attract pollinators and other insects, which, in turn, provide food for birds and amphibians, creating a more integrated and complex ecosystem. Together, woodland trees and grass seeding will enhance the pond's resilience by improving water quality, increasing biodiversity, and stabilising the landscape, leading to a healthier, self-sustaining ecosystem that supports a wide array of plant and animal species.
- 11.9.15 It is expected that creation of a large new body of standing water within the void, enhancement of the margins of some of the retained ponds and planting across the wider surrounding habitat would provide a significant net benefit for biodiversity above baseline conditions beginning in the short-term and increasing in value with time.

Running water

- 11.9.16 Mitigation measures would include the following:
- Retention of water treatment areas (sediment settlement lagoons) which will ensure any flows impacted by construction activities are treated (for sediment removal) before leaving site. This mitigates the potential effects on downstream WFD waterbodies.
 - Pollution control and containment measures to limit the spread of pollution and reduce the risk of harm to biodiversity in the case of accidents which could result in spillages of pollutants such as fuels or silt.
 - Works within and adjacent to restored watercourses with the potential to cause run-off would be monitored by Supervisors in consultation with the Environmental Liaison Officer (ELO). If discolouration of the watercourse is noted, works would stop and working practices reviewed until such time as measures are in place to allow works to continue.
 - Silt would be managed as far as reasonably possible using contour grips and cut-off drains, with straw bales used as necessary, placed downstream of the reprofiling works or works within existing watercourses to minimise transfer of any excess sediments downstream.

- All fuel, oil and chemicals used on site would be stored away in a locked store which would be banded to 110% capacity of the volume stored.

Acid flush

- 11.9.17 Much of the impact to this habitat could be mitigated by the installation of well-placed cut off ditches silt fencing or other appropriate measures at the base of OB1, which would be near this habitat and associated watercourse.
- 11.9.18 Tree and or shrub planting around the area can create a buffer zone, intercepting any pollutants and potential windblown dust, thereby reducing nutrient and sediment deposition into the wetland, which is crucial for maintaining its naturally low-nutrient, acidic conditions. This vegetation strip would also offer habitat for birds and insects that may support the ecological diversity of the surrounding area, indirectly benefiting species in the wetland by stabilising nearby ecosystems.
- 11.9.19 Grass seeding, where appropriate, in the area adjacent to the wetland will help prevent soil erosion and sediment runoff into the wetland, maintaining the delicate soil and water balance essential to acid flush habitats. Grasses contribute to soil stability, limiting disturbance that could alter the acidity and composition of the wetland substrate.
- 11.9.20 The inclusion of a nearby permanent freshwater body in the void provides an alternative habitat for water-dependent species, reducing potential pressures on the wetland and allowing it to remain a specialised habitat.

Species

Amphibians –including great crested newts

- 11.9.21 Due to the adoption of an avoidance and enhancement approach with regards to amphibian habitats within the zone of influence, risks are expected to be 'neutral', and the restoration proposals would improve the condition above baseline for amphibians.
- 11.9.22 Any approach which would seek to restore the site to a state representing conditions prior to any mining works would risk serious disruption to amphibians which have since colonised the numerous ponds constructed for previous mining operations. The baseline is now established as one including 30 ponds, more than half of which are eDNA positive from GCN. As such, baseline habitat of most value to amphibians has been excluded from proposals, except for enhancement measures.
- 11.9.23 Many of the ponds within the ZOI have shown considerable natural regeneration and now represent habitat of high quality for amphibians, including priority species such as GCN. For this reason, it is felt that enhancement measures should be limited to avoid unintentionally disrupting this process.

- 11.9.24 Several of the lined ponds were also found to be positive for GCN (**Appendix 11B – Ponds 3, 9, 27 and 28**). In certain instances, the lining is exposed around the edges, and this is likely to represent an opportunity to further enhance these areas for amphibians. Such exposed lining could make access and egress more challenging for amphibians, as well as other species which, in the case of large mammals, may become trapped and drown without the ability to gain purchase. As the lining itself cannot be removed without risk of destroying these ponds, the proposal for enhancement is to cover the exposed sections with coir-type matting (except for Pond no. 6, as described in Section 11.9.9 above). The coir matting would promote a stable medium for the growth of native plants, offering further shelter and providing a more natural transition between the pond and surrounding habitat. This is especially important as, while GCN may disperse up to 1km from their resident ponds²², a proportion of adult and immature great crested newts are more likely to over-winter in or close to the pond edge at sites with dense pond edge vegetation²³.
- 11.9.25 Risk of direct mortality to amphibians during the land-forming phase, or removal of structures, is 'slight' and could be mitigated to 'neutral' through the incorporation of 'ToolBox Talks' (TBT) given to operatives. This information would inform those involved of how to identify relevant species and the procedure to follow should they suspect that an amphibian has been discovered and/or may be at risk.
- 11.9.26 The impact to amphibian habitats from dust generated by the works is 'slight'. Dust suppression procedures will be in place during earthmoving operations as stated in 11.9.6 above.
- 11.9.27 It is expected that adherence to these procedures can mitigate to 'neutral' the impact to amphibian habitat resulting from dust.
- 11.9.28 Amphibian habitat connectivity is expected to improve significantly above baseline conditions as large areas of OB1 currently consisting of bare ground and mine spoil will be returned to acid grassland. This would provide cover and aid the movement of amphibians between ponds. As a result of this improved connectivity, it seems likely that ponds which are currently eDNA negative for GCN (e.g. 1, 6 and 8; **Appendix 11C**) could become colonised over time.
- 11.9.29 Enhancement for amphibians will also include the creation of a large permanent waterbody where the void is currently situated. The waterbody, in combination with the surrounding mixed woodland planting, has the potential to be of benefit to

²² <https://naturalresources.wales/media/679463/great-crested-newts-guidance-for-glastir-woodland-creation.pdf>

²³ Langton, T.E.S., Beckett, C.L., and Foster, J.P. (2001), Great Crested Newt Conservation Handbook, Froglife, Halesworth.

several breeding, hibernating and foraging amphibian species. In its baseline condition this area is of no benefit to amphibian species as it consists of un-vegetated mine workings/spoil with a small area of groundwater.

- 11.9.30 Further amphibian enhancements will occur on the base of OB2. Vegetation is already re-establishing in this area and the seasonal pond 13 (**ES Volume 3 - Appendix 11B**), while eDNA negative and of a relatively low HSI score, does have marginal vegetation establishing in the form of *Juncus*. Proposed enhancements include increasing the suitability of this area as wetland habitat through the incorporation of additional earth 'scrapes' which can retain water and support aquatic vegetation. Broadleaved woodland planting along the eastern side of OB2 is also likely to increase the connectivity and favourability of this area for amphibians.
- 11.9.31 New planting around the SINC would also enhance connectivity to/from this area.
- 11.9.32 While pollution incidents arising from machinery are not expected to pose a significant risk to amphibian habitats, work would follow pollution prevention guidance for works near water²⁴.
- 11.9.33 Where a scheme might impact on GCN, the concept of Favourable Conservation Status (FCS) is central to decision-making. Favourable Conservation Status is a concept at the heart of conservation action and policy and is a recognised and adopted approach utilised by NRW. The conservation status of species will be taken as 'favourable' when:
- Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats
 - The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future; and
 - There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.
- 11.9.34 Evidence suggests, from previous surveys conducted²⁵, that irrespective of previous mining activities at the site, the occurrence of GCN ponds has increased. With the current restoration proposals to include the retention and enhancement of ponds and adjacent terrestrial habitat, the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future. There will continue to

²⁴ <https://www.netregs.org.uk/media/1418/gpp-5-works-and-maintenance-in-or-near-water.pdf>

²⁵ Leek and Weston Ltd (May 2003) Ffos-y-Fran Land Reclamation Scheme Incorporating Extraction of Coal by Surface mine Methods Being the Final Phase of the East Merthyr Reclamation Scheme. Environmental Statement. For Miller Argent.

be a sufficiently large habitat to maintain the populations on a long-term basis, and the future prospect of the species look to be positive, and the FCS favourable.

Birds

- 11.9.35 Risk to nesting birds can largely be mitigated to 'neutral' by conducting operations such as earth-moving and planting within areas which are suitable to support nesting birds, outside of the nesting bird season (considered to be March - August inclusive but can be earlier or later in the season dependent upon local climatic conditions). With the inclusion of dust suppression measures the impact to viable habitat would also be reduced to 'neutral'.
- 11.9.36 While there is no evidence of peregrine falcons nesting on the site, they are known to use the benches around the void for hunting. The species is known to have a relatively high tolerance to human activity, including active quarries²⁶, and its utilisation of this area began during a time when mining operations were underway. While they may not currently nest on the site, breeding birds may continue to use the area for hunting and feeding young, and, if works in the area reduce, they may start to nest. As a precautionary approach, it is advised that pre works check are conducted and if nesting behaviour is exhibited, then re-profiling works in that area would need to be avoided until young have fledged.
- 11.9.37 The proposed restoration does not envisage any permanent loss of peregrine falcon habitat and is likely to result in enhancements over time. The works would involve retaining and stabilising the exposed rock face of the void and the addition of soil-forming material to the lower benches is expected to encourage colonisation by vegetation. With time it is quite possible that this area could succeed into classification as 'Inland Rock and Scree', a UK BAP habitat²⁷.
- 11.9.38 Broader enhancements for birds will involve habitat creation in the form of planting and re-seeding. Trees and shrubs of varying heights (e.g. oaks, birches, and hawthorns) included in the planting scheme, would mature to create layered habitats that support a range of bird species with different nesting preferences. Dense, understory vegetation offers safe nesting sites for ground-nesting and low-perching birds, while taller trees provide elevated nesting and lookout spots for predatory species.

²⁶ Wilson, M. W., Balmer, D. E., Jones, K., King, V. A., Raw, D., Rollie, C. J., ... Noble, D. G. (2018). The breeding population of Peregrine Falcon *Falco peregrinus* in the United Kingdom, Isle of Man and Channel Islands in 2014. *Bird Study*, 65(1), 1–19. <https://doi.org/10.1080/00063657.2017.1421610>

²⁷ <https://data.jncc.gov.uk/data/a81bf2a7-b637-4497-a8be-03bd50d4290d/UKBAP-BAPHabitats-19-InlandRockOutcrop.pdf>

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- 11.9.39 Woodlands also attract insects, which are crucial food sources for many bird species, especially during breeding seasons when protein-rich food is needed for young birds. The inclusion of trees and shrubs which produce fruits, seeds, and nuts will result in important food sources throughout the year; for example, berry-producing shrubs like rowan and elder offer sustenance in colder months, helping birds survive through winter. Woodland planting also creates natural corridors that connect fragmented habitats, allowing birds to move safely between feeding, nesting, and roosting areas.
- 11.9.40 The creation of a new permanent waterbody in the current void location will provide substantial benefits to birds. Freshwater bodies attract a wide variety of species by offering essential resources, including drinking/cleaning water, food and shelter. Aquatic plants, insects, and amphibians would be expected to colonise the water, creating a diverse food web that, over time, could support insect-eating birds or amphibian-eaters like herons and wading birds.
- 11.9.41 Additionally, freshwater habitats provide crucial nesting opportunities for certain species. Ducks, swans, and other waterfowl may nest near the water's edge, while reeds and dense vegetation offer sheltered spots for songbirds and marsh-nesting species. Freshwater bodies are also valuable for migratory birds, serving as stopover points where they can rest and refuel during long journeys. Due to its size, this area can also be valuable as a consistent water source, making the area more resilient for birds during droughts or hot weather.

Bats

- 11.9.42 The bridge identified as a 'potential' roost location will be retained and some limited works may be required within 100m of this area and if required would be subject to a working method statement.
- 11.9.43 If overnight working is required for the restoration proposals, it is likely that any lighting would be directed to where it is needed (i.e. re-profiling works) and would not impact upon any suitable bat habitat. Landscaping would be conducted within daylight hours and would not disturb bats.
- 11.9.44 It is anticipated that no lighting would be required post restoration.
- 11.9.45 The proposed habitat to be created would, once established, would support foraging and commuting habitat for local bat populations. With the proposed mitigation the long-term effect upon bat populations are beneficial with improved connectivity.

Otter

11.9.46 Due to the lack of direct impact on suitable habitat, mitigation measures to prevent detrimental impact on otters would largely be the same as are proposed for running water. These will include:

- Retention of water treatment areas (sediment settlement lagoons) which will ensure any flows impacted by construction activities are treated (for sediment removal) before leaving site. This mitigates the potential effects on downstream WFD waterbodies.
- Pollution control and containment measures to limit the spread of pollution and reduce the risk of harm to biodiversity in the case of accidents which could result in spillages of pollutants such as fuels or silt.
- Works within and adjacent to the restored watercourses with the potential to cause run off would be monitored by Supervisors in consultation with the Environmental Liaison Officer (ELO). If discolouration of the watercourse is noted, works would stop and working practices reviewed until such time as measures are in place to allow works to continue.
- Silt would be managed as far as reasonably possible using contour grips and cut-off drains, with straw bales used as necessary, placed downstream of the reprofiling works or works within existing watercourses to minimise transfer of any excess sediments downstream.
- All fuel, oil and chemicals used on site would be stored away in a locked store which would be bunded to 110% capacity of the volume stored.

11.9.47 It is anticipated that no lighting would be required post restoration.

11.9.48 In addition, the proposed habitat to be created would, once established, support foraging and commuting habitat for otters in an area which is currently unsuitable. With the proposed mitigation the long-term effect upon otter populations are beneficial.

11.10 Monitoring

11.10.1 Aftercare would be carried out on restored areas of the site by MSW for a period of up to 5 years. During that time, it is anticipated that MSW employees or a contractor (managed and employed by MSW) would carry out tasks such as grass cutting, weed control, replacement of dead plants, watering, repair of fences, cleaning out ditches, and other environmental measures as identified in an aftercare plan. These tasks would be performed to ensure that the seeding and planting survive and successfully establish as new vegetation. At the end of the aftercare period of each section of restored land MSW and/or the contractor (managed by MSW) would cease aftercare works and agreement would be reached with the local authority that the now

established and healthily growing landscape could be released back to the landowner and/or other interested parties.

11.10.2 Throughout the aftercare period, and for as long as is necessary to fulfil commitments, MSW would employ suitably qualified personnel to monitor the mitigation measures to:

- Ensure that it continues to develop properly to meet commitments and functions (E.g. trees should grow as planned)
- Review if it would achieve the commitment and function in the required period
- Check for adverse or changing conditions that might compromise the effectiveness of mitigation and restoration measures
- Advise on maintenance interventions that might be required if a failure to meet commitments is identified, and
- Once the mitigation and restoration achieves full effectiveness monitoring could continue to ensure that it continues to perform its proposed function.

11.10.3 These measures are set out in more detail in the Restoration and Aftercare Management Strategy.

11.10.4 Details of the monitoring required would be established in consultation with NRW and the LPA and incorporated into the CEMP and carried through to the Restoration and Aftercare Management Strategy. Monitoring would include but is not limited to:

- Continued water quality status should be maintained and monitored during the restoration and aftercare period. Regular visual inspection and testing as needed of all discharges into the existing drainage system and pit void would be carried out.
- Regular inspection of surface water runoff control measures to ensure that sediment is not transported off site.
- Regular inspection of plant that contain fuels or chemicals to ensure there is no risk of spillage.
- Requirements for monitoring of protected species (for example GCN) would be subject to agreement with MTCBC
- Monitoring for birds (e.g. Peregrine falcons) would be undertaken during restoration by the appointed ECOW and any occurrences and nesting behaviour would be noted and reported. It is likely that birds would be deterred by and displaced from utilising the void ledges due to ongoing noise and restoration and reprofiling activities, though breeding may occur during the aftercare period.

11.10.5 During the aftercare period monitoring visits would be undertaken by MSW (using experts if necessary) to monitor and advise on the performance of the mitigation, including the establishment of tree, shrub and grass seeding.

11.10.6 Reports would be prepared by MSW (using experts if necessary) summarising the results of each visit, any requirements for additional maintenance work and indicating how the scheme of mitigation is performing against agreed indicators. At the end of the aftercare period a Handover Environmental Design Performance Report (HEDPR) would be prepared accompanied by the Handover Environmental management Plan to assist in any required long-term maintenance.

11.11 Cumulative Effects

11.11.1 Cumulative effects result from multiple actions on receptors and resources over time and are generally additive or interactive (synergistic) in nature. Cumulative effects can also be considered as:

‘...impacts resulting from incremental changes caused by other past, present or reasonably foreseeable actions together with the project²⁸.’

11.11.2 Two principal types of cumulative effects are considered:

- *Intra-project effects*: These occur where a single receptor is affected by more than one source of effect arising from different aspects of the restoration scheme. An example of an intra-project effect would be where a receptor is affected by dust, noise and pollution during the restoration, with the result being a greater effect than each individual effect alone; and
- *Inter-project effects*: These effects occur because of several past, present or reasonably foreseeable proposed developments, which individually might not be significant, but when considered together could result in significant cumulative effects on a shared receptor and could include developments separate from and related to the scheme.

11.11.3 The cumulative effects of the restoration scheme have been considered in a **Chapter 17**.

Intra-project relationships

11.11.4 In identifying and assessing the likely impacts of the proposed restoration strategy on ecology and nature conservation, the inter-relationships with the environmental impacts identified in other disciplines reports has been considered. These include:

- *Geology and Soils* - The primary potential impact on most of the identified valuable receptors, including designated sites, habitats, and species, is

²⁸ European Commission, 1999.

pollution. This pollution could be in the form of dust or run-off from disturbed soils during re-grading and other earth-moving operations. The resulting sedimentation and nutrient or chemical runoff could disrupt the natural water quality and soil pH, impacting the ecological balance. Additionally, habitats such as wetlands and ponds could be affected by the introduction of fine sediments, which can settle on the pond bed, altering sediment composition and potentially suffocating invertebrates and amphibian larvae. The use of heavy machinery also carries the risk of fuel or oil spillages, posing a further pollution threat to these sensitive habitats.

- *Hydrology and Hydrogeology and Hydro-geochemical* - The existing void would remain with a permanent pit lake at a level that would roughly correlate with a groundwater level pre-surface mining operations. The excavation of the void has effectively exposed the existing groundwater levels that have re-charged since surface mining ceased at the end of November 2023. If the void had been totally filled with backfill following the cessation of coaling operations, it is anticipated the groundwater range would reflect similar levels but would be stored out of sight below ground within the backfill material. Hydrologically, the void is considered likely to perform as a large soakaway or water detention basin with groundwater discharging slowly through the underground pathways to existing watercourses to the west and south-west of the site as generally happened before works commenced. Proposed changes to the hydrogeological regime following closure are not expected to differ substantially from the current site conditions from a quantity and quality perspective. Water quality will likely remain like the current baseline or improve following the restoration plan. As mining has ceased and exposed material which could act as a source of contamination is covered with soil/and/or revegetated or reseeded, this will likely reduce the risk of pollution from these sources.
- *Landscape and visual* - The restoration proposals and proposed landscaping has been informed by the potential ecological effects of the restoration on the Valued Ecological Receptors. Net gains and losses in biodiversity have been assessed and sensitive landscaping proposed, which creates/maintains connectivity and enhances existing biodiversity or creates new habitat with biodiversity value. The proposed ecological enhancements are highly likely to enhance the visual appearance of the Site through the reduction in bare ground and the enhancement/creation of habitats.
- *Cultural Heritage* – Ecological or cultural heritage elements resulting from the proposed restoration are not expected to negatively impact each other. The intra-relationship between these two aspects is likely to be mutually beneficial. As discussed, the restoration of the site is expected to improve the ecological health of the area, which could indirectly benefit the preservation of cultural heritage. For instance, the proposed planting of trees and shrubs, primarily an ecological enhancement, would help to

stabilise the soil and prevent erosion which could damage archaeological sites. Furthermore, improvements in both ecology and cultural heritage would be expected to result in a cumulative improvement in the visual amenity of the Site as well as its value as a recreational and educational location.

- *Air Quality* - The proposed restoration operations would give rise to emissions of both aerial pollutants and greenhouse gases in the short-term, primarily during earthworks. Given that the baseline habitat has established in the context of dust and fuel emissions significantly above, and for longer than, what is expected to occur during the present restoration proposal, it is highly unlikely that significant impacts would be experienced. In the longer-term, the establishment of the proposed new grass coverage and woodland planting is likely to reduce both airborne dust and greenhouse gases. Grasses form a protective, low-lying canopy that reduces the amount of soil particles becoming airborne through wind erosion, thus lowering dust levels. In addition, the complex root networks of grasses help stabilise the soil, further preventing dust emissions. Trees, meanwhile, provide a taller, more substantial barrier, capturing airborne particles on their leaves and branches. Their canopies also slow down wind speeds, minimising the lofting of fine particles. Beyond dust mitigation, both grasses and woodlands absorb carbon dioxide through photosynthesis, thereby reducing overall greenhouse gas concentrations. As a result, these interventions not only help ensure cleaner, healthier air but also play a role in the long-term commitments to climate regulation.
- *Human Health* - As with air quality, while the proposed restoration would result in short-term increases of emissions, dust and noise, these would exist for a relatively short time and be significantly lower than that which the area has been subject to during its long history of mining. Planting and exposure to natural environments is known to provide several physical and mental health benefits²⁹. By altering the presently barren and potentially, dusty landscape of the baseline through new planting, the quality of the air improves through natural filtration, reducing respiratory irritants and improving overall health in the immediate area. The rehabilitation of the landscape and inclusion of new habitats is likely to encourage outdoor activities, promoting physical exercise, fostering community social interaction, and enhancing mental well-being through stress reduction and increased connection to nature. This also offers the potential for educational visits where the opportunity would exist for the public to observe protected species such as Great Crested Newts, peregrine falcons, barn owls and specialised plant species like marsh orchids.

²⁹ Hartig, T. *et al.* (2011). Health Benefits of Nature Experience: Psychological, Social and Cultural Processes. In: Nilsson, K., *et al.* Forests, Trees and Human Health. Springer, Dordrecht. https://doi.org/10.1007/978-90-481-9806-1_5

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- *Climate Change* - The proposed restoration is likely to be beneficial in improving the resilience of the Site to climate change. In addition to increased carbon sequestration, the proposed planting, and associated improvement in connectivity, would provide corridors for animals and plants to migrate to more suitable environments, to or from the wider area. Grass seeding promotes the moisture retention ability of the ground, while tree planting increases shading, including around waterbodies where this can help to moderate water temperatures reducing excessive evaporation in hot weather and stabilise conditions. The inclusion of a large new waterbody in the void fed by ground water also provides a permanent source of freshwater, improving resilience during periods of drought by providing a reliable area for a range of species to drink and bathe.

11.12 Summary of Significant Effects

- 11.12.1 The implementation of the final restoration strategy would see the restoration of the main void to a permanent water body and the re-profiling of the OB1 overburden tip and retention of the open cliff to the east of the pit lake. The remaining areas of the site would generally remain as they stand today, and a variety of habitats encouraged to develop naturally and developing habitats further enhanced. It is considered likely that the residual effects would, ultimately upon establishment of the various habitat types proposed, increase over time to be a positive benefit compared to the baseline conditions that currently prevail.
- 11.12.2 The history of the site is one of considerable disruption resulting from mining activities and with the gradual reduction, and now cessation, of these operations the baseline, while poor, is likely to continue improving with time. There are now several habitats and protected species that may otherwise not have existed here, and it is necessary for the restoration to retain them, rather than attempting to return the site to a pre-mining condition.
- 11.12.3 The proposal is for a restoration scheme, the most potentially impactful activities (i.e. earthmoving) of which are largely localised to the void, where mining activity has most recently been carried out and thus habitat is most heavily degraded. As such, the area most likely to be impacted is also of least quality and there are few impacts that are thought likely to be of significant detriment to any of the valuable ecological receptors. This is especially true as the purpose of this assessment is to determine how the proposed works would impact the baseline, the condition of which has largely established during a period of disruption significantly beyond what is proposed.

- 11.12.4 With the incorporated mitigation measures, primarily focusing on avoidance and enhancement, it is uncertain that any detrimental impacts will be realised. The likely residual effects upon the nature conservation interest at the site from the proposed restoration are considered to provide net benefits for biodiversity due to the impoverished baseline. The revised restoration proposals provide more opportunities for biodiversity through creating a wider range of terrestrial and aquatic habitats than the previously consented scheme.
- 11.12.5 While retaining these important features of the baseline, the enhancement measures included would result in the proposal having a positive effect on the site's biodiversity through habitat creation, improved connectivity and earth stabilisation.
- 11.12.6 **Table 11-3** provides a summary of the significance of residual effects for each receptor, as discussed in **Section 11.8**, the mitigation measures required and how mitigation measures can be secured.

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Table 11-3: Summary of residual effects on Valuable Ecological Receptors

VER	Value	Description of potential effect	Effect without mitigation	Mitigation	Significance of Residual Effect	Mechanism for securing
Non-statutory Designated Sites – Wildlife Sites						
Merthyr Common Central SINC	Local	Run-off generated by earthworks entering those waterbodies which drain into the SINC impacting water quality.	Minor – temporary reduction in water quality.	Use of settlement ponds & silt fences (if required) around the work area to capture sediment before it enters channels leading to the SINC. A phased earthworks approach, disturbing one section at a time to minimise exposed soil and reduce erosion and runoff.	Neutral – beneficial over time as planting and re-seeding improves soil stability and reduces risk of run-off. Improvement in habitat connectivity as surrounding area is enhanced.	Details set out within a CEMP which can be Conditioned
Priority Habitats						
Running water	Local	Increased silt or pollutants during activities, which discharge into the watercourse.	Minor – temporary reduction in water quality	Works within and adjacent to the watercourse would be monitored by an Environmental Liaison Officer (ELO). If discolouration of the watercourse is noted, works would stop and working practices reviewed before re-commencing.	Neutral – beneficial over time as planting and re-seeding improves soil stability and reduces risk of run-off. Improvement in habitat connectivity as surrounding area is enhanced.	As above

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VER	Value	Description of potential effect	Effect without mitigation	Mitigation	Significance of Residual Effect	Mechanism for securing
				Pollution control measures		
Ponds - Standing water	Local	Dust arising from earthmoving can settling on ponds, blocking light needed for photosynthesis, disrupting the food web and affecting organisms dependent on plants and algae. Fine particles may alter sediment and suffocate invertebrates and amphibian larvae. Dust can also bring pollutants, potentially causing toxicity for sensitive aquatic species.	Minor – risk of temporary water quality reduction and degradation of habitat.	Dust suppression during earthmoving will involve avoiding work in excessively windy or dry conditions, reducing vehicle speeds, and spraying water on haul roads and working areas to prevent dust from becoming airborne.	Neutral – beneficial with time as planting and re-seeding around margins and wider habitat will improve soil stability, reducing dust and run-off.	As above
Acid flush	Local	Runoff from disturbed soils during re-grading of the western slopes OB1 could carry sediments, nutrients, and potentially alter pH levels, which	Minor - risk of temporary degradation of habitat.	Dust suppression measures and installation of cut-off ditches and silt fencing (if required) at the base of OB1.	Neutral – beneficial overall as seeding would improve soil stability and decrease run-off. Tree planting would create a buffer zone, intercepting	As above

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VER	Value	Description of potential effect	Effect without mitigation	Mitigation	Significance of Residual Effect	Mechanism for securing
		could disrupt the balance of this habitat.			pollutants and windblown dust.	
Species (Fauna)						
Amphibians	Regional	Potential dust arising during land-forming could settle on water and may alter pH, increase turbidity, and introduce pollutants, reducing water quality. This can hinder amphibian respiration, feeding, and breeding. Higher turbidity also limits sunlight, impacting plant growth and lowering oxygen levels essential for pond organisms.	Moderate – risk of temporary degradation of habitat.	Dust suppression during earthmoving will involve avoiding work in excessively windy or dry conditions, reducing vehicle speeds, and spraying water on haul roads and working areas to prevent dust from becoming airborne.	Neutral –beneficial overall with the inclusion of enhancements to pond margins, planting to improve connectivity and creation of a new permanent waterbody. Establishment of aquatic vegetation will absorb contaminants and provide oxygen.	CEMP and Restoration and aftercare management plan secured by Condition.
Birds	Local	During re-profiling operations around the void there exists the potential for a ‘slight’ impact on the schedule 1 species <i>Falco peregrinus</i> (peregrine falcon)	Minor – temporary disturbance of hunting grounds.	Pre-works nesting bird checks.	Neutral – beneficial over time due to stabilisation of the void, planting and establishment of permanent water body.	Appropriately worded planning condition. CEMP and Restoration and aftercare management

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VER	Value	Description of potential effect	Effect without mitigation	Mitigation	Significance of Residual Effect	Mechanism for securing
		which is known to use the area for hunting.				plan secured by Condition.
		Disturbance of nests during planting and re-seeding.	Neutral or minor – risk of disturbance.	Conduct site inspections prior to bird nesting season and works commencing and deploy bird deterrent measures if required i.e. removal of potential nesting material	Neutral – beneficial effects to nesting birds over time due to habitat creation via planting.	Appropriately worded planning condition. CEMP and Restoration and aftercare management plan secured by Condition.
		Dust generated by earth-moving operations can settle on vegetation and in water, reducing food quality and contaminating drinking water for birds.	Minor – risk of habitat and health degradation.	Dust suppression measures.	Neutral – beneficial over time as new planting and seeding will improve soil stability.	CEMP
Bats	Local	None envisaged	Neutral	Habitat creation	Neutral – beneficial over time as habitat to be created would, once established, support	Restoration and aftercare management plan secured by Condition.

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VER	Value	Description of potential effect	Effect without mitigation	Mitigation	Significance of Residual Effect	Mechanism for securing
					foraging and commuting habitat for local bat populations.	
Otters	Local	Indirect pollution incidents	Minor - risk of temporary degradation of habitat	Habitat creation. Pollution control measures.	Neutral - beneficial over time as habitat to be created would, once established, support foraging and commuting habitat for local bat populations.	CEMP and Restoration and aftercare management plan secured by Condition.

12 Landscape and Visual Impacts

By RML

12.1 Introduction

12.1.1 This report details the Landscape and Visual Impact Assessment (LVIA) conducted for Merthyr (South Wales) Ltd (MSW), focusing on the final restoration of the Ffos-y-Fran surface coal mine. The assessment considers various impacts, including direct physical changes to landform, fragmentation of landscape features, indirect effects on landscape perception due to new elements, and changes in visual amenity for users both day and night. It evaluates the baseline landscape and policy context, outlines the study area, and identifies the significance of effects on land use and landscape features. The methodology includes both desk reviews and fieldwork conducted in 2024 during different seasons. The report also discusses mitigation strategies as part of an iterative design process, and it is supported by accompanying figures and appendices for further detail.

12.2 Legislation and Policy Framework

12.2.1 The legislative and policy context relevant to the LVIA for the project are informed by reviewing specific landscape policies. Key legislative acts include the following:

- National Parks and Access to the Countryside Act 1949.
- The Countryside and Rights of Way (CROW) Act 2000.
- Wildlife and Countryside Act 1981.
- The Natural Environment and Rural Communities (NERC) Act 2006.
- Well-Being of Future Generations Act 2015.
- Environment (Wales) Act 2016.

12.2.2 The National Parks and Access to the Countryside Act 1949, the Countryside and Rights of Way (CROW) Act 2000, and several others area aimed at environmental protection and biodiversity.

12.2.3 The current planning policies for Wales, outlined in Planning Policy Wales Edition 12 (2024), emphasizes biodiversity alongside social and economic objectives. Technical Advice Notes (TANs) complement these policies, providing guidance on design and recreation spaces.

12.2.4 Local planning policies by Merthyr Tydfil County Borough Council stress environmental protection and landscape quality preservation, promoting careful assessment of environmental impacts and protection of unique landscape features.

Additionally, neighbouring authorities, such as Caerphilly County Borough Council, have specific policies for safeguarding special landscape areas and visually important local landscapes.

- 12.2.5 Although the project site is outside the Bannau Brycheiniog National Park it may still impact distant views.

12.3 Assessment Methodology

Relevant guidance

- 12.3.1 The LVIA has been conducted following the Guidelines for Landscape and Visual Impact Assessment Third Edition (GLVIA3), which outlines the methodology for evaluating landscape and visual sensitivity, impact magnitude, and overall significance of effects. Additional relevant resources include the Landscape Character Map for Wales, the LANDMAP dataset from Natural Resources Wales, and various Technical Guidance Notes, including clarifications on GLVIA3 and visual representation of development proposals. It is essential to differentiate between landscape effects, which pertain to the impact on the landscape resource itself, and visual effects, which focus on the impact on specific views and general visual amenity experienced by people.

Review of previous work

- 12.3.2 In May 2003, Miller Argent (South Wales) Limited published an Environmental Statement (ES) for the Ffos-y-Fran Land Reclamation Scheme, which characterized the pre-open cast landscape around Merthyr Tydfil as a mix of quality landforms and less attractive features like power lines and colliery spoil heaps, reflecting the region's industrial and agricultural heritage.
- 12.3.3 The site, located about 3 km from a National Park, predicted significant adverse impacts on historic landscape character areas, notably the Merthyr Common and Ffos-y-Fran HLCAs, but an overall moderate impact for the broader Merthyr Tydfil area, not deemed significantly adverse.
- 12.3.4 Visual impacts were assessed through panoramic views, identifying residential areas to the west and north as the most sensitive, with impacts on nearby receptors ranging from slight to moderate, and those at mid-distances being moderately impacted. Distant receptors reported slight to moderate detriment, while views to the south and east were minimally affected due to grassed mounds of overburden. Ultimately, the long-term outcome of the reclamation was concluded to be substantially beneficial compared to the prior landscape marred by mining waste.

12.4 Study Area

- 12.4.1 Guided by GN46, the search and study areas for assessing visual effects of structures are typically based on their height, with a preliminary study area of 5 km proposed for stakeholder discussions, reflecting the height of overburden mounds. Fieldwork is conducted to refine this area, identifying potential significant effects on the existing landscape, views, and visual amenity. Representative viewpoints are selected to evaluate the project's impact on various landscape character areas from multiple directions and distances, focusing on accessible locations such as public roads and rights of way.

12.5 Approach to identification of baseline conditions

- 12.5.1 The desk study involves a comprehensive review of the landscape resource and topography in the study area to determine regional and local landscape character, utilizing sources such as National Landscape Character Areas (NLCA), LANDMAP datasets, planning policies, Ordnance Survey maps, and aerial photography.
- 12.5.2 Wales is categorized into 48 national character areas, with the project situated in NLCA 37 South Wales Valleys, and LANDMAP further classifies regions into five aspects—Geological Landscape, Landscape Habitat, Visual and Sensory Landscape, Historic Landscape, and Cultural Landscape Services.
- 12.5.3 The study defines Landscape Character Area (LCA) boundaries through fieldwork and evaluations of key characteristics, ecological and cultural significance, and capacity for accommodating proposed changes.
- 12.5.4 Additionally, a visual baseline assessment reviews views subject to change from the project, identifying screening features and potential visual receptors, with fieldwork conducted in different seasons to capture varying visibility conditions and viewer sensitivities.

12.6 Assessment Criteria and Assessment of Significance

Landscape receptors

- 12.6.1 The sensitivity of a landscape is determined by its capacity to accommodate proposed changes, such as the reclamation of a colliery landscape, along with its assessed value during the baseline study. This sensitivity assessment incorporates judgments regarding the physical condition of the landscape and the importance attributed to it, which is often reflected by local or national designations.

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Table 6 Landscape sensitivity (susceptibility and value) and typical descriptors

Sensitivity	Typical descriptions
Very high	Landscapes of very high international/national importance and rarity or value with no or very limited ability to accommodate change without substantial loss/gain. These areas may be important tourist destinations such as National Parks or internationally acclaimed landscapes such as UNESCO World Heritage Sites.
High	Landscapes of high national importance containing distinctive features/elements with limited ability to accommodate change without incurring substantial loss/gain. The area may be associated with tourism although it would not be the main destination such as designated areas, areas with a strong sense of place, registered parks and gardens, country parks.
Medium	Landscapes of local or regional recognition of importance able to accommodate some change. Areas that may be appreciated locally with features worthy of conservation, some sense of place or value through use/perception.
Low	Local landscape areas or receptors of low to medium importance with ability to accommodate change. Non-designated areas, designated areas of local recognition or areas of little sense of place.
Negligible	Landscapes of very low importance and rarity able to accommodate change.

Visual receptors

- 12.6.2 The sensitivity of visual receptors is determined by the impact of project-related changes to views and visual amenity, as well as the activities of those viewing the landscape. This assessment involves identifying visual amenity receptors through desk studies and field verification, detailing the nature of their views and defining their sensitivity. Visual receptors are categorized based on their specific occupations or activities in certain locations, and how much their attention is directed towards the views.

Table 7 Visual receptor sensitivity (susceptibility and value) and typical descriptors

Sensitivity	Typical descriptions
Very high	Static views from and of major tourist attractions. Views from and of very important national/internationally designated landscapes, cultural/historical sites such as National Parks or UNESCO World Heritage Sites. Receptors engaged in specific activities for enjoyment of dark skies.

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Sensitivity	Typical descriptions
High	Views by users of nationally important public rights of way such as promoted long distance routes and national trails. Views by users of public open spaces for enjoyment of the countryside such as country parks. Static views from dense residential areas, longer transient views from designated public open space or recreational areas. Views from and of rare, designated landscape of national importance.
Medium	Static views from less populated residential areas, schools and other institutional buildings and their outdoor areas. Views by outdoor workers. Transient views from local/regional areas such as public open space, scenic roads, railways or waterways, users of local/regional designated tourist routes of moderate importance. Views from and of landscapes of regional importance.
Low	Views by users of main roads or passengers in public transport on main arterial routes. Views by indoor workers. Views by users of recreational/formal sports facilities where the landscape is secondary to enjoyment of the sport. Views by users of local public open spaces of limited importance with limited variety or distinctiveness.
Negligible	Quick transient views such as from fast moving vehicles. Views from industrial areas or land awaiting re-development. Views from landscapes of no importance with no variety or distinctiveness.

Magnitude of impact

- 12.6.3 The assessment of landscape and visual impacts involves grading impacts based on their scale and magnitude, which are determined by several factors: the size or scale of the impact—referring to the quantity of affected landscape elements and how they represent the character area or view; the geographical extent of the project's influence; and the duration and reversibility of the impact—whether it is short-term or long-term and if it can be reversed. Impacts are then rated on a five-point scale (major, moderate, minor, negligible, and no change) and can be assessed as either detrimental or beneficial.

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Table 8 Magnitude and nature of landscape impact and typical descriptors

Magnitude	Typical criteria descriptor
Major adverse	Total loss or large-scale damage to existing character or distinctive features or elements and/or the addition of new and uncharacteristic conspicuous features or elements.
Moderate adverse	Partial loss or noticeable damage to existing landscape character or distinctive features or elements and/or addition of new uncharacteristic, noticeable features or elements.
Minor adverse	Slight loss or damage to existing landscape character of some key features and elements and/or addition of new uncharacteristic features.
Negligible adverse	Very minor loss, damage or alteration to existing landscape character of some features and elements.
No change	No noticeable alteration or improvement, temporary or permanent, of landscape character of existing features and elements.
Negligible benefit	Very minor noticeable improvement of character by the restoration of some existing features and elements.
Minor benefit	Slight improvement of landscape character by the restoration of some key existing features and elements and/or the addition of new characteristic features.
Moderate benefit	Partial or noticeable improvement of landscape character or distinctive features or elements and/or the addition of new characteristic features or elements or removal of noticeable features or elements.
Major benefit	Large scale improvement of landscape character to features or elements and/or addition of new distinctive features or elements, or removal of conspicuous elements.

Table 9 Magnitude of visual impacts and typical descriptors

Magnitude	Typical criteria description
Major	The project, or a part of it, would become the dominant feature or focal point of the view.
Moderate	The project, or a part of it, would form a noticeable feature or element of the view which is apparent to the receptor.
Minor	The project, or a part of it, would be perceptible but not alter the overall balance of features and elements that comprise the existing view.
Negligible	Only a very small part of the project would be discernible, or it is at such a distance that it would form a barely noticeable feature or element of the view.
No change	No part of the project work or activity associated with it is discernible.

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- 12.6.4 The magnitude of impact and the sensitivity of the receptor are combined to establish the significance of effect. This is expressed as a scale ranging from neutral to very large. The scale can be both positive (benefit) and negative (adverse).

Table 10 Significance of effects matrix (both landscape and visual)

		Magnitude of impact (degree of change)				
		No change	Negligible	Minor	Moderate	Major
Sensitivity of receptor	Very High	Neutral	Slight	Moderate	Large	Very large
	High	Neutral	Slight	Moderate	Large	Very large
	Medium	Neutral	Slight	Moderate	Moderate	Large
	Low	Neutral	Slight	Slight	Moderate	Moderate
	Negligible	Neutral	Neutral	Neutral	Slight	Slight

- 12.6.5 Effects that fall within the categories *Moderate* to *Very large* are considered significant in this assessment.

Limitations of the Assessment

- 12.6.6 The Landscape and Visual Impact Assessment (LVIA) has been conducted from publicly accessible locations within a rural and urban area, avoiding the need for access to private lands or third-party properties. To ensure a thorough analysis, the assessment utilized Ordnance Survey height data to create a digital terrain model (DTM) and a zone of theoretical visibility (ZTV), along with large-scale mapping and aerial photography to evaluate topographical features and potential view obstructions like buildings and vegetation. Field surveys were performed to validate the ZTV output and assess available views from public spaces and rights of way, while also considering seasonal and night-time variations.

12.7 Baseline Conditions

Landscape baseline

- 12.7.1 The Bannau Brycheiniog National Park is located 2.8 km from the Ffos-y-Fran site boundary at its closest point in Vaynor, allowing views of the project site from the ridges, plateaus, and south-facing slopes of Penmoelallt, Garn Ddu, and Cefn yr Ystrad. Three main visual features of the mine are prominent: the three overburden mounds and the upper benches of the eastern and southern walls, all of which are visible from the park's high ground, with the northernmost mound, OB1, being particularly noticeable.

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- 12.7.2 The Ffos-y-Fran site is located near several Special Landscape Areas (SLAs) and across multiple local authorities. To the south-west, the *Cynon Valley Northern Slopes* SLA is approximately 4 km away, with Mynydd Aberdare and Mynydd Merthyr obstructing views of the site.
- 12.7.3 Within the Merthyr Tydfil area, five SLAs, including *Winchfawr* and *Merthyr West Flank*, offer views of the mine's overburden mounds and eastern wall, but other aspects are obscured by terrain or restoration efforts. *The Nant Morlais and Cwm Taf Fechan* SLA, close to Pengarnddu Business Park (about 1 km north), provides visibility of the mounds, while *Pontygwaith and Gelligaer* and *Taf Bargoed* SLAs (about 3 km south) the landform obstruct the view of the site entirely.
- 12.7.4 In the Caerphilly area, the *Upper Rhymney Valley* and *Gelligaer* LCAs have limited views due to topography, with the nearest point being 1.1 km from Ffos-y-Fran.
- 12.7.5 Blaenau Gwent's *Trefil and Garnlydan Surrounds* and *Mynydd Bedwellty* LCAs also have restricted views, mainly seeing the overburden mounds from further distances.
- 12.7.6 A small portion of the *East Fforest Fawr and Mynydd-y-Glog* Historic Landscape Area (HLA) north-west of Merthyr Tydfil overlaps the 5 km study area is characterized by dissected upland plateaux and a long history of human activity, including prehistoric, medieval, and industrial remains. This region features notable archaeological sites and rich cultural landscapes that trace patterns of land use from the Mesolithic to the Bronze Age.
- 12.7.7 *Merthyr Tydfil* HLA, a significant industrial town from the 18th and 19th centuries, retains a permeating industrial landscape despite land reclamation, showcasing historical elements like ironworks and coal mining infrastructure, as well as cultural landmarks such as Cyfarthfa Castle. Ffos-y-Fran has both a direct and indirect impact on the HLA.
- 12.7.8 *Gelligaer Common* HLA offers a rare example of high upland moor laden with archaeological resources, extending from ancient settlements to peaks over 470 meters, has views of the overburden mounds from the surrounding ridges.
- 12.7.9 *Cefn Coed Cemetery and Jewish Burial Ground*, a Grade II Registered Historic Park and Garden (RHPG), is the oldest public cemetery in Merthyr Tydfil, located within the Afon Taf Fawr valley. It maintains its original layout and features significant historical graves, memorials commemorating mining disasters, and artistic works by notable sculptor Joseph Edwards RA, alongside a Jewish Burial Ground that reflects a vibrant 19th-century Jewish community.

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- 12.7.10 *Cyfarthfa Castle*, a Grade II* RHPG, is a prominent Gothic Victorian residence historically linked to Cyfarthfa Ironworks, surrounded by beautifully preserved parkland that offers views of overburden mounds.
- 12.7.11 *Aberfan Cemetery and Garden of Remembrance*, also a Grade II* RHPG, memorializes the victims of the tragic 1966 coal tip disaster, featuring a dedicated area for graves marked by white stone arches and a thoughtfully integrated landscaped area that emphasizes stability and drainage.
- 12.7.12 These sites collectively underscore the rich historical and cultural landscape of the region.
- 12.7.13 The *Cyfarthfa Conservation Area (CA)*, located in the Afon Taf valley about half a mile northwest of *Merthyr Tydfil Town Centre CA*, is surrounded by historic neighbourhoods such as *Morgantown*, *Williamstown*, and *Georgetown* CAs, with newer housing estates like Gurnos and Gellideg to the north and west.
- 12.7.14 Notable nearby areas include the *Council Street and Urban Street CA*, characterized by terraced housing linked to the former Dowlais steelworks, and the *Dowlais CA* that contains historic structures associated with the Dowlais and Ivor Iron Works. *Cwmfelin CA* preserves a pre-industrial rural settlement within the Bargoed Taf valley, while *Bute Town* and *Rhymney Town* CAs also overlap the study area.

12.8 Landscape character and context

Regional landscape character

- 12.8.1 Ffos-y-Fran is situated within NLCA37 South Wales Valleys, a region marked by deep, urbanized valleys amidst a broad upland area renowned for its industrial history and cultural identity. The area features significant ribbon development along valley floors and lower slopes, creating a stark contrast between urban environments and steep, dramatic uplands characterized by moors and forests. The region's industrial rise in the 19th century, spurred by its mineral-rich geology, led to the establishment of railway infrastructure and terraced housing, fostering vibrant settlements that have been altered by the late 20th-century industrial decline. As it transitions into a post-industrial 'city region', the south Wales valleys are witnessing a revival of greenery and community identity through redevelopment and wildlife conservation efforts.
- 12.8.2 Additionally, the study area intersects with NLCA30 Brecon Beacons and Black Mountains, the highest mountain range in South Britain, recognized for its striking landscapes, including moorland, valleys, and limestone features, and attracting tourists with its scenic beauty and tranquil environment.

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Landscape character areas

- 12.8.3 Landscape Character Areas (LCAs) with consistent characteristics have been identified within the study area, derived from the LANDMAP data source. The LCA boundaries align with the five LANDMAP aspect areas, initially based on the Visual and Sensory aspect and further refined with additional data and field surveys. Following GN46 guidelines, areas that overlap or are adjacent to Ffos-y-Fran, including Geological Landscape areas with special linkages, are considered for Geological Landscape and Landscape Habitats aspects, while Visual and Sensory and Historic Landscape aspects focus on areas overlapping the Zone of Theoretical Visibility (ZTV). The Cultural Landscape Services aspect contributes little unique information to the Landscape and Visual Impact Assessment (LVIA). Those landscape receptors likely to experience significant effects are those directly impacted by Ffos-y-Fran's final restoration works and adjacent character areas.

Table 11: Landscape Character Areas

Ref	Name	Value	Susceptibility	Sensitivity
1	Penmoelallt Plantation	Very high	Low	Low
2	Nant Ffrwd Upland	Very high	Medium	Medium
3	Winch Fawr Upland	High	Negligible	Negligible
4	Ffrwd Enclosed Farmland	Very high	Low	Low
5	Cefn Coed Cemetery	Very high	Negligible	Negligible
6	Winch Fawr Tramway	High	Negligible	Negligible
7	Cwm Ffrwd	Very high	Negligible	Negligible
8	Gellideg and Heolgerrig	Medium	Negligible	Negligible
9	Vaynor Upland	Very high	Medium	Medium
10	Cefn Coed and Trefechan	Medium	Low	Low
11	Cefn Coed-y-cymmer	High	Negligible	Negligible
12	Cwm Glo	High	Negligible	Negligible
13	A465 Road Corridor (under construction)	Low	Negligible	Negligible
14	Taf Cynon Ridge Woodland	High	Low	Low
15	Cyfarthfa Castle	Very high	Low	Low
16	Cyfarthfa Park Ward and Retail Park	High	Negligible	Negligible
17	Gurnos	Medium	Low	Low
18	Ynys-fach and Rhyd-y-car	Medium	Negligible	Negligible
19	Vaynor Farmland	Very high	Low	Low
20	Upper Abercanaid	High	Negligible	Negligible
21	Morlais Castle	High	Low	Low
22	A470 Road Corridor	Low	Negligible	Negligible
23	Merthyr Tydfil Town Centre	High	Negligible	Negligible

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Ref	Name	Value	Susceptibility	Sensitivity
24	Penydarren	High	Medium	Medium
25	Abercanaid	Medium	Negligible	Negligible
26	Mynydd Merthyr	High	Negligible	Negligible
27	Mynydd Gethin Enclosed Farmland	Medium	Negligible	Negligible
28	Aberfan Valley Side	Very high	Negligible	Negligible
29	Dowlais Ironworks Reclamation	High	Low	Low
30	Pant Farmland	High	Low	Low
31	Aberfan Farmland	High	Negligible	Negligible
32	Cwmblacks Farmland	Medium	Low	Low
33	Dowlais	High	Medium	Medium
34	Troedyrhiw and Pentrebach	Medium	Negligible	Negligible
35	Pant and Pengarnddu	High	Low	Low
36	Merthyr Common and Cilfach yr Encil	High	Medium	Medium
37	Ffos-y-Fran Open Cast	Medium	Low	Low
38	Trecatti Landfill Site	Medium	Low	Low
39	Mynydd y Capel	Medium	Negligible	Negligible
40	Cwm Bargoed	High	Medium	Medium
41	Penddeugae and Nant-y-fedw Enclosed Farmland	Medium	Negligible	Negligible
42	Pen March, Cefn yr Ystrad and Trefil Ddu Upland	Very high	Medium	Medium
43	Gelli-gaer Enclosed Farmland	High	Negligible	Negligible
44	Rhoslas Unenclosed Upland	Medium	Low	Low
45	Cwm Carno	Low	Negligible	Negligible
46	Blaen Rhymni	Medium	Low	Low
47	Fochriw	Low	Negligible	Negligible
48	Cefn Gelligaer and Mynydd Fochriw	High	Low	Low
49	Rhymni	Medium	Negligible	Negligible
50	Tafarnaubach Industrial Estate	Low	Negligible	Negligible
51	Cwm Darran	High	Negligible	Negligible
52	Rhymney Hill and Bryn Oer	Medium	Low	Low
53	Cefn Y Brithdir	Low	Low	Low
54	A465 Heads of the Valleys Road Corridor	Low	Negligible	Negligible
55	Tredeggar Patch	Low	Negligible	Negligible

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Ref	Name	Value	Susceptibility	Sensitivity
56	Cwm Tyswg	Medium	Negligible	Negligible
57	Rhymney Hill and Mynydd Bedwellte	High	Negligible	Negligible
58	Cefn Rhychdir	Low	Negligible	Negligible

12.9 Visual receptors

Zone of theoretical Visibility

- 12.9.1 The baseline visual amenity assessment includes the description of the Zone of Theoretical Visibility (ZTV) and the examination of visual receptors, which have informed the design and evaluation of the Ffos-y-Fran restoration. The ZTV, illustrated indicates the visibility of the restored landform, based on a terrain model that lacks obstructive features, which representing a 'worst-case scenario.' Key target points for observation have been identified across various locations on the reclaimed landform, including the edges of different overburden mounds and ridge lines. The observer height is set at 1.6 meters, in line with standard human eye level, and the ZTV extends beyond a 5 km radius from the site boundary, indicating visibility from surrounding hill summits, ridges, and various slopes, as well as urban areas in Merthyr Tydfil and adjacent uplands.

Potential visual receptors and visual baseline

- 12.9.2 Existing views of the potential visual receptors for Ffos-y-Fran and a judgment of their visual sensitivity are summarised below. Near distance views are those that are within 0.5 km from the Ffos-y-Fran site boundary. Intermediate distance views are those between 0.5 and 2 km from the site boundary and long-distance views more than 2 km.

Table 12 Visual receptor sensitivity

Ref	Name	Visual Sensitivity
1	Penmoelallt Plantation	Very high
2	Nant Ffrwd Upland	Very high
3	Winch Fawr Upland	Medium
4	Ffrwd Enclosed Farmland	Medium
5	Cefn Coed Cemetery	Medium
6	Winch Fawr Tramway	Medium
7	Cwm Ffrwd	Medium
8	Gellideg and Heolgerrig	High
9	Vaynor Upland	Very high
10	Cefn Coed and Trefechan	High
11	Cefn Coed-y-cymmer	High
12	Cwm Glo	Medium
13	A465 Road Corridor (under construction)	Low

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Ref	Name	Visual Sensitivity
14	Taf Cynon Ridge Woodland	Medium
15	Cyfarthfa Castle	High
16	Cyfarthfa Park Ward and Retail Park	High
17	Gurnos	High
18	Ynys-fach and Rhyd-y-car	High
19	Vaynor Farmland	High
20	Upper Abercanaid	Low
21	Morlais Castle	Medium
22	A470 Road Corridor	Low
23	Merthyr Tydfil Town Centre	High
24	Penydarren	High
25	Abercanaid	Medium
26	Mynydd Merthyr	High
27	Mynydd Gethin Enclosed Farmland	Medium
28	Aberfan Valley Side	High
29	Dowlais Ironworks Reclamation	Medium
30	Pant Farmland	Medium
31	Aberfan Farmland	High
32	Cwmblacks Farmland	Medium
33	Dowlais	High
34	Troedyrhiw and Pentrebach	Low
35	Pant and Pengarnddu	High
36	Merthyr Common and Cilfach yr Encil	Medium
37	Ffos-y-Fran Open Cast	Medium
38	Trecatti Landfill Site	Medium
39	Mynydd y Capel	Medium
40	Cwm Bargoed	Medium
41	Penddeugae and Nant-y-fedw Enclosed Farmland	Medium
42	Pen March, Cefn yr Ystrad and Trefil Ddu Upland	Very high
43	Gelli-gaer Enclosed Farmland	Medium
44	Rhoslas Unenclosed Upland	High
45	Cwm Carno	Medium
46	Blaen Rhymni	Medium
47	Fochriw	Medium
48	Cefn Gelligaer and Mynydd Fochriw	Medium
49	Rhymni	Medium
50	Tafarnaubach Industrial Estate	Low
51	Cwm Darran	High
52	Rhymney Hill and Bryn Oer	Medium
53	Cefn Y Brithdir	Medium
54	A465 Heads of the Valleys Road Corridor	Low
55	Tredegar Patch	Medium
56	Cwm Tyswg	Medium
57	Rhymney Hill and Mynydd Bedwellte	Medium
58	Cefn Rhychdir	Medium

12.10 Mitigation and Enhancement Measures

Summary of requirements

- 12.10.1 The Ffos-y-Fran Land Reclamation Scheme (FLRS) represents the final phase of the East Merthyr Reclamation Scheme (EMRS), following an initial phase that involved backfilling and reprofiling the mine pit to create upland pasture and urban common areas.
- 12.10.2 The second phase focuses on further reclamation of backfilled material and restoration of land between the dualled and abandoned sections of the A4060, which began after mineral extraction ended in November 2023 and will continue into summer 2024. Reprofiling work near Bogey Road is scheduled for summer 2025. The ongoing reclamation aligns with the original consented plans, and future restoration proposals aim to ensure that mine walls and mounds remain safe and stable for agricultural and recreational use, while enhancing the landscape with diverse land cover, benefiting wildlife, plant life, and public amenity.

Landscape design proposals

- 12.10.3 The final phase of the Ffos-y-Fran Land Reclamation Scheme will encompass multiple work packages designed to extend restoration efforts initiated in previous phases. This phase includes the reclamation of various land areas such as overburden mounds (OB1, OB2, and OB3) and mine walls, with specific attention to enhancing habitat diversity through native planting and managing soil erosion. The mine areas would be converted into a mosaic of unimproved grassland, heathland, and scrub, while slopes and mine walls will be reshaped to promote natural vegetation growth and discourage human and livestock access using bunds and fencing.
- 12.10.4 Restoration plans for the coal wash area and former workshop sites involve regrading to create smoother landscapes that can support new plant life, including deciduous woodlands. Continuous monitoring will ensure the successful establishment of plant species and protect water bodies created during mining operations, particularly as the backfill and lower slopes are regraded to support an upland pasture environment.

12.11 Assessment of effects

Landscape and visual effects

- 12.11.1 The assessment evaluates the effects of final restoration during two stages: the initial earthwork operations (EW), deemed the worst-case scenario with bare ground, and the subsequent stage after proposed planting has matured (PM), representing the best-case scenario. Following final restoration, the site would not have any light

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sources from buildings or structures; future lighting will be limited to that from farm vehicles or nighttime recreational activities.

Landscape effects

- 12.11.2 Where landscape sensitivity is judged as negligible, landscape receptors are unlikely to experience a significant landscape effect. The LCA is filtered out from further assessment.

Table 13 Assessed landscape effects (EW – earthwork operations, PM – planting maturity)

LCA and landscape sensitivity	Magnitude of landscape impact	Significance of landscape effect
1 Penmoelallt Plantation Low	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
2 Nant Ffrwd Upland Medium	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
4 Ffrwd Enclosed Farmland Low	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
9 Vaynor Upland Medium	EW No change PM No change	EW Neutral PM Neutral
10 Cefn Coed and Trefechan Low	EW No change PM No change	EW Neutral PM Neutral
14 Taf Cynon Ridge Woodland Low	EW No change PM No change	EW Neutral PM Neutral
15 Cyfarthfa Castle Low	EW No change PM No change	EW Neutral PM Neutral
17 Gurnos Low	EW No change PM No change	EW Neutral PM Neutral
19 Vaynor Farmland Low	EW No change PM No change	EW Neutral PM Neutral
21 Morlais Castle Low	EW No change PM No change	EW Neutral PM Neutral
24 Penydarren Medium	EW No change PM Negligible Benefit	EW Neutral PM Slight benefit
29 Dowlais Ironworks Reclamation Low	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
30 Pant Farmland Low	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
32 Cwmblocks Farmland Low	EW Negligible adverse PM Negligible benefit	EW Slight adverse PM Slight benefit
33 Dowlais Medium	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
35 Pant and Pengarnddu Low	EW No change PM Negligible benefit	EW Neutral PM Slight benefit

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LCA and landscape sensitivity	Magnitude of landscape impact	Significance of landscape effect
36 Merthyr Common and Cilfach-yr-Encil – Medium	EW Negligible adverse PM Negligible benefit	EW Slight adverse PM Slight benefit
37 Ffos-y-Fran Open Cast Low	EW Negligible adverse PM Minor benefit	EW Slight adverse PM Slight benefit
38 Trecatti Landfill Site Low	EW Negligible adverse PM Negligible benefit	EW Slight adverse PM Slight benefit
40 Cwm Bargoed Medium	EW Negligible benefit PM Negligible benefit	EW Slight benefit PM Slight benefit
42 Pen March, Cefn yr Ystrad and Trefil Ddu – Medium	EW No change PM No change	EW Neutral PM Neutral
44 Rhoslas Unenclosed Upland Low	EW Negligible benefit PM Negligible benefit	EW Slight benefit PM Slight benefit
46 Blaen Rhymni Low	EW No change PM No change	EW Neutral PM Neutral
48 Cefn Gelligaer and Mynydd Fochriw – Low	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
49 Rhymni Negligible	EW No change PM No change	EW Neutral PM Neutral
52 Rhymni Hill and Bryn Oer Low	EW No change PM No change	EW Neutral PM Neutral
53 Cefn Y Brithdir Low	EW No change PM No change	EW Neutral PM Neutral

Summary of landscape effects

- 12.11.3 No LCAs are predicted to experience a significant detriment to the landscape during earthwork operations. LCA37 Ffos-y-Fran Open Cast is the only character area that would be directly affected by the works. This area has been a rapidly changing landscape during the open cast operation. During the earthworks there would be a reduction in rock faces and angular slopes. There would be an increase in scree and more naturally profiled slopes.
- 12.11.4 Neighbouring LCAs 32 Cwmblacks Farmland, 36 Merthyr Common and Cilfach yr Encil, and 38 Trecatti Landfill Site are predicted to experience a slight detrimental landscape impact during restoration earthworks. This is due to the noise and movement of machinery and continuation of activities at the surface mine site after the cessation of mineral extraction.
- 12.11.5 Neighbouring LCAs 40 Cwm Bargoed and 44 Rhoslas Unenclosed Upland are predicted to experience a slight beneficial impact during the restoration. This is due to a reduction in the movement and haulage activities between the rail head depot and maintenance workshops and coal washing plant areas.

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- 12.11.6 No LCAs are predicted to experience a significant detrimental or beneficial lasting landscape impact after planting has reached maturity and the area returned to urban common use. Land cover would predominantly be upland pasture with a mosaic of woodland, heath, waterbodies and scrub, with bare rock and scree slopes.
- 12.11.7 17 LCAs are predicted to experience a slight beneficial landscape impact after planting has matured, including the reversal of the temporary detrimental impacts predicted to be experienced by LCAs 32, 36 and 38.

*Visual effects**Table 14 Assessed visual effects (EW – earthwork operations, PM – planting maturity)*

LCA and visual sensitivity	Magnitude of visual impact	Significance of visual effect
1 Penmoelallt Plantation Very high	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
2 Nant Ffrwd Upland Very high	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
3 Winch Fawr Upland Medium	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
4 Ffrwd Enclosed Farmland Medium	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
5 Cefn Coed Cemetery Medium	EW No change PM No change	EW Neutral PM Neutral
6 Winch Fawr Tramway Medium	EW No change PM No change	EW Neutral PM Neutral
7 Cwm Ffrwd Medium	EW No change PM No change	EW Neutral PM Neutral
8 Gellideg and Heolgerrig High	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
9 Vaynor Upland Very high	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
10 Cefn Coed and Trefechan High	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
11 Cefn Coed-y-cymmer High	EW No change PM No change	EW Neutral PM Neutral
12 Cwm Glo Medium	EW No change PM No change	EW Neutral PM Neutral
13 A465 Road Corridor (under construction) - Low	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
14 Taf Cynon Ridge Woodland Medium	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
15 Cyfarthfa Castle High	EW No change PM Minor benefit	EW Neutral PM Moderate benefit

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LCA and visual sensitivity	Magnitude of visual impact	Significance of visual effect
16 Cyfarthfa Park, Ward and Retail Park – High	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
17 Gurnos High	EW No change PM Minor benefit	EW Neutral PM Moderate benefit
18 Ynys fach and Rhyd-y-car High	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
19 Vaynor Farmland High	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
20 Upper Abercanaid Low	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
21 Morlais Castle Medium	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
22 A470 road corridor Low	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
23 Merthyr Tydfil Town Centre High	EW No change PM No change	EW Neutral PM Neutral
24 Penydarren High	EW Minor adverse PM Minor benefit	EW Moderate adverse PM Moderate benefit
25 Abercanaid Medium	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
26 Mynydd Merthyr High	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
27 Mynydd Gethin Enclosed Farmland - Medium	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
28 Aberfan Valley Side High	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
29 Dowlais Ironworks Reclamation – Medium	EW Minor adverse PM Minor benefit	EW Moderate adverse PM Moderate benefit
30 Pant Farmland Medium	EW Minor adverse PM Minor benefit	EW Moderate adverse PM Moderate benefit
31 Aberfan Farmland High	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
32 Cwmblacks Farmland Medium	EW Negligible adverse PM No change	EW Slight adverse PM Neutral
33 Dowlais High	EW Minor adverse PM Moderate benefit	EW Moderate adverse PM Large benefit
34 Troedyrhiw and Pentrebach Low	EW No change PM No change	EW Neutral PM Neutral
35 Pant and Pengarnddu High	EW Minor adverse PM Minor benefit	EW Moderate adverse PM Moderate benefit
36 Merthyr Common and Cilfach-yr-Encil – Medium	EW Negligible adverse PM Negligible benefit	EW Slight adverse PM Slight benefit

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LCA and visual sensitivity	Magnitude of visual impact	Significance of visual effect
37 Ffos-y-Fran Open Cast Medium	EW Negligible adverse PM Minor benefit	EW Slight adverse PM Slight benefit
38 Trecatti Landfill Site Medium	EW Negligible adverse PM Minor benefit	EW Slight adverse PM Moderate benefit
39 Mynydd y Capel Medium	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
40 Cwm Bargoed Medium	EW Negligible adverse PM Minor benefit	EW Slight adverse PM Moderate benefit
41 Penddeugae and Nant-y-Fedw – Medium	EW No change PM No change	EW Neutral PM Neutral
42 Pen March, Cefn yr Ystrad and Trefil Ddu – Very high	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
43 Gelli-gaer Enclosed Farmland – Medium	EW No change PM No change	EW Neutral PM Neutral
44 Rhoslas Unenclosed Upland High	EW Negligible adverse PM Negligible benefit	EW Slight adverse PM Slight benefit
45 Cwm Carno Medium	EW No change PM No change	EW Neutral PM Neutral
46 Blaen Rhymni Medium	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
47 Fochriw Medium	EW No change PM No change	EW Neutral PM Neutral
48 Cefn Gelligaer and Mynydd Fochriw – Medium	EW Negligible adverse PM Minor benefit	EW Slight adverse PM Moderate benefit
49 Rhymni Medium	EW No change PM No change	EW Neutral PM Neutral
50 Tafarnaubach Industrial Estate – Low	EW No change PM Negligible benefit	EW Neutral PM Slight benefit
51 Cwm Darran High	EW No change PM No change	EW Neutral PM Neutral
52 Rhymni Hill and Bryn Oer Medium	EW No change PM No change	EW Neutral PM Neutral
53 Cefn Y Brithdir Medium	EW Negligible adverse PM Negligible benefit	EW Slight adverse PM Slight benefit
54 A465 Heads of the Valleys Low	EW No change PM No change	EW Neutral PM Neutral
55 Tredegar Patch Medium	EW No change PM No change	EW Neutral PM Neutral
56 Cwm Tyswg Medium	EW No change PM No change	EW Neutral PM Neutral
57 Rhymni Hill and Mynydd Bedwellte - Medium	EW No change PM Negligible benefit	EW Neutral PM Slight benefit

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LCA and visual sensitivity	Magnitude of visual impact	Significance of visual effect
58 Cefn Rhychdir Medium	EW No change PM No change	EW Neutral PM Neutral

Summary of visual effects

- 12.11.8 LCAs 24 Penydarren, 29 Dowlais Ironworks Reclamation, 30 Pant Farmland, 33 Dowlais and 35 Pant and Pengarnddu are predicted to experience a temporary significant adverse visual impact during earthwork operations. The LCAs are located to the north of the open cast and experience direct views of a sizeable part of the reclamation work areas.
- 12.11.9 LCAs 15 Cyfarthfa Castle, 17 Gurnos, 24 Penydarren, 29 Dowlais Ironworks Reclamation, 30 Pant Farmland, 33 Dowlais, 35 Pant and Pengarnddu, 38 Trecatti Landfill Site, 40 Cwm Bargoed and 48 Cefn Gelligaer and Mynydd Fochriw are predicted to experience a significant positive lasting visual impact after planting has reached maturity and the land use restored to that of urban common. The temporary adverse impact experienced by LCAs 24, 29, 30, 33 and 35 would be reversed.
- 12.11.10 29 LCAs are predicted to experience a slight beneficial visual impact after planting has matured. No LCAs are predicted to experience a detrimental visual impact after planting maturity.

13 Cultural Heritage

By Archaeology Wales

13.1 Introduction

13.1.1 This Chapter considers the potential significant effects of the alternative restoration scheme on the heritage assets, including archaeological sites, features and artefacts, historic buildings and historic landscapes. Both potential ‘direct’ and ‘indirect’ effects on the historic environment are considered. Where likely significant adverse effects are identified, mitigation measures to prevent, reduce, or offset them are proposed, and likely residual effects remaining after mitigation are determined as well as opportunities for enhancement.

13.1.2 A Desk-based assessment (DBA) has been carried out (**Appendix 13.A**) which has collated details of the known archaeological and historic sites and features and considered the potential for the presence of unknown or unrecorded heritage assets.

13.2 Consultation

13.2.1 Consultations were carried out with Cadw and Archaeological Planning – Heneb Glamorgan Gwent Archaeology (APHGGA) to outline the scope of the assessment for both the designated assets and the non-designated assets. Both consultees recommended that a Desk-based Assessment (DBA) be carried out. Cadw clarified that an ASIDOHL2 would not be required.

13.3 Legislation and Policy

13.3.1 The assessment will be carried out with due regard to the following:

- Historic Environment (Wales) Act 2023³⁰
- Town and Country Planning Act 1990: Section 314A³¹
- Future Wales: The National Plan 2040 (February 2021)³²
- Planning Policy Wales (Edition 12, February 2024)³³
- Technical Advice Note (TAN) 24: The Historic Environment, 2017³⁴

³⁰ <https://www.legislation.gov.uk/asc/2023/3/contents>

³¹ <https://www.legislation.gov.uk/ukpga/1990/8/section/314A>

³² Welsh Government. 2021. <https://www.gov.wales/future-wales-national-plan-2040>

³³ Welsh Government. 2024. <https://www.gov.wales/planning-policy-wales>

³⁴ Welsh Government, 2017. <https://www.gov.wales/technical-advice-note-tan-24-historic-environment>

- Local Development Plans³⁵
- Cadw Setting of Historic Assets in Wales (2017)³⁶
- Guidance for the Submission of Data to the Welsh Historic Environment Records³⁷
- Guidelines for digital archives³⁸
- Standard and Guidance for Desk-Based Assessment³⁹

13.4 Methodology

- 13.4.1 The primary objective of the DBA was to assess the potential impact of the development proposals on the historic environment. This was used to help inform decision making, design solutions and potential mitigation strategies. The aim was to make full and effective use of existing information in establishing the heritage/archaeological significance of the site to elucidate the presence or absence of heritage/archaeological material, its character, distribution, extent, condition and relative significance.
- 13.4.2 A DBA was undertaken by Archaeology Wales (**ES Volume 3 - Appendix 13.A**), the results of which have been used to help inform this ES chapter. Following consultation with APHGGA only those non-designated sites within the bounds of the development were assessed, with particular attention to identifying which assets remain in situ following the mining operations.
- 13.4.3 Sources consulted to compile the baseline comprised:
- Collation and assessment of all relevant information held in the regional HER at the Heneb Glamorgan-Gwent Archaeology within the bounds of the proposed development.
 - Collation and assessment of the impact on all designated heritage assets (Scheduled Monuments, Listed Buildings, Historic Parks & Gardens, Landscapes and Conservation Areas) within a 3 km study area around the proposed development area following the advice within Schedule 4 of the Town and Country Planning (Development Management Procedure) (Wales) (Amendment) Order 2016⁴⁰.
 - Assessment of all available excavation reports and archives including affecting the site encompassed by the proposed work.

³⁵ <https://www.merthyr.gov.uk/ReplacementLDP>

³⁶ <https://cadw.gov.wales/advice-support/placemaking/heritage-impact-assessment/setting-historic-assets>

³⁷ <https://cpat.org.uk/docs/HER-Docs/Guidance-for-the-Submission-of-Data-to-Welsh-HERs-V2-EN.pdf>

³⁸ <https://rcahmw.gov.uk/wp-content/uploads/2016/09/RCAHMW-Guidelines-for-Digital-Archives.pdf>

³⁹ https://www.archaeologists.net/sites/default/files/CIfAS%26GDBA_4.pdf

⁴⁰ <https://www.legislation.gov.uk/wsi/2016/59/schedules/made>

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- Assessment of aerial photographic (AP) and satellite imagery evidence.
- Assessment of archive records held at the County Archive in the National Library of Wales (NLW) and the Royal Commission on Ancient and Historical Monuments in Wales (RCAHMW).
- Records held by the developer e.g., bore-hole logs, geological/geomorphological information, aerial photographs, maps, plans and ZTV data.
- Map regression analysis using all relevant cartographic sources e.g., all editions of the Ordnance Survey County Series, Tithe, and early estate maps (as available).
- Place-name evidence, Historic documents (e.g., charters, registers and estate papers)

13.4.4 Following the compilation of the baseline data, the significance of any remains in their context both regionally and nationally and considering the findings of the desk-based study were assessed along with: -

- The history of the site.
- Previous impacts to the heritage assets
- The potential impact of any proposed development on the setting of known sites of heritage/archaeological importance.
- The potential for further assets to be present, which have not been identified in pre-existing archaeological records.
- The potential for further work, with recommendations where appropriate for a suitable investigative and/or mitigation methodology.

13.4.5 A site visit was carried out as a part of the desk-based assessment and the ground surface visually inspected for all earthworks, structures and finds. The site visit also assessed the visual impact of the proposed development on the setting of known sites of archaeological importance. Photographs were taken from within the proposal area to help illustrate and assess this visual impact. Designated sites within the study area were visited with photographs taken towards the proposed development to help illustrate and assess this visual impact on these sites.

13.4.6 In assessing the value of heritage assets, and the potential impacts upon them by the proposed development, the terms and guidance used in the Design Manual for Roads and Bridges, Volume 11, Section 3 (Highways England 2007) will be used. Values and impacts are given as detailed in the tables below.

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Table 13-1. Factors for assessing the value of archaeological assets

Value	Description
Very High	World Heritage Sites (including nominated sites). Assets of acknowledged international importance. Assets that can contribute significantly to acknowledged international research objectives.
High	Scheduled Monuments (including proposed sites). Assets of national importance. Assets that contribute to regional research objectives.
Medium	Assets of regional importance. Assets that contribute to regional research objectives. Assets with lower levels of preservation
Low	Assets of local importance. Includes locally listed buildings and assets of limited value or poor preservation
Negligible	Assets with little surviving archaeological or historic interest.
Unknown	The importance of the resource has not been ascertained

Table 13-2. Factors in the Assessment of the Magnitude of Impact

Magnitude	Description
Major	Change to most or all key heritage/archaeological materials, such that the resource is totally altered; comprehensive changes to setting
Moderate	Changes to many key heritage/archaeological materials, such that the resource is clearly modified; considerable changes to setting that affect the character of the asset
Minor	Changes to key heritage/archaeological materials, such that the asset is slightly altered; slight changes to setting
Negligible	Very minor changes to heritage/archaeological materials, or setting
No Change	No loss or alteration. Change not distinguishable or does not result in loss of heritage significance

13.4.7 Significance of effect is assessed by combining the value of the resource and the predicted magnitude of effect likely to arise, as per the matrix within the DMRB (Vol.II, Sect.3, Pt.2, Chap.5 – Table 5.1). The following table outlines the significance matrix used in this assessment to assign significance, as per the DMRB guidelines.

Significance of Effects Matrix

- 13.4.8 For the purposes of the EIA, only moderate, moderate/large, large/very large or very large effects are considered significant.
- 13.4.9 Where likely significant adverse effects are identified, mitigation measures to prevent or reduce them are proposed, and the likely residual effects remaining after mitigation ascertained.

13.5 Baseline

- 13.5.1 The baseline established on the existing condition of the proposal area as of November 2023 is detailed in the DBA (**ES Volume 3 - Appendix 13.A**), the key features are summarised below.

Registered Landscapes

- 13.5.2 The restoration area is within the Merthyr Tydfil Landscape of Outstanding Historic Interest in Wales (HLW (MGL) 2) which is identified within the Register of Landscapes of Historic Interest in Wales⁴¹.
- 13.5.3 Within the 3km Study Area lies the Registered Outstanding landscape of Gelli-Gear Common (MGI) 4 and the Grade II Registered Park and Garden, Cyfarthfa Castle - PGW(Gm)1(MER).

Conservation Areas

- 13.5.4 There are no Conservation Areas within the bounds of the site. There are seven within the 3km study area. The nearest being Dowlais, which is adjacent to the site, immediately to the north of the extraction area.

Scheduled Monuments

- 13.5.5 There is a one SM within the bounds of the proposed restoration area, Sarn Howell Pond and Watercourses (GM494) and another just beyond the bounds, the Deserted iron Mining Village (GM496). A further 26 are within the 3km study area.

Listed Buildings

- 13.5.6 There is one Listed Building within the bounds of the site, the Grade II Timber Aqueduct (LB16143). Within the 3km study area, there are a further 201 Listed Buildings. Two are Grade I, both relating to Cyfarthfa Castle, seven Grade II*, and 192 Grade II.

⁴¹ Cadw, CCW & ICOMOS. 1998. *Register of Landscapes of Outstanding Historic Interest*.

Non-Designated Assets

13.5.7 There are 190 previously recorded sites of heritage/archaeological interest within the bounds of the development area. The non-designated sites have been split into four categories.

- Group 1- Assets which lie outside of the extraction/overburden areas;
- Group 2- Assets which have had the impacts of the restoration works mitigated as part of an earlier scheme;
- Group 3- Assets with no clear previous mitigation, below the overburden mounds, survival possible but unlikely and;
- Group 4- Assets with no clear previous mitigation, within the main extraction areas, destroyed.

13.6 Assessment of Effects

13.6.1 The following summarises the potential effects of the proposed scheme on the designated heritage assets which are likely to be impacted without mitigation.

Merthyr Tydfil Landscape of Outstanding Historic Interest (HLW (MGL) 2)

13.6.2 The proposed scheme aims to improve the visible amenity of the extraction area and remaining overburden mounds improving the setting of the landscape from its current condition. The scheme also allows to make the area safe therefore improving the accessibility to, and continued maintenance of, the surviving heritage assets.

Gelligaer Common Landscape of Special Historic Interest (HLW (MGI) 4)

13.6.3 The restoration works will be visible from the northern extent of the Registered landscape and once completed should restore the setting of the landscape to its previous state prior to the start of the extraction works. The main visible element will be the retention of the overburden mounds, however once these are revegetated and reprofiled they should blend into the upland landscape.

Sarn Howell Pond and Watercourses (GM494)

13.6.4 The proposals intend to retain and maintain the Sarn Howell Pond and Watercourses incorporating them, along with related features, into the final design. This will result in a safer, more accessible site with a potential for educational opportunities.

Ffos-y-fran Deserted Iron Mining Village (GM496)

13.6.5 The visual element of the setting of both Sarn Howell and the Deserted Mining Village has been impacted during the main extraction works, and by the current

proposals, predominantly the result of the retention of OB3. The evolving backdrop of the monuments are a testimony to the continuation of the coal and iron extraction industry of which they are a component.

Listed Buildings and Conservation Areas

13.6.6 The impact on the Timber Aqueduct (LB16143) Listed Building within the bounds of the development would have the same benefits as those to the Sarn Howell Pond. These assets form part of the DFDS and are part of the final design of the restoration providing safer and better accessibility and educational opportunities.

13.6.7 Most of the remaining Listed Buildings and Conservation Areas lie in the valley bottom with few lines of sight to the restoration area. There are isolated views from Dowlais Engine House (LB11491) and Dowlais Stables (LB11478) within the Dowlais Conservation Area, and Lower Row (LB27085) and Ivor Works (LB27086) as the topography rises. The restoration area is also visible from those designated sites on the opposing valley side such as the Cyfarthfa Conservation Area, however the site does not dominate the views.

13.6.8 All these views would be improved by the revegetation of the site and the relandscaping of the restoration area integrating them into the hillsides.

Non-Designated Assets

13.6.9 The restoration works do not propose any direct impacts to non-designated assets which remain following the main extraction works.

13.7 Mitigation Measures

13.7.1 The records used to compile the baseline show that there are nearly 200 sites noted as being present within the bounds of the current proposal area. Mitigation is known to have been carried out on many of the sites as a part of an earlier phase of the restoration, in some cases, the reporting has been completed. The dissemination of this information is the key element of the preservation by record conditions of the earlier phase of the development.

13.8 Enhancement Opportunities

13.8.1 As a part of the final stage of the restoration, there would be some benefit in the compilation and dissemination of the research which has been carried out during the Stage III Reclamation scheme and making the extensive archaeological work that has already been undertaken available as public records.

- 13.8.2 Further measures which would result in an increased beneficial impact would be the creation of information panels near to Sarn Howell Pond and the Listed Aqueduct, informing the public on the nearby monuments as well as considering the incorporation of heritage walking routes into the final design subject to further health and safety risk assessments.

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13.9 Impacts following mitigation measures*Table 13-3 Impacts following mitigation measures*

Asset	Value	Nature of Impact	Magnitude of Impact	Significance	Mitigation	Residual
(HLW (MGL) 2) Merthyr Tydfil Landscape	High	Direct impact to the fabric of the landscape and the heritage assets within Indirect impact to the setting of the remainder of the landscape	Direct – Moderate - Adverse Indirect – Minor – Beneficial	Direct – Moderate Indirect -Slight	Reporting/ archiving completion as to disseminate the information from the previous investigations	Moderate- Beneficial
(HLW (MGI) 4) Gelligaer Common Landscape	High	Indirect impact on its setting	Minor - Beneficial	Slight	None	Minor - Beneficial
(GM494) Sarn Howell Pond and Watercourse	High	Indirect impact on its setting	Moderate- Beneficial	Moderate	None	Moderate - Beneficial
(GM496) Deserted Iron Mining Village	High	Indirect impact on its setting	Moderate- Beneficial	Moderate	None	Moderate- Beneficial
(GM624) Rhas Las Dam	High	Indirect impact on its setting	Minor- Beneficial	Slight	None	Minor- Beneficial
(LB16143) Timber Aqueduct	Medium	Indirect impact on its setting	Moderate- Beneficial	Moderate	Reporting/ archiving completion as to disseminate the information from the restoration of the aqueduct.	Major- Beneficial

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Asset	Value	Nature of Impact	Magnitude of Impact	Significance	Mitigation	Residual
Dowlais Conservation Area	Medium	Indirect impact on its setting	Minor- Beneficial	Slight	None	Minor- Beneficial
LB11491 Dowlais Engine House	Medium	Indirect impact on its setting	Minor- Beneficial	Slight	None	Minor- Beneficial
LB11478 Dowlais Stables	Medium	Indirect impact on its setting	Minor- Beneficial	Slight	None	Minor- Beneficial
LB27085 Lower Row	Medium	Indirect impact on its setting	Minor- Beneficial	Slight	None	Minor- Beneficial
LB27086 Ivor Works	Medium	Indirect impact on its setting	Minor- Beneficial	Slight	None	Minor- Beneficial
Cyfarthfa Conservation Area	Medium	Indirect impact on its setting	Minor- Beneficial	Slight	None	Minor- Beneficial
Non-designated Assets	Low	Loss of sites if the former preservation by record is incomplete	Major - Adverse	Moderate	Reporting/ archiving completion as to disseminate the information from the previous investigations	Moderate- Beneficial

13.10 Cumulative Effects

- 13.10.1 There are no expected cumulative impacts that would result in a significantly adverse impact on the cultural heritage receptors.

13.11 Summary of Significant Effects

- 13.11.1 No significant adverse effects are anticipated following the proposed works. Due to the nature of the proposals, the direct impacts of the scheme are, in large, beneficial, returning the setting of the landscape to its former state prior to the extraction works.

14 Air Quality and Greenhouse Gases

By Smith Grant

Introduction

- 14.1.1 The potential air quality and dust impacts and effects of the Scheme have been assessed by Smith Grant LLP as detailed in an Air Quality Assessment (AQA) attached at Technical **ES Volume 3 - Appendix 14A**. A separate Greenhouse Gas Assessment (GHGA) has been undertaken of greenhouse gas (GHG) emissions by Smith Grant LLP and is attached at Technical **Appendix 14B**
- 14.1.2 The following Chapter summarises the findings of the AQA and GHGA. It describes the methods used to assess the baseline conditions currently existing at the Site and surroundings, the potential severity of direct and indirect air quality impacts of the Proposed Development and the mitigation measures required to prevent, reduce, or offset the impacts and the significance of residual effects.
- 14.1.3 In this Chapter the term ‘Site’ has been used to refer to the area that is subject to the existing planning permission. It therefore includes the areas that are to be subject to final restoration along with those areas that have already been progressively restored and are not to be subject to further major earthworks as part of the Scheme. The term ‘Works Site’ has therefore been used to refer to the areas to be subject to major earthworks as part of the final restoration as detailed in the AQA.

Competence

- 14.1.4 The Chapter has been prepared by Smith Grant LLP, an environmental consultancy specialising in air quality. The author, Katrina Hawkins BSc (Hons) MSc MIAQM CEnv, is an environmental scientist with over 30 years’ experience in the field of environmental risk management now specialising in the assessment of air emission impacts. The author regularly provides air quality input to planning applications for a wide range of developments including waste management and treatment facilities, mineral extraction, and housing developments.

14.2 Scope of the Assessment

Local Air Quality and Dust

- 14.2.1 The proposed restoration may give rise to the following aerial emissions, which could give rise to potential impacts and resulting effects on local human and ecological receptors:

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- dust (fugitive dust and particulate matter (PM₁₀ / PM_{2.5})) arising from material handling and internal haulage.
- combustion emissions from Non-Road Mobile Machinery (NRMM) associated with material handling within the Site and any on-site power generation (nitric oxides (NO_x), PM₁₀ / PM_{2.5}, carbon monoxide (CO) and sulphur dioxide (SO₂).

14.2.2 However, it is of note that any potential impacts and resulting effects that may arise during the proposed restoration works would be expected to be significantly reduced when compared to those that may have arisen during recent surface mining operations and for the existing approved restoration scheme.

14.2.3 The proposals do not include for any importation of material to the site, or export of material off-site, for the purposes of restoration. As such any on-road vehicle movements associated the proposals would be solely related to staff car movements, which would be minimal and the occasional delivery of supplies. As such further consideration of potential impacts of on-road vehicle emissions at relevant receptors is not required and assessment of these emissions can be scoped out of the assessment.

Greenhouse Gases (GHGs)

14.2.4 The Proposed Development may give rise to a range of GHGs both directly using NRMM and any on-site power generation and indirectly through the consumption of materials and water use. However, the emissions of GHGs would be significantly less than may arise when compared to those that may have arisen during recent surface mining operations and for the existing approved restoration scheme.

14.3 Legislation and Policy

Air Quality and Dust

14.3.1 A summary of the key current strategies, legislation, planning policy and guidance relevant to the assessment of the Scheme with regards to local air quality is provided below:

Strategies

- UK Clean Air Strategy 2019
- Wales Clean Air Plan 2020

Legislation

- Environment Act 1995 : Part IV Air Quality

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- Air Quality Wales (Regulations) 2000, as amended by the Air Quality (Wales) (Amendment) Regulations 2002;
- Air Quality Standards (Wales) Regulations 2010; as amended by the Air Quality (Wales) (Amendment) (EU Exit) Regulations 2019;
- Environmental (Air Quality and Soundscapes) (Wales) Act 2024
- National Planning Policy
- Planning Policy Wales (PPW) – Edition 12 (2024): Section 6: Air Quality and Soundscape;
- Local Planning Policy
- Merthyr Tydfil County Borough Council Replacement Local Development Plan (2016-2031);
- Merthyr Tydfil County Borough Council Replacement Local Development Plan (2016-2031): ENW4: Environmental Protection;
- National Guidance and Best Practice
- Welsh Government, Local Air Quality Management in Wales, Policy Guidance PG(W)(17), June 2017;
- Defra, Local Air Quality Management, Technical Guidance, LAQM TG (22), August 2022
- Institute of Air Quality Management (IAQM): Planning for Air Quality (2017);
- Institute of Air Quality Management (IAQM): Guidance on the Assessment of Mineral Dust Impacts for Planning (2016),
- Institute of Air Quality Management (IAQM): Guidance on the Assessment of Dust from Demolition and Construction (2024),

14.3.2 There are currently no national planning policy guidance documents in Wales that specifically deal with air quality. A draft revised Technical Advice Note TAN 11: Air Quality, Noise and Soundscape which incorporated air quality was issued in October 2022. At the time of preparing of this Chapter this remains in draft form, although is understood to be undergoing review by the Welsh Government.

GHGs

14.3.3 A summary of the current legislation, planning policy and guidance relevant to the assessment of the Scheme with regards to GHG emissions is provided below:

Legislation

- Climate Change Act 2008
- Environment (Wales) Act 2016: Part 2

- Climate Change (Wales) Regulations 2018
- Climate Change (Wales) Regulations 2021
- National Planning Policy
- Planning Policy Wales (PPW) – Edition 12 (2024);
- Local Planning Policy
- Merthyr Tydfil County Borough Council Replacement Local Development Plan (2016-2031);

National Guidance and Best Practice

- Defra, Environmental Reporting Guidelines, including streamlined energy and carbon reporting guidance (2019)
- Institute of Environmental Management (IEMA): Assessing Greenhouse Gas Emissions and Evaluating Their Significance (2017)

14.4 Baseline Conditions

Local Air Quality and Dust

- 14.4.1 The baseline conditions have been taken as being the condition of the local air quality at the date of end November 2023 when all coaling operations ceased and prior to the commencement of the restoration of Phase 2A. The baseline has been informed through a desk top review of existing mapping information, existing air quality data sets and site maintenance activities in place in November 2023.
- 14.4.2 The nearest residential properties to the Site include those within Mountain Hare about 40 m to the west of the site boundary beyond the A4060 and at Ffos-y-Fran Incline Side about 30 m to the south off the Bogey Road. Other properties within 250 m of the Site include those within Dowlais and Dowlais Top to the north and those within Incline Top and Twynyrodyn to the west.
- 14.4.3 The nearest identified statutory nature conservation site to the Site is the Cwm Glo a Glyndyrys SSSI which extends to about 1.9 km to the south-east at its nearest point. No other statutory designated nature conservation sites have been identified within 2 km of the Site. As detailed above in **Chapter 11**, the Merthyr Common Central SINC lies to the south of Bogey Road and the Tair Carreg Moor SINC lies to the immediate east of the Site.
- 14.4.4 MTCBC has declared an Air Quality Management Area (AQMA) within its area under its' Local Air Quality Management (LAQM) duties⁴². This encompasses Twynyrodyn Road and adjoining properties about 960 m to the south-west of the

⁴² Merthyr Tydfil County Borough Council 2023 Air Quality Progress Report, September 2023

Site. The AQMA was declared in 2017 due to levels of nitrogen dioxide (NO₂) exceeding the UK Air Quality Objective (AQO) of 40 µg/m³ (as an annual mean).

- 14.4.5 MTCBC undertakes monitoring for NO₂ air quality across the Council area using a combination of automatic (continuous) monitors and passive diffusion tubes. This includes several locations within 1 km of the site. In its most recently published Annual Air Quality Status Report¹ the Council reported that all monitored NO₂ concentrations in the borough are all below the relevant AQO Objectives. The report also noted that MTCBC is proposing to revoke the Twynyrodyn Road AQMA if air quality monitoring continues to show NO₂ levels are now well below the AQO in this area.
- 14.4.6 In addition, Merthyr (South Wales) Ltd has undertaken monitoring for particulate matter (as PM₁₀ and PM_{2.5}) using a continuous analyser for several years at Twynyrodyn Community Primary School. This has been carried out during the surface mining operations in accordance with an agreed air quality monitoring strategy⁴³ as required under Condition 16 of the planning permission for the Ffos-y-Fran Reclamation Scheme. The available data showed PM₁₀ and PM_{2.5} levels to have been below the relevant long-term and short-term AQOs.
- 14.4.7 Merthyr (South Wales) Ltd has also historically undertaken extensive dust monitoring (as deposition and directional dust) during the surface mining operations in the locality under the agreed air quality monitoring scheme. The dust impact risks recorded at the monitoring locations across the monitoring period were generally low.

GHGs

- 14.4.8 As for air quality the baseline conditions would be taken as being the condition of the Site as of November 2023. At this stage site activities were limited to care and maintenance and as such the baseline GHG emissions associated with the Site would have been negligible.

14.5 Assessment Methodology

Local Air Quality and Dust

- 14.5.1 The overall assessment has undertaken in accordance with the Planning Policy Wales (PPW) as detailed above. In addition, reference has been made to several non-statutory guidance documents published by the IAQM that outline

⁴³ Peter Brett Associates, Ffos-y-Fran Land Reclamation Scheme, Air Quality, Noise and Vibration Strategy, Project Ref: 1192/304, January 2007

requirements for air quality assessment for a range of aspects, including for mineral dust, construction dust and vehicle emissions. These each set out when an air quality assessment is required and outline recommended methodologies for carrying out such assessments and determining the significance of impacts and effects. The recommended approaches will be adapted as applicable and necessary to the specific proposals.

- 14.5.2 The assessment of potential pollutant impacts uses the source-pathway-receptor concept and considers the potential magnitude of release (the source potential), the effectiveness of the pathway (i.e. dispersion of a pollutant towards a receptor) and the sensitivity of the receptor.
- 14.5.3 Receptors considered in the assessment comprise human receptors, that is locations where a person or property may experience adverse impacts of airborne dust or exposure to ambient pollution (e.g. residential, leisure, amenity and sensitive commercial use) and ecological receptors, where this refers to any sensitive habitat that may be affected by dust soiling or increased ambient pollution (e.g. locations with an international, national or local designation and sensitive habitat features). The sensitivity of the receptors to potential impacts from aerial emissions, whether changes in pollutant concentrations or dust soiling, has been determined as detailed in the relevant guidance.
- 14.5.4 The fugitive dust assessment considers potential impacts from dust soiling and increased ambient PM₁₀ (and PM_{2.5}) concentrations arising from the material handling and internal haulage activities. The assessment considers the potential source of dust, distance and orientation to receptors, sensitivity of receptors and the local weather conditions. In accordance with IAQM guidance the assessment considers in-design mitigation.
- 14.5.5 The assessment of NRMM and on-site power generation emissions considers the quantity and type of machinery to be used on Site.

Greenhouse Gases

- 14.5.6 The GHG assessment has primarily been undertaken with reference to the non-statutory guidance provided by IEMA on Assessing Greenhouse Gas Emissions and Evaluating Their Significance (2017).
- 14.5.7 The principal direct and indirect sources of GHGs have been identified and the total tonnes of potentially released GHGs estimated. These have been estimated as tonnes of carbon dioxide equivalent (tCO₂e) using appropriate conversion factors.

- 14.5.8 There is no available methodology to determine the significance of the GHG emissions associated with proposed developments. Hence, to provide context therefore the assessment has compared the predicted GHG emissions arising from both the proposed restoration scheme and the currently approved scheme.

14.6 Assessment of Effects

Local Air Quality and Dust

- 14.6.1 The assessment of potential impacts and resulting effects arising from dust emissions has considered the potential sources of particulate matter during the proposed Scheme on the Site; proximity and orientation of sensitive receptors to the Works Area; the prevailing wind direction, and presence of screening.
- 14.6.2 The proposed Scheme would require the movement of circa 2.5M m³ of materials in the form of earthworks. The Scheme includes several in-design mitigation measures that serve to reduce the likelihood for the generation of dust. This includes the minimisation of the quantity of material requiring re-location and reducing the requirement for internal haulage. As under the current approved scheme, there would not be any importation of materials such as fill or soil forming materials to the Site for restoration or any export of materials or waste off-Site.
- 14.6.3 The facility would continue to be operated in accordance with various existing planning conditions in relation to dust, adapted as appropriate to the Scheme. These measures would be set out in an updated and revised Air Quality Strategy, and incorporated within a wider Environmental Management Plan (EMP) that would be agreed with the LPA in advance of commencement of the final restoration works.
- 14.6.4 Through the physical in-built mitigation measures, and the implementation of best practice mitigation measures, the risk of adverse impacts due to deposition dust at all identified human and ecological receptors is *negligible* at most.
- 14.6.5 Fine particulates (PM₁₀ and PM_{2.5}) also make up a part of the fugitive and wind-blown dust and which can give rise to human health impacts. The measures that would be outlined within the AQS to minimise dust emissions will similarly serve to minimise PM₁₀ (and PM_{2.5}) emissions. The risk of adverse impacts due to PM₁₀ (and PM_{2.5}) are *negligible*. The provision of additional measures is not considered necessary to protect human health.
- 14.6.6 Overall, no unacceptable impacts or resulting effects from dust on human health, amenity or ecological receptors have been identified.

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- 14.6.7 The overall significance with regards to dust, PM₁₀ (and PM_{2.5}) is **not significant**.
- 14.6.8 NRMM operating on Site during the earthworks would primarily comprise 7 tracked dozers at any one time. There would be additional short period of time (estimated as 17.5 weeks) when additional excavation and internal haulage would be undertaken requiring an additional excavator and 5 articulated dump trucks. Processing would be limited to a mericrusher (or similar equipment) to reduce large stones to a finer grade as a medium for grass seeding.
- 14.6.9 All NRMM would be mobile within the relevant working areas within the Site and would not result in continuous emissions for any substantial period at any location, including close to site boundaries. Human receptors lie at least 105m distant from the working areas and ecological receptors at least 115m.
- 14.6.10 In addition, increasingly stringent emission limits are being applied to NRMM engines
- 14.6.11 On this basis, the use of NRMM and on-site plant is not expected to result in significant adverse impacts at any location. Resulting effects would be not significant.
- GHGs*
- 14.6.12 The proposed Scheme solely relates to the restoration of the Site through the relocation of existing materials onsite and subsequent surface treatment and cultivations (hydroseeding, landscaping, seeding etc). There would not be any importation of material on site, or exportation off-site. There would not be any mineral extraction, and processing would be limited to use of a mericrusher to reduce large stones to a finer grade medium for grass seeding. There would not be any on-site activities on completion of the restoration other than associated with aftercare.
- 14.6.13 The Scheme would not result in the production of any material that may result in subsequent generation of greenhouse gases, either onsite or 'downstream'. As such the primary activities associated with the Scheme involve material movement using bulldozers, an excavator and dump trucks along with use of pumps to reduce the water level in the void during works on the lower slopes.
- 14.6.14 The assessment has focused on the quantity of fuel required for the NRMM and pumps during the restoration works. It has been estimated that this use of fuel during the Scheme would result in GHG emissions of 7,072 tCO₂e. For comparison the estimated GHG emissions that would arise from the existing approved scheme are substantially higher at 64,692 tCO₂e.

14.6.15 Both the proposed Scheme and currently approved scheme would result in additional fuel use and hence direct and indirect GHG emissions from the subsequent soiling and agricultural activities to complete the restoration. However, these are expected to be similar for both schemes and have not been considered further.

14.6.16 In addition, indirect GHG emissions would arise associated with water use and downstream waste and waste-water treatment. However, these would be insignificant compared to the GHG resulting from fuel usage and have not been considered further.

14.7 Mitigation Measures

Local Air Quality and Dust

14.7.1 Industry guidance is that potential effects that may be associated with fugitive dust can be readily controlled through the implementation of appropriate mitigation measures. As noted above the Scheme incorporates several in-design measures that would serve to minimise the potential for dust generation.

14.7.2 In addition, the Scheme would be operated in accordance with best practice measures as recently employed at the former surface mine, and as required under the existing planning permissions. These measures would be adapted as necessary and applicable for the specific restoration operations and detailed in an updated and revised Air Quality Strategy.

14.7.3 This would include measures such as maintenance of a site speed limit, minimisation of drop heights when loading, provision of dust suppression as and when required to dampen down haul roads and working areas, and particularly during prolonged periods of dry and/or excessively windy weather, and the ongoing maintenance of smooth internal running surfaces.

GHGs

14.7.4 The Scheme incorporates in-built mitigation measures primarily through the minimisation of quantity of material requiring movements to achieve restoration, and hence substantially reducing the need for NRMM and reducing the need for internal haulage. Further mitigation would be provided through regular servicing and maintenance of NRMM and on-site plant.

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14.8 Monitoring*Local Air Quality and Dust*

- 14.8.1 Condition 16 of the existing planning permission requires an air quality monitoring scheme, to include the monitoring of dust and particulates. This existing monitoring scheme will be revised as appropriate for the Final Restoration activities. The monitoring scheme would include both regular visual monitoring and quantitative monitoring.
- 14.8.2 A dust monitoring scheme would be re-established at suitably agreed revised locations. Locations would focus on those relevant receptors within 250m of the Works Area and subject to access and safety considerations. Monitoring would be undertaken for dust deposition dust and directional dust subject to a methodology to be agreed in advance with MTCBC.
- 14.8.3 Given the nature of the proposed activities and from historical data collected during surface mining operations, it is not considered that re-commencement of PM10 and PM2.5 monitoring at Twynyrodyn School or elsewhere is required. This is subject to agreement with MTCBC.

GHGs

- 14.8.4 No specific monitoring is required in relation to GHG emissions. However, the fuel use would be continually monitored as part of the financial management of the Scheme.

14.9 Cumulative Effects

- 14.9.1 The works area where the main earthworks would be undertaken is in the northeast of the Site and there are limited human and ecological receptors within 250m of this area. In consideration of this, the nature of the works to be undertaken and incorporation of best practice mitigation measures, and the relatively short period for the works (2-4 years) the potential for cumulative effects with any other projects in the area is *negligible*.

14.10 Summary of Significant Effects*Local Air Quality and Dust*

- 14.10.1 Through the physical in-built mitigation measures, and the implementation of best practice mitigation measures, the risk of adverse impacts due to disamenity dust is *negligible* at all identified human and ecological receptors at most.

- 14.10.2 Fine particulates (PM₁₀ and PM_{2.5}) also make up a part of the fugitive and wind-blown dust and which can give rise to human health impacts. The measures that would be outlined within the AQS to minimise dust emissions will similarly serve to minimise PM₁₀ (and PM_{2.5}) emissions. The risk of adverse impacts due to PM₁₀ (and PM_{2.5}) are *negligible*. The provision of additional measures is not considered necessary to protect human health.
- 14.10.3 The resulting significance of dis-amenity, health (PM₁₀) and ecological effects resulting from fugitive dust emissions is **not significant**.
- 14.10.4 The main works areas are over 100m from nearest receptors and the risk of adverse impacts due to machinery and plant combustion emissions is *negligible* at all identified human and ecological receptors at most.
- 14.10.5 The overall residual effects associated with machinery and plant combustion emissions are **not significant**.
- 14.10.6 It should be noted that the risk of the generation of dust and aerial emissions, and hence of adverse impacts and effects, during the proposed Scheme is substantially less than that during the recent coaling works undertaken between 2007 and November 2023.
- 14.10.7 Furthermore, the risk of the generation of dust and aerial emissions, and hence of adverse impacts and effects, during the proposed Scheme is substantially less than that during the existing consented scheme which would require the movement of about 25M m³ of materials. If compared to consented scheme the proposals would therefore result in beneficial effects.

GHGs

- 14.10.8 The GHG emissions that would be generated by the proposed Scheme would be substantially less than those that would be generated by the consented scheme. They would equally be substantially less than those associated with the coaling operations which were undertaken until November 2023. These operations would also have had downstream GHG emissions associated with the transport and subsequent combustion of the coal extracted on the Site. If compared to consented scheme the proposals would therefore result in beneficial effects.
- 14.10.9 Based on the above, the GHG emissions that would be generated by the proposed Scheme should not be considered significant or preclude the granting of planning permission.

14.11 Summary of Significant Effects

Local Air Quality and Dust

- 14.11.1 Through the physical in-built mitigation measures, and the implementation of best practice mitigation measures, the risk of adverse impacts due to disamenity dust is *negligible* at all identified human and ecological receptors at most.
- 14.11.2 Fine particulates (PM₁₀ and PM_{2.5}) also make up a part of the fugitive and wind-blown dust and which can give rise to human health impacts. The measures that would be outlined within the AQS to minimise dust emissions will similarly serve to minimise PM₁₀ (and PM_{2.5}) emissions. The risk of adverse impacts due to PM₁₀ (and PM_{2.5}) are *negligible*. The provision of additional measures is not considered necessary to protect human health.
- 14.11.3 The resulting significance of dis-amenity, health (PM₁₀) and ecological effects resulting from fugitive dust emissions is **not significant**.
- 14.11.4 The main works areas are over 100m from nearest receptors and the risk of adverse impacts due to machinery and plant combustion emissions is *negligible* at all identified human and ecological receptors at most.
- 14.11.5 The overall residual effects associated with machinery and plant combustion emissions are **not significant**.
- 14.11.6 It should be noted that the risk of the generation of dust and aerial emissions, and hence of adverse impacts and effects, during the proposed Scheme is substantially less than that during the recent surface mining works undertaken between 2007 and November 2023.
- 14.11.7 Furthermore, the risk of the generation of dust and aerial emissions, and hence of adverse impacts and effects, during the proposed Scheme is substantially less than that during the existing approved scheme which would require the movement of about 25M m³ of materials. If compared to the approved scheme the proposals would therefore result in beneficial effects.

GHGs

- 14.11.8 The GHG emissions that would be generated by the proposed Scheme would be substantially less than those that would be generated by the approved scheme. They would equally be substantially less than those associated with the surface mining operations which were undertaken until November 2023. These operations would also have had downstream GHG emissions associated with the transport and subsequent combustion of the coal extracted on the Site. If

compared to the approved scheme the proposals would therefore result in beneficial effects.

- 14.11.9 Based on the above, the GHG emissions that would be generated by the proposed Scheme should not be considered significant or preclude the granting of planning permission.

15 Population and Human Health

By RML

15.1 Introduction

- 15.1.1 A population and human health assessment is a requirement of The Town and Country Planning (Environmental Impact Assessment) Regulations 2017⁴⁴. The European Centre for Health Policy⁴⁵ is widely accepted as the seminal definition of Health Impact Assessment (HIA) and defines it as *‘a combination of procedures, methods and tools by which a policy, programme or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population’*.
- 15.1.2 The World Health Organisation defines health as *‘a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.’* These are factors which span environmental, social and economic aspects. In Wales, there is also a statutory duty to consider the well-being of future generations.
- 15.1.3 HIA employs a systematic and practical method, of assessing the possible negative and positive effects of a proposal on health and well-being, to support decision making, and suggests ways in which opportunities for health gain can be maximized and risks to health minimised.
- 15.1.4 The wider determinants of health include social, economic, cultural and environmental factors that may affect the health of the local community. Some examples are illustrated below⁴⁶:
- Social factors including, but not limited to, education and employment opportunities; housing, a good diet, social connection, where we live and whether that facilitates exercise.
 - Economic factors include unemployment, income and economic activity.
 - Cultural factors include community identity, family organisation and role.

⁴⁴ UK Statutory Instrument 2017 571. Schedule 4, items 4 and 5 (d): a *‘description of the factors specified in regulation 4(2) likely to be significantly affected by the development: population, human health,*

⁴⁵ (1999) Gothenburg Consensus

⁴⁶ Health Impact Assessment (Wales) Regulations – Consultation Document – December 2023

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- Environmental factors include access to green space, housing, air and water quality, access and quality of services, medical services, transport and matters such as biodiversity and climate.

HIA and the Ffos-y-Fran scheme

- 15.1.5 The Ffos-y-Fran reclamation scheme was predicted to provide on average around 170 direct jobs and contribute to the region of £45 million in wages alone to the local economy over the lifetime of the project. It is not known what the actual outturn figures over the operational period of the surface mine were, but it is generally recognised that Ffos-y-Fran was a major source of employment in the local area and contributed significantly to the local economy of Merthyr Tydfil and the South Wales Valleys. The Ffos-y-Fran surface mine ceased to be operational at the end of November 2023, resulting in the remaining 125 plus employees being made redundant.
- 15.1.6 The original environmental assessment for the Ffos-y-Fran Land Reclamation Scheme (FLRS) identified that the likely effects on human health would be because of changes to air quality.⁴⁷ Air quality around the site in terms of nitrogen dioxide particles, dust and odour was reported as being good before the surface mining operations commenced.
- 15.1.7 The main potential air quality impact of the surface mining operations was predicted as being dust nuisance on the local communities, however most nearby dwellings were reported to lie outside the recommended 100 to 200 metres buffer zone or located where the risk of dust nuisance was considered low due to prevailing weather conditions. The impact on air quality because of emissions from plant and machinery (that omit nitrogen oxides (NO_x) and PM₁₀) was predicted to cause some deterioration in air quality during the operational phase of coal extraction. However, this was considered likely to easily fall within the parameters of the relevant air quality objectives at the time of the assessment. It was also predicted that there could be some minor adverse effects with odour from the adjacent landfill site caused by disturbance because of the nearby proposed coal extraction works.
- 15.1.8 The original environmental assessment for the Ffos-y-Fran Land Reclamation Scheme (FLRS) identified that the likely effects on human health would be because of changes to air quality.⁴⁸ Air quality around the site in terms of nitrogen dioxide

⁴⁷ Environmental Statement – Chapter 19 Air Quality – Peter Brett Associates

⁴⁸ Environmental Statement – Chapter 19 Air Quality – Peter Brett Associates

particles, dust and odour was reported as being good prior to the open cast operations.

15.2 Legislation and Policy context

Public Health (Wales) Act 2017 - Health Impact Assessment Regulations

15.2.1 To address the wider determinants of health, the Welsh Government (WG) has had a longstanding approach to a commitment to health in all policies. To support this approach, the WG has championed embedding the use of HIA and made provision for HIAs in the Public Health (Wales) Act 2017.

15.2.2 HIA is a tool to help people assess the potential health effects of a project on a population, particularly on vulnerable or disadvantaged groups. If this ES was for a proposed new surface mine an HIA would most likely be required and is generally mandated for surface mining operations. As this ES addresses revisions to the agreed final restoration scheme, following the cessation of coal extraction in 2023, then the assessment is based on the changes that would arise between the original restoration proposal and the changed proposal.

Well-being of Future Generations (Wales) Act 2015

15.2.3 The Well-Being of Future Generations (Wales) Act 2015 (WFG Act) makes public bodies to consider long-term implications of their decisions and actions, to work better with people and communities and each other, and to prevent problems by taking a more proactive, sustainable and joined-up approach to address persistent problems such as poverty, health inequalities and climate change.

15.2.4 The (WFG Act) aims to improve the social, economic, environmental, and cultural well-being of Wales through 7 wellbeing goals in law⁴⁹. They are:

- A prosperous Wales
- A resilient Wales
- A healthier Wales
- A more equal Wales
- A Wales of more cohesive communities
- A globally responsible Wales
- A Wales of vibrant culture and thriving Welsh language



⁴⁹ Well-being of Future Generations Act: the essentials: <https://www.gov.wales/sites/default/files/publications/2024-07/well-being-future-generations-wales-act-2015-the-essentials-2024.pdf>

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15.2.5 A healthier Wales is defined in the WFG Act as a society in which people’s physical and mental well-being is maximised and in which choices and behaviours that benefit future health are understood.

15.2.6 Placemaking is an important factor in contributing to people’s physical and mental well-being. The restoration of Ffos-y-Fran provides an opportunity to vastly improve the physical environment and create a diverse landscape that will provide many opportunities for biodiversity, while returning the land to urban common and general amenity for the local community.

Planning Policy Wales (PPW) – Edition 12, February 2024

15.2.7 PPW requires that where significant effects are likely to arise because of development plans or individual development proposals, environmental impacts should be considered in full knowledge of the likely consequences for health. Where relevant, health impacts should be incorporated into environmental impact assessments to develop stronger and more cohesive approaches towards maximising health and well-being.

15.2.8 PPW also refers to previously developed land and sites of industrial heritage where it may be appropriate to consider remediation for nature conservation, amenity value or to reduce risks to human health.

15.2.9 In the case of any applications for surface mining, PPW requires that a Health Impact Assessment be provided to accompany any planning application and to inform the Environmental Statement. This clearly does not apply to the final restoration strategy for Ffos-y-Fran, as the surface mining has now ceased, and so any impacts on human health because of the surface mining are not considered here.

15.2.10 PPW advocates the minimisation of adverse environmental impacts and avoiding risks to human health. Although this applies to sustainable waste management facilities, there is no reason why this approach could not be adopted to other forms of development such as mineral extraction and restoration schemes.

15.2.11 PPW recognises that there remains a need for mineral extraction and that extraction is limited to locations where the required mineral occurs. When mineral extraction ceases *‘land needs to be reclaimed to a high standard and to a beneficial and sustainable after-use so as to avoid dereliction and to bring discernible benefits to communities and/or wildlife.’* (PPW para 5.14.4)⁵⁰.

⁵⁰ Planning Policy Wales (PPW) – Edition 12, February 2024: <https://www.gov.wales/sites/default/files/publications/2024-07/planning-policy-wales-edition-12.pdf>

Minerals Technical Advice Note (MTAN) 2: Coal

- 15.2.12 Sets out the requirement for Mineral Planning Authorities ‘to balance local or community benefits against the disbenefits of likely impacts. One aspect of this will be the physical benefits of land restoration, but other factors need to be considered. The MPA will need to adopt a process for considering these less measurable factors, to ensure that decision making is both just and transparent. This will require them to assess, to a reasonable degree, the changes to people’s quality and way of life, their community, their environment, health and wellbeing’⁵¹.
- 15.2.13 Minerals Planning Policy Wales (MPPW) sets out the general policies for all mineral development and the Ministerial Interim Planning Policy Statement (MIPPS) on Health Impact Assessment (HIA) MTAN2. Clause 120 to 129 of MTAN2 addresses Health Impact Assessment. Dust nuisance, particulates and noise are discussed in the MTAN.

15.3 Zone of Influence and scope of the assessment*Zone of Influence*

- 15.3.1 The DMRB LA112 guidance requires a Population and Health assessment to consider a Zone of Influence (ZOI), ZOI, that extends 500m beyond the boundary of the proposed development. The scheme redline boundary and the 500m wide ZOI is shown in Figure 15.1. The county boundary passes down the eastern redline boundary with Merthyr Borough to the west and Caerphilly Borough to the east. Part of Caerphilly Borough lies within the eastern side of the 500m ZOI, although there are no residential properties present within this portion.
- 15.3.2 The site ‘redline’ boundary encloses an area of approximately 386 hectares, which includes the derogated 254.36ha of Merthyr Common. The 500m ZOI covers an additional 494ha of land and urban areas. To the east, south and southwest the ZOI boundary includes agricultural land, including additional parts of Merthyr Urban Common. Also included is most of the Cwm Bargoed railway yards and former coal processing works, the Biffa Waste Cwmbargoed Landfill and part of the adjacent solar farm. To the south of the surface mine area lies a small group of residential properties, at Incline Side, beside the Bogey Road.
- 15.3.3 To the north and west of the site the ZOI boundary extends west of the A4060 from Mountain Hare northwards to Dowlais Top. Included are residential areas, formal designated public open space, informal open space, sports facilities

⁵¹ Minerals Technical Advice Note 2: Coal (Wales); January 2009

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including football, rugby and an industrial area associated with Goat Mill Road and the urban streets of Dowlais with shops, public houses, social clubs, guest houses, Dowlais Primary School, a day nursery, Ty Dysgi Pupil Referral Unit and religious buildings.

- 15.3.4 The concentration of residential areas in the north and west portions of the ZOIs contrast sharply with the virtual absence of residential properties to the south and east. Inversely, the south and east portion is predominantly in use as agricultural land accessible to the public along a network of public footpaths. Some of these footpaths are within the neighbouring county of Caerphilly.

Scope of the assessment

- 15.3.5 The scoping report indicated that the HIA would focus on what the potential effects the proposed restoration scheme would have on human health. A separate assessment of the likely effects on air quality and greenhouse gases has been completed and is reported in this ES.

- 15.3.6 The potential effects on human health will consider the effects of restoring the site on the receptors shown in **Table 15.1**:

Table 15.1 Receptors

Land Use and Accessibility	Community and Open Access Land
	Gelligaer and Merthyr Urban Common (Commoners Association)
	Walkers, Cyclists and Horse Riders
	Motorised Off Road Community (GLASS)
Human Health	Health Determinants (e.g. noise or air pollution)
	Likely Health Outcomes (Well-being and tranquillity)

15.4 Method of Assessment

- 15.4.1 This section sets out the methodology by which the impacts have been assessed. As set out in the Scoping Report⁵² and is based on the Design Manual for Roads

⁵² Ffos-y-Fran Final Restoration Strategy, Environmental Impact Assessment Scoping Report July 2024

and Bridges (DMRB) LA 112 Population and Human Health. While this guidance is intended for reporting the environmental effects on population and human health from the construction, operation and maintenance of highways projects, there are sufficient similarities between the restoration works and the construction of a highways project with similar earthmoving operations and similar plant and machinery required.

- 15.4.2 DMRB LA112 provides guidance on environmental sensitivity, scale of effect and magnitude of impact, however the assessment of most relevant environmental aspects have been assessed in other chapters. On this basis it was not considered appropriate to reassess these aspects, but to take into consideration the findings, which will include the significance of effects and any required mitigation. Other aspects have been assessed using professional judgement.

Assessment of potential effects

- 15.4.3 There are two relevant time periods to consider in this assessment, when the scheme has potential to affect workers on the site and in nearby communities:

- Restoration works.
- Post restoration, when the site is in use for grazing, recreation and nature conservation.

- 15.4.4 When considering population and health effects a buffer zone of 500m is applied, in accordance with the guidance. Aspects that could influence health are dust, air quality and noise. Different buffer zones are applied to dust and air quality. Noise was scoped out of the assessment. Dust is assessed over a buffer zone of 350 metres of the works boundary, while air quality is assessed over 200m. Reference is made to the relevant chapters for the appropriate buffer or ZOI boundary.

Assessment of significance

- 15.4.5 The following list sets out the basis on which effects have been assessed:
- Nature: the status of the effects has been assessed by considering whether the proposed development would have a positive or negative effect on receptors.
 - Likelihood: assessing if the impact is expected to be definite, possible or speculative.
 - Scale and significance: the assessment will consider what proportion of the population is likely to be affected, how severe or beneficial the effect would be.
 - Timing and duration: the assessment will assess whether the risk to health would be short or long term.

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- Distribution: the assessment will consider if the proposal would affect groups or sections of the population.

15.4.6 The outcomes of the assessment on human health would fall into one of the categories in **Table 15.2**.

Table 15.2 Human health outcome categories⁵³

Health outcome category	Health outcome description
Positive	A beneficial health impact is identified
Neutral	No discernible health impact is identified
Negative	An adverse health impact is identified
Uncertain	Where uncertainty exists as to the overall health impact

Assumptions and limitations

15.4.7 The data on population and health was gathered in past years and whilst being, in most cases, the latest available reliable source, there will have been more recent changes that are not reflected in these statistics.

15.5 Baseline

The baseline scenario

15.5.1 The baseline conditions will be taken as being at the end of November 2023 when coal extraction ceased and prior to the restoration works progressing. At that time, the surface mine had been partially restored, with the western fringes of the site shaped and seeded to provide a green naturalistic landform. Progressive restoration meant that as the coal extraction progressed further land was restored. Further east the land was partially restored, or unrestored. Mining activity was focussed on a large mine void which was kept dry by pumping out water from a sump. Excavated spoil had been placed in a spoil tip (OB1) on the east side of the void and in OB2 and OB3. In November 2023 the process of returning spoil to the void had already commenced but ceased when the coaling operations stopped, and all employees were made redundant. For health, safety and security reasons the mine area is kept secure to exclude unauthorised visitors and livestock released onto common land by the Commoners.

⁵³ DMRB LA 112 Population and human health – Table 3.32 Human health outcome categories

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Housing, community assets, development land, business, agricultural holdings walkers, cyclists and horse riders

- 15.5.2 This site occupies a large area entirely within Merthyr Borough and is surrounded by a diverse range of urban and rural land uses. To the east and south the land is almost exclusively in use as farmland or as common grazing, while the west and north is predominantly urban with residential, and employment uses. **Table 15-3a and b** identify the land use and where they lie in relation to the site.
- 15.5.3 **Figure 15.1**, which shows the site in the context of the ZOI, demonstrates that there is no settlement and therefore no population in those parts of the ZOI in CCB. Much of the current demographic data for the ZOI is available from Merthyr Tydfil County Borough (MTCB) and Caerphilly County Borough (CCB). The whole of the eastern side of the ZOI falls within the high ground of Merthyr and Gelligaer Urban Commons. The nearest settlement in CCB is Fochriw, which lies 1.5km to the east of Mynydd Fochriw, in the Cwm Darran valley.

Table 15-3a: Community facilities

Community facilities within the ZOI, or essential services in the vicinity.	
Schools and nurseries	Cyfartha High School (out) St Tudful Primary School (out) Twynyrodin Community Primary School (out) Pili Pala Day Nursery (Penheolferthyr)
Religious buildings	Hebron Evangelical Church (High St) All Saints Church in Wales (Garden St) (out) New Beginnings Church (South St) Heads of the Valleys Church (South St)
Community centres	Dowlais Community Centre (High St) & (Victoria St) Twyn Community Hub (Glasier Rd) (out) Greenwood St Community Hub (out)
Hospitals	No hospitals lie within or close to the ZOI.
Care homes	Victoria House (Victoria St) (out) Ty Brynseion (Brynseion St) (out) Ty Cwm Extra Care Centre (Clos Pwll Glo) (out) Greenwood Sheltered Housing (Greenwood Cl) (out)
Medical practices	Ivor Street Surgery (out)
Retail and entertainment	Dowlais High Street Dowlais Post Office and retail area, (Victoria St) (out) Dowlais Top retail

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Table 15-3b Land uses, settlement and public facilities in or close to the ZOI

Land uses within the ZOI, or essential services in the vicinity. These are shown in Figure 13.1	
Enclosed farmland	Mainly to the south of the site associated with lower lying land west of Mountain Hare and the Nant Gryrawd valley.
Urban Common	Merthyr and Gelligaer Commons lie entirely to the east and south of the site on the high ground. The site was once common land, and a large part will be returned on completion of the restoration.
Trecatti waste management site	On the northeast side of the site, adjacent to the A4060/A465 roundabout and accessed via Bogey Road.
Business and employment sites	Dowlais Top industrial estate (out) Goat Mill Road business park. Solar farm at Cwmbargoed.
Rural settlement	Incline Side, or Ffos-y-Fran is a small group of properties beside Bogey Road to the south of the site.
Urban residential areas	High St, Dowlais and associated streets on the south of the settlement from Dowlais Top to Goat Mill Rd. Incline Top (east side) Mount View (Goat Mill Rd) Gilfach-Cynon Mountain Hare and Twynrobyn (east side)
Public Open Space and public sports fields (identified in the First Replacement Local Development Plan (FRLDP)).	Public areas of sports grounds, parks, gardens and grassed roadside areas are classified in the LDP as being Open Space. These are concentrated in the urban areas on the west side of the site.
Informal green space	There are several areas of vegetated and wooded land which appear to have been adopted as informal public green space. These are concentrated in the urban areas on the west side of the site. (see also common land).
Private sports clubs	Dowlais Rugby Football Club (Blaen Dowlais)
FRLDP housing allocations	All are located on the west side of the site.
FRLDP Employment allocations	Located on either side of the A4060 between the site and Great Mill Road. The easterly of the two is adjoining the site and within the redline boundary.

Caerphilly population data

15.5.4 There are two communities that are nearest to the site:

Rhymney: a settlement of around 8,000 people living over 2.5 kms to the east of the site boundary.

Darran Valley: in which is located the settlement of Fochriw, with a population of 2,440 people living no closer than 1.5km to the east of the site boundary.

- 15.5.5 The distance between the site boundary and these settlements is significantly greater than the 500m ZOI and is empty of residential property or other sensitive receptors. In these circumstances the gathering of population and health data was not considered further.

Merthyr population data

- 15.5.6 Data for MTCB was collected during the last Census in 2021. Data used here also comes from other official sources. As with a population data, changes occur all the time and so the data used here is subject to the caveat that some is some years out of date and the most comprehensive up to date source is the 2021 census was completed when lockdown restrictions and the furlough scheme were in place. Whilst changes occur, the official UK 2021 census data and the other sources used as adequately representative for this study⁵⁴ ⁵⁵.

Health profiles for Merthyr Tydfil

- 15.5.7 The official 2021 census shows that the population of the town was 39,542 in November 2021, which is a slight reduction from the previous census in 2011. The Office of National Statistics published data in 2022 that showed total population of the borough, within which the town is located, was 58,869. Land allocations for new houses imply that the population of Merthyr is to increase in the next few years, if these reflect local demand.
- 15.5.8 Merthyr Tydfil contains a homogenous ethnic population with 96.3% made up of White British, against a Wales average of 93%. The gender split is broadly in line with the average for Wales.

Age distribution

- 15.5.9 The median⁵⁶ age is 40 years, and this has remained the same between 2011 and 2021. People below the age of 16 made up 19.6% of the population, while 18.3% were over the age of 65. These figures are similar in other areas of South Wales. Male life expectancy in 2013 was just short of 77, less than the Welsh average of just over 78. Female life expectancy in 2013 was just below 81, and again this is less than the Welsh average of 82.

⁵⁴ Local Area Summary Statistics for Merthyr Tydfil, Welsh Government 2014 <https://www.gov.wales/sites/default/files/statistics-and-research/2018-12/141218-local-area-summary-merthyr-tydfil-en.pdf>

⁵⁵ Merthyr Tydfil - local data profile March 2024 by the ONS for the Department for Levelling Up, Housing and Communities. https://assets.publishing.service.gov.uk/media/660444a1f9ab410011eea41d/Merthyr_Tydfil.pdf.

⁵⁶ Median: the middle value in a set of numbers, where 50% of the numbers are greater than or equal to the median, and 50% are less than or equal to the median. It's a measure of central tendency, which is the location of the center of a group of numbers

Health

15.5.10 The health of the population of Merthyr is available for each political Ward (Town, Dowlais and Plymouth), the Local Health Board is Cwm Taf Morgannwg University Health Board. There are some indicators of ill health for the whole borough, which are applicable to this assessment.

- Obesity is higher than the average for Wales.
- Mental health and wellbeing was lower than Wales as a whole.
- The rate of individuals referred for treatment of alcohol misuse was the highest in Wales at 450 individuals per 100,000.
- The average proportion of low-birth-weight babies is higher than average for Wales.
- The percentage of adults who regularly participated in sport and active recreation in Merthyr Tydfil in 2008/09 was 27 per cent (a decrease from 2004/05) and was one of the lowest rates amongst Welsh local authorities.
- The average unemployment levels of over 16's who have never worked is on average around 25%
- On average 3.6% of people reported themselves as being in very bad health with 7% in bad health and 15% in fair health

Employment and income

15.5.11 Employment and income for Merthyr were among the lowest in Wales in 2013. Of the portion of the population aged between 16 and 64 years old, 67.3% are employed, (32.7% are not employed). This is below the average percentage for Wales of 69% employment and the third lowest among the 22 Welsh local authorities.

15.5.12 With 32.7% unemployed, Merthyr Tydfil had the seventh highest rate of children living in workless households amongst the Welsh local authorities in 2013. The Wales average was around 16.5%.

15.5.13 For those who are employed the average earnings were £491 per week, which means that gross disposable income in 2012 was £13,500, one of the lowest in Wales and well below the Wales average of around £540/wk. The data also shows that relative to the rest of Wales earnings decreased between 2008 and 2013.

15.5.14 The profile of Merthyr Tydfil is one of social deprivation, unemployment, poor health and poor life expectancy.

Welsh Index of Multiple Deprivation (WIMD) 2019

- 15.5.15 Merthyr Tydfil Borough contains 36 Lower Layer Super Output Areas (LSOAs)⁵⁷ out of 1909 in the whole of Wales. LSOAs are areas which are generally subdivisions of Wards, identified for statistical purposes and typically contain between 400 and 1,200 households, with a population of 1,000 to 3,000 people. Of the 36 LSOAs in Merthyr, 8 are within the lowest 10% of most deprived areas in Wales. Of those eight, none are contiguous with the site, but Dowlais 1, in Dowlais and Pant Ward, lies close to the northern boundary. The remaining 7 LSOAs are further west within the northern edges or the centre of the town of Merthyr and in Cyfartha.

15.6 Assessment of Significant Effects*Health and wellbeing indicators*

- 15.6.1 The UK's National Clean Air Strategy 2019 sets out government's obligations to keep concentrations of specified pollutants below certain levels. While some of these are considered irrelevant to the restoration of the surface mine site, there are others that are known to arise from minerals extraction and restoration, these include Nitrogen oxides and particulate matter.

Nitrogen oxides

- 15.6.2 NO_x exacerbates symptoms of those already suffering from lung or heart conditions, shortening lives and reducing quality of life. Short term exposure to high concentrations of NO₂ can cause inflammation of the airways. The main source of these would be during earthmoving works when diesel fuel is burnt in plant. The government aim is to reduce nitrogen oxide emissions by 73% from the 2005 baseline by 2030.

Particulate Matter (PM_{2.5})

- 15.6.3 Particulate matter (PM) is not a single pollutant but is made up of a huge variety of chemical compounds. PM in the air is a gas, it is a suspension of particles which are solid, liquid or both. Particles emitted directly from sources such as dust or pollen are called primary Particulate Matter. Secondary Particulate Matter is formed in the atmosphere through chemical reactions between other air pollutant gases such as nitrogen oxides (NO_x), ammonia (NH₃) and sulphur dioxide (SO₂). Particulates are classified according to size, either as PM₁₀ (particles of ≤10µm

⁵⁷ 3Lower Layer Super Output Areas (LSOAs) are statistical geographies used to group Output Areas (OAs) for statistical purposes. LSOAs are made up of four or five OAs and typically contain between 400 and 1,200 households, with a population of 1,000 to 3,000 people. LSOAs are useful for monitoring data over time because their boundaries rarely change. Data for LSOAs generally included Indices of Deprivation, Universal Credit, and local health data.

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(micrometres) diameter) or PM_{2.5} (particles of $\leq 2.5\mu\text{m}$ diameter particles which are 200 times smaller than a grain of sand). Both PM and the gases that can form it travel large distances in the atmosphere. Around 15% of UK PM comes from naturally occurring sources and around half from UK human-made sources. 13% arise from steel making, brick making, quarries and construction. Government aims to reduce PMs by 46% against the 2005 baseline by 2030.

- 15.6.4 PMs can get into the lungs and blood and be transported around the body, lodging in the heart, brain and other organs. PM affects health in two ways: by being toxic or by providing a surface for transporting toxic compounds to where they can do harm. PM can have short-term health impacts over a single day when concentrations are elevated, and long-term impacts from lower-level exposure over the life course. Effects are amplified in vulnerable groups including young children, the elderly, and those suffering from breathing problems like asthma.

Noise

- 15.6.5 The Welsh Government Noise and Soundscape Action Plan states that '*Welsh Government considers environmental noise as an airborne pollutant*'. At Ffos-y-Fran, earthmoving to restore the site is one possible source of noise.

- 15.6.6 The EIA undertaken for the original application for the Ffos-y-Fran Land Reclamation Scheme that covered the operational phase of the surface mine operations, had identified that noise may be experienced at night by some receptors at nearby properties, and therefore limitations against night-time working were put in place for the operational phases of coal extraction. Noise was considered in relation to residential amenity and specifically at five baseline locations at:

- Blaen Dowlais
- Japonica Drive
- Mount View
- Cottages at Ffos-y-Fran, off Bogey Road (Incline Side)
- Nant-y-Ffin Farm, south of site

- 15.6.7 The main source of noise was predicted to be caused by dump trucks. Therefore, all haul roads in direct line of sight and within 500 metres of any residential dwelling were to be adequately screened to attenuate noise levels. Blasting was to be limited to four blasts a day between the hours of 10:00 to 13:00 and 14:00 to 16:00 hours and were not to be carried out on Sunday or Bank Holidays or in the hours of darkness.

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- 15.6.8 The noise assessment concluded that noise levels could be controlled to within acceptable limits by a combination of best practice and earth bunding at specified locations during the operational phase of the surface mine.
- 15.6.9 The original noise assessment was undertaken to assess the likely impact of noise generated by extensive movements of plant and machinery during the operational phases of the coal extraction process that lasted over a 15-year period. Noise generated by the proposed restoration phases of the original scheme, do not appear to have been considered in the original EIA that focussed on the operational period that subsequently ceased at the end of November 2023.
- 15.6.10 The restoration of the approved scheme would involve significant earthworks operations to move around 26 million m³ from the three overburden mounds which are spread over a relatively large area. It is estimated that using 4No. excavators, associated dump trucks and support equipment, the earthworks would take approximately 120 weeks or 2.5 years to complete operating on a single shift. This could take longer if the earthworks were delayed due to bad weather or other unforeseeable factors. The fuel consumption to carry out these works would amount to around 20 million litres, excluding the transport and spreading of soils and other cultivation work required.
- 15.6.11 In comparison, the proposed restoration scheme is limited to a much smaller geographical area within the site area centred around the main void and does not include major earthworks to OB2 and OB3. The earthworks required for the proposed scheme are 2.5 million m³, less than 10% of the approved scheme and in the main do not require large rigid dump trucks. It is estimated that this scheme would take approximately 70 weeks, around 1.5 years using tracked dozers in the area surrounding OB1, the void and on land north of the Bogey Road. However, as much of the work is seasonal the 70 weeks required could be spread over a 2 – 4-year period, particularly if we include soiling, cultivation and seeding/planting works. For example, if planning permission were granted in August 2025, it may not be possible to carry out much of the work until the following Spring and some plant would have to be parked up over the winter period.
- 15.6.12 The generation of noise by a much-reduced number of plant and machinery covering a much-reduced area and relatively short period of actual operation time, is not considered likely to cause significant adverse effects. Three receptors identified as part of the original assessment are located over 500 metres away from the main void where most of the earthworks operations for the restoration will be undertaken with the remaining two (Blain Dowlais Street and Japonica

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Drive) lie north of the A4060 dual carriageway. The earthworks operations required as part of the restoration proposals are minor compared to the operational works during coal extraction and substantially less when considered against the original and approved restoration scheme.

- 15.6.13 The machines used for the earthworks are considered unlikely to generate significant levels of noise to any potential human receptor and the haul routes are substantially less than those needed for restoring the approved scheme. Therefore, it is considered that the potential for noise nuisance on nearby receptors would be negligible, and the works can be carried out in accordance with the requirements of Conditions No's 17 – 22, included in the Ffos-y-Fran planning approval of 11th May 2011 (Appeal Ref: APP/U6925/A/10/2129921).

National Well-being Indicators

- 15.6.14 **Table 15.4** below shows the National Wellbeing Indicators⁵⁸ that are relevant to the scheme.

Table 15.4 Wellbeing of Wales: National Well Being Indicators

No.	Potential contributions to well-being because of the Scheme	Yes	No
1	Percentage of live single births with a birth weight of under 2,500g		×
2	Healthy life expectancy at birth including the gap between the least and most deprived	✓	
3	Percentage of adults with two or more healthy lifestyle behaviours	✓	
4	Levels of nitrogen dioxide (NO2) pollution in the air	✓	
5	Percentage of children with two or more healthy lifestyle behaviours	✓	
6	Measurement of development of young children		×
7	Average capped 9 points score of pupils eligible or not for free school meals		×
8	Percentage of adults with qualifications at different levels of the NQF		×
9	Gross Value Added (GVA) per hour worked (relative to UK average)		×
10	Gross Disposable Household income per head		×
11	Percentage of businesses with are innovation-active		×
12	Capacity (in MW) of renewable energy equipment installed		×
13	Concentration of carbon and organic matter in soil	✓	
14	The global footprint of Wales	✓	
15	Amount of waste generated that is not recycled, per person		×
16	Percentage of people in employment, on permanent contracts and earn the real Living Wage		×
17	Pay difference for gender, disability and ethnicity		×
18	Percentage of people living in households in income poverty		×

⁵⁸ Wellbeing of Wales: national indicators: Data and summaries for each of the national well-being indicators. Welsh Government; First published: 29 September 2022

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No.	Potential contributions to well-being because of the Scheme	Yes	No
19	Percentage of people living in households in material deprivation		×
20	Proportion of employees whose pay is set by collective bargaining		×
21	Percentage of people in employment		×
22	Percentage of people in education, employment or training for different age groups		×
23	Percentage who feel able to influence decisions affecting their area		×
24	Percentage of people satisfied with their ability to access the facilities & services they need		×
25	Percentage of people feeling safe at home, walking in the local area, and when travelling		×
26	Percentage of people satisfied with local area as a place to live		×
27	Percentage of people agreeing that they belong to the area		×
28	Percentage of people who volunteer		×
29	Mean mental well-being score for people	✓	
30	Percentage of people who are lonely	✓	
31	Percentage of dwellings that are free from hazards		×
32	Number of properties at medium or high risk of flooding from rivers and sea		×
33	Percentage of dwellings with adequate energy performance		×
34	Number of households prevented from becoming homeless per 10,000 households		×
35	Percentage of people attending/participating in arts, culture or heritage activities 3x a year		×
36	Number of people who speak Welsh daily and more than just a few words of Welsh		×
37	Number of people who can speak Welsh		×
38	Percentage of people participating in sporting activities three or more times a week		×
39	Percentage of museums and archive collections meeting UK accreditation standards		×
40	Percentage of designated historic environment assets in stable or improved conditions		×
41	Emissions of greenhouse gases within Wales	✓	
42	Emissions of greenhouse gases attributed to the consumption of global goods & services	✓	
43	Areas of healthy ecosystem in Wales	✓	
44	Status of biological diversity in Wales	✓	
45	Percentage of surface & groundwater bodies, achieving good or high overall status		×
46	Active global citizenship in Wales		×
47	Percentage of people who have confidence in the justice system		×
48	Percentage of journeys by walking, cycling or public transport		×
49	Percentage of household spending 30% or more of their income on housing costs		×
50	State of digital inclusion		×

15.6.15 It is considered that the final restoration scheme could potentially contribute to some of the well-being indicators as indicate in the table above and the reasons why, are set out and described in Table 15.5.

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Table 15-5: Relevant National Wellbeing Indicators

Nº.	National Well-being Indicator	Potential effect
2	Healthy life expectancy at birth including the gap between the least and most deprived	Improved health in the community should contribute to this
3	Percentage of adults with two or more healthy lifestyle behaviours	Increased public open space should encourage physical activity
4	Levels of nitrogen dioxide (NO2) pollution in the air	The reduced scale of the earthmoving required for the scheme will substantially reduce fuel use and the production of NO2. Once restored there will no longer be any contribution to NO2 in the air from the scheme
5	Percentage of children with two or more healthy lifestyle behaviours	Increased public open space should encourage physical activity
13	Concentration of carbon and organic matter in soil	The restored scheme will be revegetated, and the process of fixing carbon and organic matter will commence as new topsoil forms
14	The global footprint of Wales	
26	Percentage of people satisfied with local area as a place to live	The restoration will improve the local environment and provide more recreational space which is likely to improve the satisfaction of people
29	Mean mental well-being score for people	Improved quality of environment, increased contact with the natural world, increased opportunity for physical activity and reduced Nox, reduced dust in the air will improve health and mental wellbeing
30	Percentage of people who are lonely	Opportunities for physical activity and contact with the natural world will provide opportunities for social contact and community development.
38	Percentage of people participating in sporting activities three or more times a week	The restoration of the scheme will improve the local environment and provide more recreational space which is likely to encourage sporting activity
41	Emissions of greenhouse gases within Wales	The reduced scale of the earthmoving required for the scheme will substantially reduce greenhouse gas emissions with less fuel being burnt

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Nº.	National Well-being Indicator	Potential effect
		Once restored there will no longer be any contribution to greenhouse gases from the scheme.
42	Emissions of greenhouse gases attributed to the consumption of global goods and services in Wales	No more burning of Welsh coal
43	Areas of healthy ecosystems in Wales	The completion of the restoration scheme will provide large areas of new grassland, woodland, scrub and wetland habitat and improve species connectivity.
44	Status of biological diversity in Wales	
45	Percentage of surface water bodies, and groundwater bodies, achieving good or high overall status	Existing waterbodies around the site have biodiversity value and the water quality in these should improve with the reduction in atmospheric pollution.

Progressive changes to the baseline with mine restoration

- 15.6.16 A fully restored surface mining site is the objective of the current planning application. Phase 2A restoration within the parameters of the extant planning permission, has seen a period of earthmoving underway since November 2023. It is anticipated that earthworks, cultivations, seeding and planting will be substantially completed by 2028. There will be an aftercare period of 5 years.
- 15.6.17 In the period between November 2023 and November 2024, work on restoration has progressed, and although amendments to the baseline environmental conditions have occurred in the area surrounding the working area of the mine (the void) much have remained unaltered. Here, material from the western part of the overburden mound (OB1) will be moved to re-profile the side slopes and to achieve specified gradients to satisfy engineering standards for slope stability. The pit lake formed from natural groundwater will remain and it is anticipated this will have seasonal variations in water level of between 275-285 mAOD depending on rainfall and other climatic conditions.
- 15.6.18 Following progressive restoration and re-profiling of the landform surrounding the main void and pit lake, there will be an extensive programme of ground preparation, soil spreading, cultivation and revegetation by seeding, planting and

natural re-colonisation. To facilitate this and allow the establishment of vegetation, extensive areas of fencing to prevent grazing by livestock would be erected and maintained for a period of up to 5 years.

15.6.19 The restored landform and young vegetation will be managed under a five-year establishment maintenance (aftercare) period to ensure that an attractive landscape is created with woodland, scrub, heathland and grassland. The benefits to biodiversity will gradually increase and commoners will be able to release their livestock onto restored grazing land in a controlled manner. A network of informal paths would be open to public access for general amenity and include a Byway Open to All Traffic (BOAT) that will connect to the wider Public Rights of Way (PRoW).

15.6.20 It is anticipated that the likely significant effects arising from the cessation of mining and restoration, and which would deliver positive health benefits as follows:

- Reduced burning of diesel fuel, reduced dust generation by vehicle movements and bare ground surfaces leading to substantial improvements in air quality.
- Improved visual amenity as the land is revegetated.
- Reductions in noise (noise was excluded from the assessments at EIA scoping stage) in parts of the site.
- New and increased opportunities for physical recreation.
- Reinstatement of land to Urban Common, used for grazing stock.
- The creation of an informal path network across the site and connections to the wider network of public rights of way.

Embedded mitigation that would influence likely significant effects

15.6.21 The design of the scheme has been developed by the design team to ensure that the most appropriate solutions have been identified and a suitable method of restoration planned. Numerous minor changes have been made to improve the design or to avoid or minimise environmental impacts. The scheme is both large and complex because it must satisfy wide ranging project objectives and comply with safety and environmental standards.

15.6.22 The following list sets out the assumptions that have been made for the purpose of this ES, in terms of mitigation embedded. This list is not exhaustive:

- A Construction Environmental Management Plan (CEMP) would be prepared which would set out how the restoration would proceed in

line with best practice and regulation. A pre-construction CEMP will be prepared to address the minimising of dust and noise offsite because of the work, controlling the possible spread of silt from surface water, measures to address unexpected contamination, the preparation of the ground for cultivation, seeding and requirements of the five year planting and aftercare to ensure vegetation establishes and develops appropriately.

- Measures would be adopted during the works to mitigate any environmental effects of earthmoving, soil spreading, cultivations and revegetating.
- Relevant pollution control measures will be in place during the works in line with current legislation and any planning conditions.
- A permanent lake fed naturally by surface and ground water has been included within the scheme to significantly reduce the volumes of overburden required in the restoration process, reduce the duration of the restoration works. This will also significantly reduce the volume of NRMM fuel used and Nox, reduce greenhouse gases emissions, and minimise the use of carbon.

15.7 Assessment of Effects

15.7.1 The assessment of residual significant effects, i.e. those that remain with proposed mitigation in place, are set out in **Table 15.6**. These express the differences in effects between the previous restoration proposal and the current proposal.

Design, mitigation and enhancement

15.7.2 The completed design, which incorporated a range of embedded mitigation, also included measures to reduce residual effects, including those to integrate the completed landform into the landscape setting, to reinstate common land grazing, provide surface water drainage and further measures to enhance biodiversity. The details of these measures are set out in the **Landscape and Visual Impact Assessment chapter** and the **Ecology Chapter**.

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Table 15-6 - Residual significant effects

Element from LA 112	Impact related to Population and Human Health	Residual significant effect	
		during restoration	When restored
Land use and accessibility			
Private housing & property	None	None	None
Community land & assets	Relief from severance and enhanced access to Open Access common land and PRoW.	None	None
Development & business	Relief from severance from development land allocation	None	None
Agricultural land holdings	Restored areas of common land grazing will not be as extensive due to the presence of the waterbody and the proposed planting proposals, which will be fenced off from grazing	None	None
Walkers, cyclists and horse riders	Removal of severance and increased connectivity to open access land and PRoW	None	None
Human Health			
Human health	Air quality: improvement in air quality	Positive	None
	Noise: reduction in noise generated during restoration	None	None
	Climate change: reduction in release of greenhouse gases from fuel burned with potential beneficial effects on the consequences of climate change	Positive	None
	Landscape: introducing a waterbody is an attractive addition to the restored landscape, which will enhance well-being	None	Positive
Policy and guidance			
Well-being of Future Generations (Wales) Act		None	Positive
Active Travel (Wales) Act 2013		None	None

Summary of Residual effects

- 15.7.3 **Table 15-6** sets out an assessment of the residual significant effects of the scheme on population and human health. None of the elements considered will suffer an adverse effect. In all case the effect is beneficial, or there is no effect. Overall, therefore, the scheme is considered beneficial because it will progressively remove the adverse effects of mining and earthmoving and as a result also provide enhancements to the landscape, biodiversity, public access, recreation and agriculture.

15.8 Cumulative effects*Intra-project cumulative effects*

- 15.8.1 Intra-project effects are those that ‘*occur between different environmental topics within the same proposal, as a result of that developments direct effects*’⁵⁹. Intra-project effects are reported in each environmental topic chapter. No potentially significant intra-project cumulative effects have been identified with the assessment of population and human health.
- 15.8.2 Interproject effects have been considered as those where ‘cumulative effect occurs as a result of the likely impacts of the proposed development interacting with the impacts of other developments in the vicinity’¹⁴. Table 15.7 outlines the potential Inter-project cumulative effects that have been considered.
- 15.8.3 Based on a list of sites which include LDP allocations, new applications and planned transport projects, there are 6 possible future developments, listed in **Table 15.7**, that fall within the 500 ZOI boundary for Population and Human Health.

Table 15.7: Inter-project cumulative effects (long listed sites within or on boundary of ZOI)

Projects within ZOI	Timing and certainty	Cumulative effects
Land east of A4060 at Ffos-y-Fran Merthyr. Allocated employment land within the Defined Settlement Boundary.	This site will require a new road access from the A4060, which could make future development less likely. Development unlikely to occur concurrently with restoration.	If these two developments occurs, the effects will likely occur after the Ffos-y-Fran site is restored and revegetated. Development of the land would have a potentially positive cumulative effect on population

⁵⁹ Institute of Environmental Management and Assessment (IEMA), 2011. Special report – The State of Environmental Impact Assessment Practice in the UK.

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Projects within ZOI	Timing and certainty	Cumulative effects
Land at Goat Mill Road and west of the A4060. Allocated employment land within the Defined Settlement Boundary.	An area adjacent and readily accessible from the existing Goat Mill employment area (Goat Mill Road and the A4102.	and human health from both the improved quality of the landscape and the additional employment.
Active travel measures in Merthyr and local cycle network route in Caerphilly. These routes surround the site with a concentration of routes in the town of Merthyr.	Much of the proposed network follow existing roads and are likely to use existing infrastructure. Some new infrastructure will be required for the off-road routes.	The network of Active Travel routes and local cycle routes would have a positive cumulative impact with the completed scheme by improving cycle and pedestrian access to the site. Policy benefit from Active Travel measures in achieving reductions in air quality, traffic noise ⁶⁰ and carbon.
Policy to retain the Cwm Bargoed railway lines and railhead.	The existing facility has taken coal from Ffos-y-Fran, but the site could be redeveloped. The railway could be retained as a transport link.	With no clear indication of the future redevelopment of the coal facilities or the railway, it is not possible to indicate the nature of any cumulative effects.
Waste management facility: Trecatti site: area of search for future disposal facility	This site is currently in use as a waste management facility.	The current use and the proposed future use for waste management are likely to be similar and there would be cumulative effects of the two sites. Once the restoration of Ffos-y-Fran is completed, the waste site could have potential to cause an adverse effect on the health and well-being benefits of the restored urban common and open space that it would provide.
Demolition and rebuild of school in Merthyr Tydfil (10)	Potentially at the construction stage only of school but likely limited.	As the development is a replacement for an existing use and located well outside the ZOI there is unlikely to be any potential health effects associated with the Ffos-y-Fran site restoration works. Potentially, limited for only some of the receptors, such as noise and dust. Permanent change in landscape/views involved with the Ffos-y-Fran restoration implementation stage will include change in landscape and visual receptors.

⁶⁰ See datamap wales: <https://datamap.gov.wales/maps/new?layergroup=inspire-wg:EnvironmentalNoiseMapping2017#/>

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Projects within ZOI	Timing and certainty	Cumulative effects
Dragon Park Abercanaid Merthyr Tydfil. Residential development of 200 unit to south of site (12)	Full application approved and conditions discharged.	Located well outside the ZOI there is unlikely to be any potential health effects associated with the Ffos-y-Fran site restoration works.
Highway Improvements Heads of the Valleys A465. (16). Widening of approximately 17.7km section of 3 lane carriageway to dual lane carriageway, which is under construction, with end date stated as 2025	The only project that is capable of potential cumulative effects within the ZOI of Population and Human Health Construction will be completed in 2025.	Potentially at the construction stage only but likely limited to air quality associated with traffic, and traffic noise during restoration of Ffos-y-Fran.

Table 15.8: Short listed sites within ZOI

Short listed sites		
Highway Improvements Heads of the Valleys A465. (16).	Within ZOI	

15.9 Conclusions

- 15.9.1 The final restoration strategy has the potential to contribute significantly to the human health of the local communities of Merthyr Tydfil and surrounding area. This alternative restoration strategy has considerably more environmental benefits than the original approved scheme by virtue of its implementation requires substantially less bulk earthworks and therefore significantly less fuel, greenhouse gases and carbon needed to implement the restoration.
- 15.9.2 The alternative scheme also reduces potential adverse physical effects on biodiversity by avoiding and minimising damage and disruption to habitats that have developed in response to earlier phases of progressive restoration.

Table 15.9: Conclusions to the assessment

Aspect	Human Health Outcome Categories
Private housing and property	Neutral - No discernible health benefits
Community land and assets	Positive – The scheme would be implemented over a shorter period than the currently consented scheme due to less bulk earthworks and therefore less disruption
Development and business	Neutral - No discernible health benefits

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Aspect	Human Health Outcome Categories
Agricultural land holdings	Neutral - No discernible health benefits
Walkers, cyclists and horse riders	Positive – Returning PRoW to provide open access has the potential to deliver some health benefits for public amenity and recreation.
Human health	Positive - The current proposal would have benefits to health from a series of differences to the previous approved scheme in for form of improved air quality during the restoration scheme. The reduction in greenhouses gases would also contribute. The retention of a permanent waterbody will enhance the landscape and views with benefits to a sense of well-being for those people using the restored landscape for recreation.

16 Climate Change

By Groundwater Science Introduction

- 16.1.1 Assessment of climate-related elements of the EIA will require consideration of how the climate impacts the ground and surface water environments. Climate, particularly climate change, will have a strong bearing on other assessments, including but not limited to hydrology, hydrogeology, water quality and ecology/biodiversity

16.2 Scope of the Assessment

- 16.2.1 The consideration of climate change is undertaken primarily to provide projections of rainfall and evaporation associated with climate changes to those areas of the impact assessments where it must be considered. This includes the hydrogeology, water quality and ecological assessments.
- 16.2.2 Consideration of climate change in the hydrological assessment is dictated by the climate change allowances set out in the 'Flood Consequences Assessments: Climate change allowances' document. (refer to the hydrological assessment **chapter 10** for further details).

16.3 Legislation and Policy

- 16.3.1 Following the precautionary principle, the 50th percentile of the RCP 8.5 higher emissions scenario ('Business as usual scenario') will be used as a future climate baseline. A sensitivity analysis is used to assess change to risk with consideration for variability in climate change predictions.

16.4 Baseline Conditions

- 16.4.1 Baseline is considered as the climate from 1981 to August 2024, which coincides with the period during which climatic data is available from Cwmbargoed weather stations and available HADUK and EA PET data. This overlaps with the baselines used in other aspects of the EIA.

16.5 Assessment Methodology

- 16.5.1 The pit water balance model described in section 8.5 above is used to simulate the effects of different climate change scenarios on potential pit lake variability. Rainfall and evaporation inputs to this model are upscaled using rainfall data from the UK Climate Projections (UKCP), produced by the Met Office and UKCP

temperature, wind speed and other variables (e.g. relative humidity, solar radiation).

16.5.2 The UKCP repository includes a range of climate change projections up to the year 2100. The assessment includes three separate scenarios to reflect the range of uncertainty in future climate, comprising:

- Wet, using a time series with relatively high rainfall and low temperature compared to other projections.
- Dry, using a time series with relatively low rainfall and high temperature compared to other projections.
- Intermediate, using a time series close to the median of all projections for both rainfall and temperature.

16.6 Assessment of Effects

16.6.1 There are no specific impacts or effects relating to the implementation of the proposed restoration scheme within the scope of the climate change modelling. Instead, the climate change modelling provides is necessary to provide inputs to other disciplines, such as hydrogeology and water quality. The following discussion provides an overview of the climate change modelling findings.

16.6.2 A daily rainfall probability of exceedance plot for the three climate change scenarios is shown in Figure 16.1. HADUK rainfall data, which was used as the basis for the rainfall data upscaling, is provided for context. All scenarios, including the HADUK dataset, exhibit similar distributions of rainfall above a probability of 25%. Below this, there is a noticeable upward shift in the rainfall totals for the climate scenarios relative to the HADUK baseline. Furthermore, this shift becomes more accentuated at the lowest probabilities of exceedance, which reflects both the increased frequency and intensity of significant rainfall events.

16.6.3 Figure 16.2 shows the probability distribution for daily potential evapotranspiration for the three climate scenarios, relative to the original EA PET dataset. There is a clear increase in the daily potential evapotranspiration across the full range of the probability distribution, which reflects the projection of a warmer future climate.

Figure 16.1: Probability of daily rainfall exceedance plot for climate change scenarios

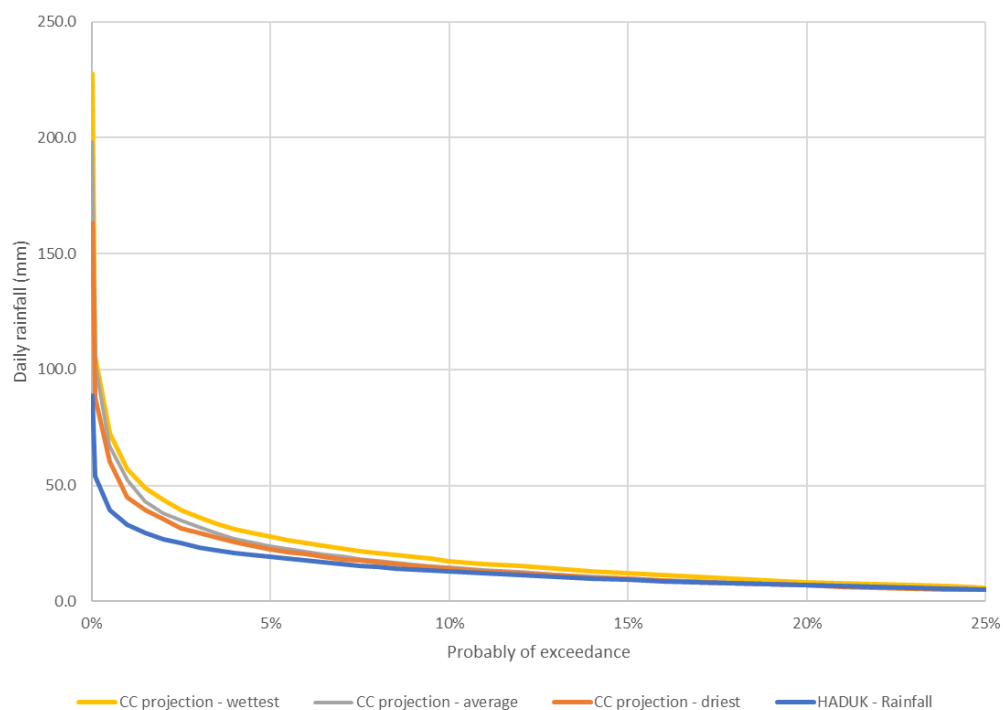
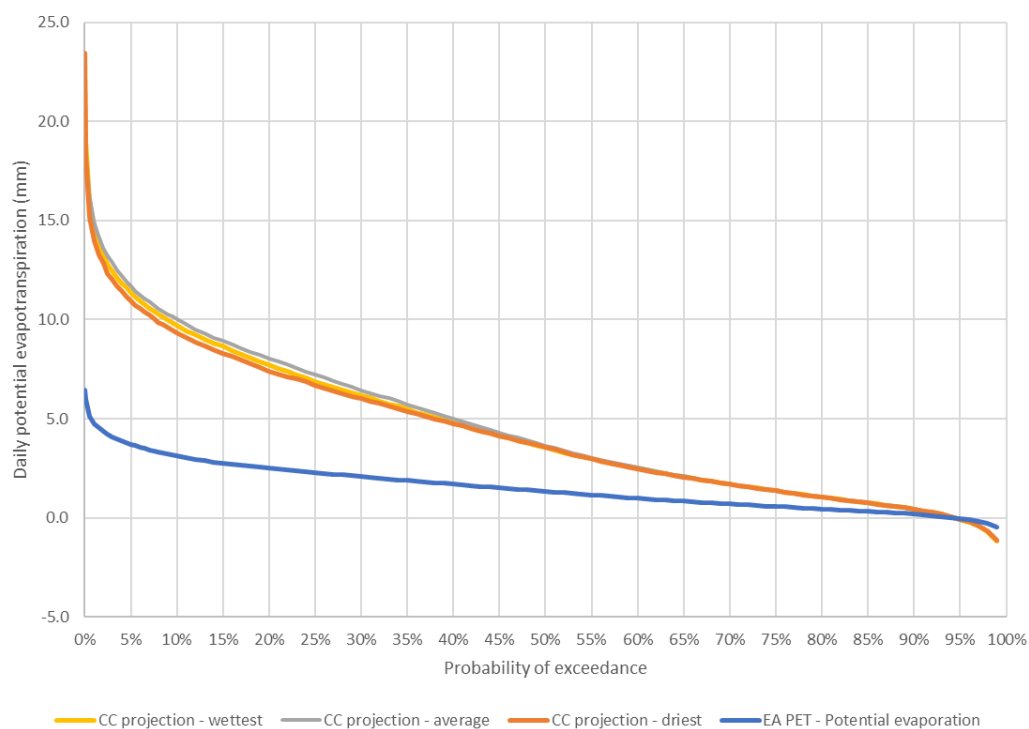


Figure 16.2: Probability of daily potential evapotranspiration exceedance plot for climate change scenarios



16.6.5 The hydrologically effective rainfall is calculated by subtracting potential evapotranspiration from the rainfall total and is an approximate indicator of the water available to groundwater recharge and runoff. The probability of exceedance distribution for hydrologically effective rainfall is plotted in Figure 16.3 for each of the climate scenarios relative to a reference dataset using historical HADUK / EA PET data. Above a probability of 10%, the reference historical dataset generally produces higher totals of hydrologically effective rainfall. This is likely to be related to the projected increase in daily potential evapotranspiration relative to the present climate, which is greater than projected increase in daily rainfall. This trend is reversed below the 10% probability threshold owing to the increased intensity and frequency of high rainfall events.

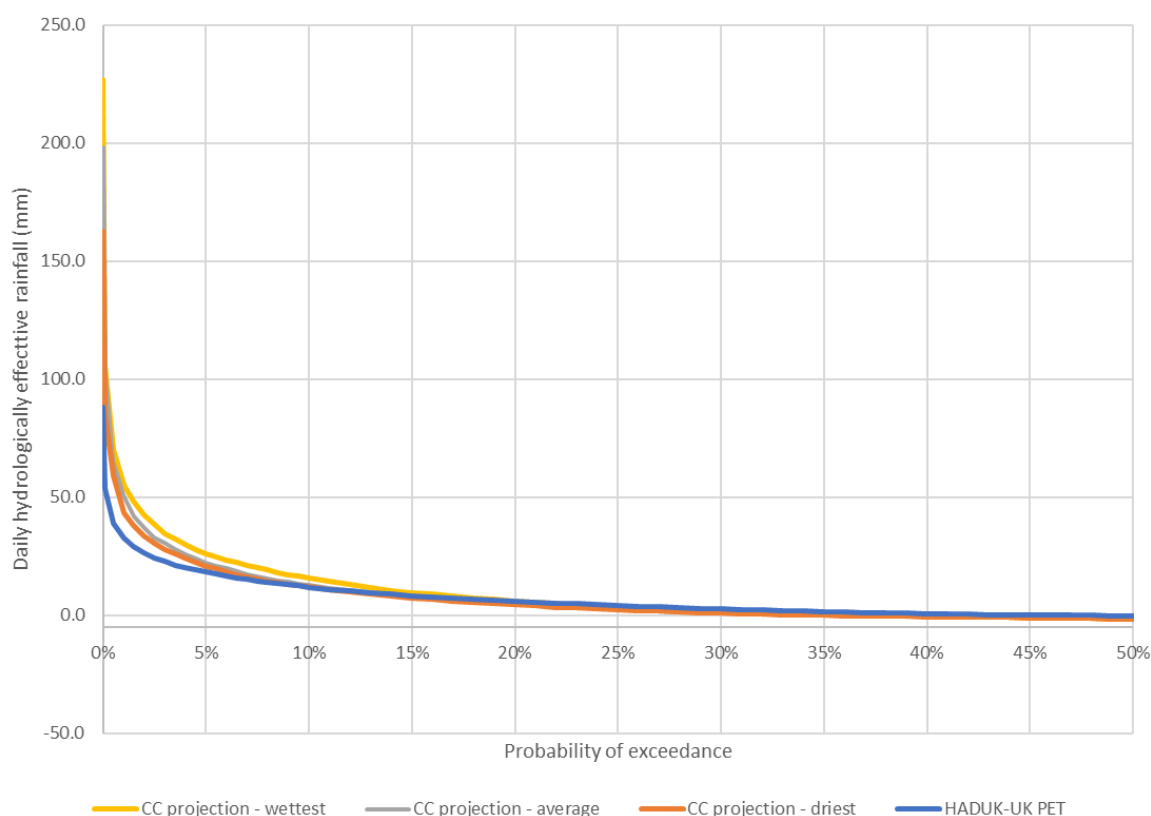


Figure 16.3: Probability of daily potential evapotranspiration exceedance plot for climate change scenarios

16.7 Summary of Significant Effects

16.7.1 In summary, the projections of future climate show a tendency towards more intense and frequent storm events, which is demonstrated through the trend for higher rainfall totals in the low probability range for all climate change scenarios.

However, hydrologically effective rainfall is generally reduced throughout most of the probability range, meaning there is less water available for groundwater recharge and runoff. As such, based on these projections the future climate can be characterised as exhibiting more extreme variability, characterised by more intense and frequent storm events but also through long periods of drought where low rainfall combined with higher evaporative potential results in less water availability in the environment.

17 Cumulative Effects

By RML

17.1 Introduction

- 17.1.1 This ES chapter identifies whether cumulative effects could occur and determines whether potentially significant effects could arise. It is not intended to identify and assess all potential effects. A Cumulative Effects Assessment (CEA) is prepared using a method that differs from that used for other ES chapters.
- 17.1.2 The ES Scoping Report identified the need for a CEA for the project because of the large scale of the proposals, the complexity of the environment and because the potential significant effects of other projects in the vicinity could affect receptors such as humans, habitats, wildlife and protected species.
- 17.1.3 This CEA takes a proportionate and pragmatic approach. Recent published government guidance advises that ‘In preparing the assessment, applicants should remember that a main purpose of the Environmental Statement is to enable the examination necessary to inform decisions’ on the planning application. ‘While applicants should make a genuine attempt to assess the effects arising from multiple, individually non-significant effects, the assessment should be proportionate and no longer than necessary to identify and assess likely significant cumulative effects.’⁶¹
- 17.1.4 In accord with current advice, this Chapter is presented with two separate CEA elements⁶² that are separate types of cumulative effects:⁶³
- a) **Intra-project effects:** these occur where a single receptor is affected by more than one source of effect arising from different aspects of same the Project⁶⁴. An example of an intra-project effect would be where a local resident might be shown to experience the effects of construction noise, while also being affected by dust and local traffic disruption. The result would be greater combined nuisance than each individual effect alone. This assessment is reported under the *intra-relationship* assessments – a review of the conclusions reached as part of the ES specialist topic chapter.
 - b) **in-combination effects:** these effects occur because of several past, present or reasonably foreseeable proposed developments, which individually might not be significant, but when considered together could result in significant cumulative effects on a shared receptor and could include developments

⁶¹ <https://www.gov.uk/guidance/nationally-significant-infrastructure-projects-advice-on-cumulative-effects-assessment>. Applicable to England and Wales.

⁶² <https://www.gov.uk/guidance/nationally-significant-infrastructure-projects-advice-on-cumulative-effects-assessment>

⁶³ <https://www.gov.uk/guidance/nationally-significant-infrastructure-projects-advice-on-cumulative-effects-assessment>

⁶⁴ ‘The project’ for the purposes of this ES CEA is the Ffos-y-Fran Land restoration scheme. (FFYFRLRS).

separate from and related to the Project. This assessment is reported under the '*other developments*'⁶⁵ and their potential for 'in-combination effects to occur.

- 17.1.5 Current government advice⁶⁶ confirms that a 'range of public sector and industry guidance is available, but there is no single industry standard for CEA. The approach undertaken will vary between applications.
- 17.1.6 In preparing this chapter of the ES, reliance is placed on a '*staged process*' that acknowledges CEA principles:
- Developing existing good practices, methods and techniques
 - Professional judgement and expert opinion
 - Knowledge of the project
 - Presentation of the outcome
- 17.1.7 Guidance from the Design Manual for Roads and Bridges (DMRB) LA 104 has also been used to inform the assessment process. LA 104 requires that the assessment of cumulative effects shall:
- a) establish the zone of influence of the project together with other projects;
 - b) establish a list of projects which have the potential to result in cumulative impacts; and
 - c) obtain further information and detail on the list of identified projects to support further assessment.

⁶⁵ As defined

⁶⁶ <https://www.gov.uk/guidance/nationally-significant-infrastructure-projects-advice-on-cumulative-effects-assessment>

17.2 Definitions

Table 17.1: Definitions used

Term/Abbreviation	Definition
Additional effects	The cumulative effects of a proposed development assuming past, present and future proposals are already present within the existing baseline.
In combination effects	Effects that arise where two impacts from the same project effect receptors. For example, noise and dust from construction activity.
Direct effect	Effect arises from activities associated with the project
Indirect effects	Effects that result indirectly from the proposed project because of the direct effects, often occurring away from the site, or because of a sequence of interrelationships or a complex pathway. They may be separated by distance or in time from the source of the effects and can occur because of a complex pathway.
Inter-project effects	Multiple effects occurring with a single project to affect a particular receptor or resources
Intra-project effects	Multiple or single effects occurring in more than one project which could affect receptors of resources at the same time or sequentially.
Secondary effects	Subsequent or less predictable effects
short/medium/long term effects.	Short – a period of one to three years. Medium – a period of four to nine years. Long – a period of greater than nine years.
permanent effects	An effect that will remain forever
temporary effects	An effect that will last for a shorter duration than a permanent effect. This might arise from a change that will be reversed at the end of construction, for example.
Study area	A nominal area around a project which might typically represent a maximum extent of environmental effect. Views of a project could be visible up to 1km away.
Zone of Influence (Zoi)	Zone of Influence is a clearly defined extent to which environmental effects will occur (views of the project from the surrounding landscape might be limited by hills or woodland).

17.3 Study Area

17.3.1 The project includes:

1. a temporary restoration period from 2024 to 2028.
2. thereafter a 5-year establishment aftercare period.

17.3.2 The recently published UK Government 2024 guidance does not define a specific ‘study area’ for CEA but recommends a proportionate approach. The approach for this assessment is set out in this section.

Study area for effects caused by different aspects of the project

17.3.3 The initial CEA process adopted a study area (see definitions) suitable for each ES aspect (reported in the chapters of this ES. When the project design was refined a more accurate Zone of Influence (see definitions) were identified where actual effects are likely to occur. Normally the zone of influence is smaller than a study area and is the area where there is potential for Combined Effects to occur (ecology and noise, for example⁶⁷).

17.3.4 The ES aspect Study Areas and Zones of Influence are shown drawn in Figure 17.1 and inset Figure 17.2⁶⁸.

17.3.5 Each of the ES aspect chapters considers the inter-relationship between effects on the relevant receptors. For example, the effects on ecological receptors arising from a combination of hydrological, landscape and visual, cultural, air quality, greenhouse gases and climate effects. Table 17.1⁶⁹ summaries the process for identifying the potential for aspect interrelationship to occur.

Study area for In- combination effects arising from more than one project

17.3.6 A systematic search for ‘Other’ development projects was completed within the Zones of Influence to identify where there was a reasonably foreseeable likelihood of in-combination effects. Development sites and projects at the margins of the Zones of Influence were also included. This systematic approach screened-in projects which have potential for ‘in-combination effects’. The screening process is set out in Table 17.2. Matrices are used to present the findings in a clear and transparent method.

⁶⁷ <https://www.gov.uk/guidance/nationally-significant-infrastructure-projects-advice-on-cumulative-effects-assessment>

⁶⁸ Except for the 500 m ZOI for the Geology and Soils ES Chapter, the CEA ZOI's were submitted to the LPA on the 20th of November 2024 and subsequently confirmed by the LPA on the 5th of December 2024.

⁶⁹ Sourced; DMRB Volume II Section 2 Part 5 HA 205/08 Part IV Paragraph 2.14. Withdrawn and superseded in 2019. National Highways.

Table 17.1 Method of assessment for the consideration of CEA interrelationships

STAGE	DESCRIPTION	OUTCOME
1	Identify which receptor/resources are affected by the development	Scoping out: - where receptors or resources not affected, or - where these are assessed wholly in a single EIA topic.
2	Determine how the receptor/resource could be affected	- Review the assessment of effects for each aspect chapter of the ES. - Identify those receptors/resources affected by more than one effect.
3	Evaluate the likelihood of these effects occurring	Identify the likely inter-relationship effects
4	Establish the ability of the receptor/resource to absorb likely effects	Assess magnitude of interrelated effects on each receptor for: - Multiple effects spread over time: during construction, in operation, during closure and post-closure phases. - Multiple simultaneous effects on a single receptor at a single time.

Table 17.2 Four stage approach for identifying 'other development.'

TITLE	DESCRIPTION
Developing the long list	Using the identified Zone of Influence (ZOI) of the project, identify 'Long List' of 'Other developments'.
Refining to the short list	From the 'Long List', identify shortlist of 'Other developments', by applying inclusion/exclusion criteria.
Gathering data about short listed projects	Specifically for information on 'other developments' shortlisted in Stage 2. Matrix presentation.
Assessment	Detailed assessment of each of the 'other development' from Stage 3 and assess overlap in effects between the project and 'other developments'.

Sources of relevant information

- 17.3.7 The following sources of information were reviewed to identify ‘other developments’ in the adjacent Local Planning Authorities (LPA’s); Merthyr Tydfil County Borough Council, Caerphilly County Borough Council and the Bannau Brycheiniog National Park:
- a) Website details for planning applications, with emphasis on proposed developments (including housing and/or minerals related).
 - b) Report, maps and updates relating to adopted and reviews of the Local Development Plan LDP.
- 17.3.8 Planning Environment Decisions Wales (PEDW) website was searched for projects and the details were reviewed up to a baseline date of October 2024⁷⁰.for:
- a) Planning Appeals.
 - b) ‘Call in’ proposals.
 - c) Any consents applications and appeals.
 - d) Significant Infrastructure Consents projects (see new 2024 Consents legislation below).
 - e) Nationally Significant Infrastructure.

New 2024 legislation- Significant Infrastructure Project consents.

- 17.3.9 June 2024 saw the commencement of the Infrastructure (Wales) Act 2024⁷¹, which established a single infrastructure consenting process for the Welsh Government to determine specific types of ‘significant infrastructure project’. Alongside transitional arrangements, the Act is intended to replace/partially replace existing statutory infrastructure consents regimes.
- 17.3.10 At the time of writing this ES Chapter, late 2024, the Welsh Government were consulting on the process for ‘Implementing the Infrastructure (Wales) Act 2024’⁷². As such, *no* ‘Infrastructure consent’ project can be identified at this stage.
- 17.3.11 The four-stage approach (Table 17.2) for identifying ‘other development’ includes:

⁷⁰ These include planning applications submitted and determined to the LPA’s within a five- year period up to the end of October 2024. Further updates may be necessary on the progression and status of some of these applications.

⁷¹ <https://law.gov.wales/infrastructure-wales-act-2024-2>

⁷² https://www.gov.wales/sites/default/files/consultations/2024-09/consultation-implementing-the-infrastructure-wales-act-2024_0.pdf with response deadline for the 13th of December 2024.

Stage 1. The Long list

- 17.3.12 The 'long list' of 'other developments' was established⁷³:
- a) Development **under construction**
 - b) Application(s) permitted but which are **not yet implemented**
 - c) Submitted applications **not yet determined**, and which, if permitted, would affect the proposed development in the scoping request.
 - d) Development identified in the adopted and emerging LDP (with appropriate weight being given as they move closer to adoption).
- 17.3.13 Information available on Local Authorities or developer websites and/or similar sources were also scrutinised, particularly for land use/planning /transport policy matters for projects either not at a planning application stage or, exempt from the need for planning permission, for example, as a statutory undertaker.
- 17.3.14 A draft list of the identified 'long sites' was provided to the LPA (MTCBC) for their consideration.
- 17.3.15 **ES Volume 3 - Appendix 17.A** contains 'Matrix 1'⁷⁴, the review of forty-two 'long list' other developments which included a systematic description of the 'type' of development and the relationship with the current and proposed Ffos-y-Fran ES project. The review concludes by setting out a 'short list' of developments and/plans which could have an interaction with the ES project.

Stage 2. The Short list

- 17.3.16 In consultation with the LPA⁷⁵, a 'short-list' was subsequently agreed. **Table 17.3** include the three 'short listed' projects:

Table 17.3 short list

	Figures 3 & 4 site reference	Site or title
1	10	Planning permission for new school
2	12	Planning permission for residential development
3	16	Highways Infrastructure, A465

⁷³ An initial draft email sent to David Cross Group Leader, Development on the 20/12/2023, followed with a draft 'long list of 'other developments' emailed to Carig Watkins, Planning Services Manager, David Cross, Group Leader Development Control, and Geraint Morgan, Solicitor, Merthyr Tydfil County Borough Council on the 6th of November 2024 from Shan Wyn Jones, Principal Planning Consultant, RML.

⁷⁴ As defined in the standard guidance, known as CEA 'Matrix1' long list.

⁷⁵ 16th December 2024

17.4 Cumulative Effects Assessment (CEA) ‘significance’ criteria.

- 17.4.1 This CEA includes a qualitative ‘significance’ criteria. Recommended approaches and guidance highlight the need for significance criteria to set out thresholds for receptor sensitivity to cumulative effects.

17.5 Regulatory and Policy Framework

- 17.5.1 ES **Chapter 5** provide the relevant environmental legislative and policy context for the project and need not be repeated in detail in this CEA Chapter.

The EIA Directive 2011/92/EU (as amended) and transposed.

- 17.5.2 This requires the consideration of interrelationships and cumulative effects with an assessment of the direct effects and any indirect, secondary, cumulative, short, medium and long term permanent or temporary, positive and negative effects of the project’.

The National Plan 2040-Future Wales⁷⁶

- 17.5.3 The national development framework for Wales up to 2040. The highest spatial plan for directing and controlling infrastructure and developments., this sets out a framework for regional development plans in the form of Strategic Development Plans and Local Development Plans at a local authority level. Regional Development Plans are at an early stage of preparation.

- 17.5.4 The NDF includes a spatial national map of constraints and proposed growth areas, and this includes a pre-assessed area (ref. 10) for Wind energy to the south of Merthyr Tydfil. For National Significant Renewable and Low Carbon Energy Developments, notes the considerations for cumulative impacts of existing and consented renewable energy schemes should be considered.

Planning Policy Wales, February 2024. (PPW)

- 17.5.5 PPW accompanies the National Development Plan and sets out the land use planning policies of the Welsh Government, supplemented by Technical Advice Notes, Circulars and policy clarification letters.

- 17.5.6 The implications of ‘cumulative’ impacts are briefly mentioned and quoted as part of Section 6 of the Environment (Wales) Act 2016.

⁷⁶ <https://www.gov.wales/sites/default/files/publications/2021-02/future-wales-the-national-plan-2040.pdf>

Local Development Plans

- 17.5.7 The relevant adopted LDP's for this project includes the following:
- a) Merthyr Tydfil County Borough Council First Replacement LDP 2016-2031 plan⁷⁷, adopted 2023.
 - b) Caerphilly County Borough Council LDP up to 2021, adopted in 2010⁷⁸. Preparation on a second Replacement LDP up to 2035 has commenced with a revised Draft Delivery Agreement in 2024 setting out the relevant key dates. An independent examination is expected in early 2027.
 - c) Bannau Brycheiniog National Park Local Development Plan 2007-2022 adopted 17/12/2013. A delivery agreement is aimed for the end of 2024 for a replacement LDP.

Relevant UK Government Welsh Government Guidance

- 17.5.8 The UK government has published updated guidance⁷⁹, aimed at National Infrastructure scale projects, and repeats some previous published governmental information, the guidance applies equally to all CEA's and sets out the information and advice required to assess cumulative effects.

Minerals Technical Advice Note 2 (MTAN): Coal ⁸⁰(2009).

- 17.5.9 Appendix G sets out Best Practice for assessing cumulative impacts. Sections G4- G7 Sets out the requirements for a cumulative assessment impact.

Further Guidance

- 17.5.10 Further guidance is taken from:
- Environmental Impact Assessment of Projects – Guidance on the preparation of the Environmental Impact Assessment Report. Directive 2011/92/EU, as amended 2014/52/EU
 - The Environmental Impact Assessment: A practical guide for planners, developers and communities' Handbook (2009), page 115.
 - 'Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions' European Communities 1999. EC DG X1 NE80328/D1/3

⁷⁷ <https://www.merthyr.gov.uk/resident/planning-and-building-control/replacement-local-development-plan-2016-2031/first-replacement-local-development-plan-2016-2031/>

⁷⁸ <https://www.caerphilly.gov.uk/caerphillydocs/ldp/written-statement.aspx>

⁷⁹ <https://www.gov.uk/guidance/nationally-significant-infrastructure-projects-advice-on-cumulative-effects-assessment#legal-and-policy-requirements-for-cumulative-effects-assessment>

⁸⁰ <https://www.gov.wales/sites/default/files/publications/2018-11/minerals-technical-advice-note-mtan-wales-2-coal.pdf>

Nationally Significant Projects Planning Inspectorate Advice Note 9

- 17.5.11 Rochdale envelope: good practice for the assessment of cumulative effects for major infrastructure Schemes, particularly where there is uncertainty or a need for flexibility within the project.

17.6 Design, Mitigation and Enhancement measures

Design

- 17.6.1 The iterative design approach to the project included all matters integral at the restoration and the aftercare and maintenance stages, and to the consideration of potential inter- relationships and in combination effects.
- 17.6.2 The ES aspect specialists carrying out the related ES Chapter assessments considered the implications of inter- relationship to identify potential impacts and design changes.
- 17.6.3 ES **Chapter 6** sets out the context for alternative restoration proposals for the site and the related constraints. In particular, the potential impact on the water environment, biodiversity and common land have been important considerations. The assessment and consideration of the inter-relationships and in-combination effects of alternative options were influential in identifying and describing the preferred restoration design.

Mitigation, enhancement and monitoring

- 17.6.4 The measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant cumulative effects and monitoring arrangements should be described are in the chapters of this Environmental Statement. The means of securing delivery of these measures is documented within Matrix 2⁸¹.

17.7 Magnitude of Impacts (Change)

Inter-relationship Assessment

- 17.7.1 **Table 17.5** sets out the respective ES topic study areas and their Zones of Influence.

⁸¹ <https://www.gov.uk/guidance/nationally-significant-infrastructure-projects-advice-on-cumulative-effects-assessment#legal-and-policy-requirements-for-cumulative-effects-assessment>

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Table 17.5 ES Topic study areas and ZOI's

Environmental Statement Receptor or Resource		ES aspect receptor/resource study area (in km)		
		A Scoping Opinion study area	B Environmental Statement Study area	C Environmental Statement Zone of Influence
1	Geology & Soils	Not specific	No defined study area but to encompass the site area up to 500m, as this identifies potential historical land uses and ground conditions.	Best practice approach is to encompass the site area up to 500m, as this identifies potential historical land uses and ground conditions.
2	Hydrology	Not specific	No defined study area but best to encompass all the relevant WFD Waterbodies, with a 15.5km indicator	Limited by the extent of environment - encompass all the relevant WFD Waterbodies, with a 15.5km indicator.
3	Hydrogeology	Not specific	No defined study area but restricted to the relevant groundwater catchment relevant to the site and the extent of major formations.	Limited by the extent of environment– restricted to the surrounding groundwater catchment relevant to the site and the extent of major formations.
4	Hydro-Geochemical	Not specific	No defined study area, but to encompass relevant WFD Waterbodies, with a 3km indicator.	To encompass relevant WFD Waterbodies, with a 3km indicator, to reflect the current and historical drainage systems.
5	Biodiversity	Maximum desk study area of 30 km-SAC designation for bats.	Maximum desk study area of 30 km-SAC designation for bats	Maximum desk study area of 30 km -SAC designation for bats.
6	Landscape & Visual	5km	5km	5km
7	Cultural Heritage	3km	3km	3km
8	Air Quality	Not specific	Maximum of 1km based primarily on methodology guidance for PM10 provided in National Planning Practice Guidance on Mineral Extraction (England) and IAQM Guidance on Mineral Dust Impacts for Planning. No equivalent, up to date guidance for Wales.	Up to 2km to cover project overlaps.

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Environmental Statement Receptor or Resource		ES aspect receptor/resource study area (in km)		
		A Scoping Opinion study area	B Environmental Statement Study area	C Environmental Statement Zone of Influence
9	Human Health	Not specific	0.5km	0.5km
10	Climate Change	The ES Chapter utilises three separate study areas for the different components of the assessment: 1. <i>In- combination Climate Change Impact (ICCC)</i> Assessment: for each ES discipline, the study area of the ICCC will match that of the relevant discipline. 2. <i>Climate Change Resilience Assessment (CCRA)</i>: the study area for this assessment will not go beyond the boundary of the project. This is to capture only the risks to the project itself from climate change. 3. <i>Green House Gas Assessment (GHG)</i>: the study area for the GHG assessment will include the project, as well as the transportation and movements of materials, the embodied carbon associated with the relevant materials and the emissions arising during the restoration and aftercare of the project.		

17.7.2 The identification of ES topics with possible inter-relationship are listed in **Table.17.6**. The table confirms that many of the ES specialist chapters have considered the full range of potential effects of the project on a single receptor, or group of receptors, and include the possibility of inter-relationship effects. None are 'scoped out' of this CEA.

17.7.3 Some of the ES topic chapters have a more extensive 'inter- relationship' for example, biodiversity, others are more limited, such as Cultural Heritage. The project includes several potential receptor 'inter-relationships', with potential to cause indirect or secondary effects on several receptors.

Table 17.6 ES topics which include cumulative effects

Topic receptor/resource		Coverage of inter-relationship effects
1.	Geology & Soils	All the potential impacts on Geology and Soil receptors were assessed and reported within ES Chapter 7. The assessment sets out the inter-relationship effects of: <i>None have been identified.</i> No additional / effects are therefore considered likely to occur beyond the conclusions assessed in the Chapter 7.

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Topic receptor/resource		Coverage of inter-relationship effects
2.	Hydrogeology	All the potential impacts on hydrogeology receptors were assessed and reported within ES Chapter 8. The assessment sets out the considerations on the inter-relationship effects of: <i>Cumulative impact to groundwater discharge to surface water occurs to the Nant Morlais culvert, involving an increase attributed to groundwater flow through the groundwater pathway. This represents an acceptable range of flow deviation as presented in the JNCC Common Standard Monitoring for Rivers.</i> No additional / effects are considered likely to occur beyond the conclusions assessed in the Chapter.
3.	Hydro-Geochemical	All the potential impacts on hydro-geochemical receptors were assessed and reported within ES Chapter 9. The assessment sets out the considerations on the inter- relationship effects of: <i>High concentrations of ammonia were measured in a perimeter borehole on the Trecatti landfill. This location is directly upgradient (groundwater flow) of the pit void. Groundwater monitoring has shown an increase in ammonia in some locations within the pit void, and the level of ammonia measured in the pit waterbody and modelled over a longer time period is found to be elevated. Phosphorous concentrations in the downgradient groundwater from the pit void are relatively high. These appear to be related to background groundwater levels based on information in the WFD groundwater body.</i> No additional / effects are therefore considered likely to occur beyond the conclusions assessed in the Chapter 9.
4.	Hydrology	All the potential impacts on hydrology receptors were assessed and reported within ES Chapter 10. The assessment sets out the considerations on the inter-relationship effects: <i>none have been identified.</i> No additional / effects are therefore considered likely to occur beyond the conclusions assessed in the Chapter 10.
5	Ecology	The assessment of inter-relationship effects is central to the assessment of potential impacts on all ecological receptors and the integrity of the biodiversity network of sites and species. ES Chapter 11 relies on the coordination with several other ES Topics to understand the potential range and complexity of impacts on ecological receptors. Chapter 11 has assessed the impact of potential inter-relationship effects to arise from all ES Topic receptors. Chapter 11 sets out the considerations for the inter-relationship effects of the following receptors/topics: <i>Geology & Soils: pollution/sediment from disturbed soils, nutrient rich runoff, soil pH.</i>

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Topic receptor/resource		Coverage of inter-relationship effects
		<i>Hydrogeological, Hydro-Geochemical and, Hydrological: no change, although possibly a reduction in pollution carried in water.</i> <i>Landscape & Visual: net benefits to biodiversity from landscape proposals.</i> No additional effects are considered likely to occur beyond the conclusions assessed in Chapter 11. References made towards positive impacts from ecological enhancements.
6	Landscape & Visual	All the potential impacts on landscape and visual receptors were assessed and reported within ES Chapter 12. The assessment sets out the considerations on the inter-relationship effects of: <i>Landscape & Visual: cumulative visual impact with Pen March Wind Farm.</i> No additional effects are therefore considered likely to occur beyond the conclusions assessed in Chapter12.
7	Cultural Heritage	All the potential impacts on cultural heritage receptors were assessed and reported within ES Chapter 13. The assessment sets out the considerations on the inter- relationship effects of: <i>No expected cumulative effects</i> <i>References made towards positive impacts in returning the landscape to its former setting.</i> No additional effects are therefore considered likely to occur beyond the conclusions assessed in Chapter 13.
8	Air Quality & Greenhouse Gases.	All the potential impacts on Air Quality and Greenhouse Gases receptors were assessed and reported within ES Chapter 14. The assessment sets out the considerations on the inter- relationship effects of: <i>Air quality: with no receptors within 250 m of the main earthworks the cumulative effects would be negligible</i> No additional effects are therefore considered likely to occur beyond the conclusions assessed in Chapter14.
9	Human Health	All the potential impacts on Human Health receptors were assessed and reported within ES Chapter15. The ES Chapter 15 assessment sets out the considerations on the inter-relationship effects of: <i>Beneficial effects from positive cumulative impact of Active Travel measures.</i> <i>The adjacent waste management facility could cause adverse effect on the human wellbeing benefits of the restored site.</i> <i>Potential cumulative air quality effects with the A465 Heads of the Valleys scheme if not completed before restoration commences.</i> No additional effects are therefore considered likely to occur beyond the conclusions assessed in Chapter15.

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Topic receptor/resource		Coverage of inter-relationship effects
10	Climate Change	All the potential impacts on climate change receptors were assessed and reported within ES Chapter16. The ES Chapter 16 assessment sets out the considerations on the inter-relationship effects of: <i>No cumulative effects</i> No additional effects are therefore considered likely to occur beyond the conclusions assessed in Chapter16.

In combination assessment

17.7.4 The three *short listed* projects⁸² includes the details set out in **Table 17.7**.

Table 17.7 Identified 'short listed' projects

Site Map ref.	LDP Allocation		Planning Permission or consent		Residential	Industrial	Other use
	Y	N	Y	N			
10		✓	✓				Educational
12	✓*		✓		✓		
16	✓		✓				WG Transport Infrastructure
TOTAL	2	1	3				

* But not for housing specific.

- 17.7.5 All the three 'short listed' projects include relevant consents in place and as such are identified as reflecting the highest level of 'certainty' for the CEA methodology.
- 17.7.6 Two out of the three short listed sites (sites 10 and 12) lie within the 3Km Zone of Influence for the Ffos-y-Fran proposed restoration. The 3km ZOI includes the following ES receptors: Hydro-Geochemical, Cultural Heritage, Air Quality, Human Health, Geology and Soils and, Climate Change.
- 17.7.7 Site reference 16, A465 Highway improvements, lies within the 1km ZOI 'Air Quality' and lies close to the ZOI's for Human Health and Geology and Soils and lies closest to the Ffos-y-Fran proposed restoration scheme and the potential for an 'inter-relationship' to occur. However, the A465 Improvements scheme is ending and may be completed soon so that in-combination effects cease.

⁸² See Matrices 1 and 2 in Appendices

17.7.8 All ES chapter specialists have considered the potential implications for an in-combination effect with the three short-listed projects to take place at the same time as this Ffos-y-Fran scheme. Within the limits of the information available, each of the three projects were reviewed to assess whether likely effects could:

- Extend to ‘**overlap**’ with the effects of this ES project, affecting the same receptors.
- Arise or apply at the **same time** (i.e. concurrent) as the effects of this ES project (temporary effects).
- ‘**Add**’ together to generate *significant* effects.

17.7.9 Matrix details included within **Appendix 17.B** shows the consideration of cumulative effects of each of the three ‘*short listed*’ projects against each this project ES topic list.

17.7.10 At the time of the preparation of this CEA, none of the short-listed projects are identified which would potentially generate effects which, cumulatively with the effects of this projects, are considered as significant within the area influenced by the project. The project is considered to have potential to cause inter-relationship effects and in-combination effects. These are set out in the following paragraphs.

Review of Inter-relationships

17.7.11 **Table 17.6** identifies several inter-relationships for the project. The ES aspect of ecology/biodiversity is the most likely to see temporary or permanent effects on several receptors. A draft CEMP will be produced before construction commences setting out mitigation and enhancement commitments which would be implemented at all stages of the Ffos-y-Fran restoration and aftercare scheme.

17.7.12 Mitigation and enhancement commitments will reduce the potential for significant adverse inter-relationship effects and so the proposed approach to restoration should have a minor to medium beneficial effect overall on ecological receptors.

In-combination Review

17.7.13 The review highlights that none of the short-listed projects would result in significant cumulative effects with the Ffos-y-Fran scheme.

17.8 Residual Effects

17.8.1 The potential residual effects are limited to a potential increase in effects from temporary construction traffic and site compounds of the different projects coinciding, up to the end date for the Ffos-y-Fran restoration of 2028.

17.9 Indication of any difficulties encountered

- 17.9.1 the conclusions reached are reliant on the use of secondary information. The characterisation of the effects are dependent on the availability of information about projects and plans. As time passes projects will be completed and the potential in-combination effects will change. While the programme for the Ffos-y-Fran restoration is well-defined, the timescale over which the potential impacts from ‘other developments’ cannot be determined with certainty. The Caerphilly Local Plan is currently at an early review stage. New land use allocations and designations could be added as the review progresses. For some of the developments, professional judgement and knowledge of the wider study area is employed.

17.10 Conclusions

- 17.10.1 A 2028 timetable is aimed for completion of the Ffos-y-Fran restoration project (2028) and the corresponding five-year aftercare’ stage (2033). Based on the identified list of ES receptors for the project, the ES Scoping Opinion identified the need for a CEA. None of the ES receptors were excluded from the need for a CEA. This was primarily based on the current range and ‘sensitivity’ of ES receptors around the site and the potential complexity of the restoration measures likely to be involved.
- 17.10.2 The Chapter sets out the two types of CEA (interrelationship and in-combination effects). All the details related to these two assessments is presented within tables and Matrices.
- 17.10.3 The inter-relationships are considered by each ES aspect author. Based on the complexity of the identified inter-relationships, the assessment identifies the significance of effects as moderate or minor, primarily affecting ecological receptors.
- 17.10.4 CEA In-combination Matrices are included within the **ES Volume 3 - Appendices 17.A and 17.B**. The format of these Matrices aligns with the guidance and good practice referenced within this Chapter, including the UK Government advice on Cumulative Effects Assessment, issued in September 2024.
- 17.10.5 The in-combination assessment identified three projects with the potential for cumulative environmental effects with the Ffos-y-Fran project. These projects include:

1. A proposed new local authority school within Merthyr;
 2. A large-scale residential development to the south of Ffos-y-Fran
 3. The Welsh Government A465 Head of the Valleys improvement project.
- 17.10.6 The third, which is nearing completion has the most potential to generate cumulative in-combination effects. The CEA indicates that the effects would be minor and therefore are insignificant.
- 17.10.7 Mitigation proposals for the Ffos-y-Fran scheme would be incorporated into a CEMP document prepared for each works package (refer to **Chapter 18**). Any potential for these minor in-combination effects can either be avoided or minimised during the detailed design and implantation.

18 Environmental Management Plan

18.1 Introduction and purpose

- 18.1.1 The Environmental Impact Assessment (EIA) presented in this Environmental Statement has established potential environmental risks that would be associated with the implementation of the final restoration strategy. To ensure these measures are properly implemented and to ensure compliance with relevant legislation and the Scheme's Environmental Management System (EMS), it is essential there is effective environmental management throughout the restoration and aftercare of the Scheme.

18.2 Construction Environmental Management Plan (CEMP)

- 18.2.1 The Construction Environmental Management Plan (CEMP) would form the basis for environmental management of the Scheme. It would ensure that environmental issues are properly addressed initially through the construction phase and establishes the basis for ensuring environmental issues and commitments are dealt with during operation and aftercare of the Scheme.
- 18.2.2 The draft contents of the Construction Environmental Management Plan (CEMP) is provided in **Table 18-1** below and would be agreed with Merthyr Tydfil County Borough Council prior to implementation.
- 18.2.3 The CEMP would include any requirements identified within the ES and updates from any additional pre-development surveys and any modifications because of planning conditions. During the restoration and aftercare works, the CEMP would be modified as necessary to take account of changes arising during the works. These modifications could include changes to the design to reflect site conditions or new environmental legislation.
- 18.2.4 Towards the end of the restoration and aftercare phase the CEMP would be refined to provide the essential environmental information needed for the five years of contract aftercare and the future maintenance of the land. This would include any landscape and ecological mitigation management and maintenance.

Table 18-1 Outline CEMP

CEMP Annex		Description
A.	Regulatory Framework	A list of the legal statutory requirements of operational staff and responsibilities for working on the restoration and aftercare scheme
B.	Preliminary List of Permits / Consents	A list of the statutory consents and permits required to facilitate restoration and aftercare works. Some items may be subject to seasonal requirements. I.e. working adjacent to waterbodies known to support great crested newts
C.	Outline Pollution Control and Prevention Plan (PCPP)	The PCPP would identify the main risks of pollution during the restoration phases and the prevention measures which should be implemented to prevent or reduce potential environmental risks and adverse effects.
D.	Outline Site Waste Management Plan (SWMP)	The SWMP would be used to plan, implement, monitor and review waste minimisation and management on site during the restoration and aftercare period.
E.	Outline Ground and Surface Water Management Plan	Developed in conjunction with Natural Resources Wales (NRW) good practice. It would describe the design of each element of the surface water management system required to manage surface water runoff during construction and potential risks to surface waters. It would include consideration of temporary storage and settlement requirements to manage waterborne sediment, water quality criteria to ensure that any discharge to receiving watercourses meets regulatory requirements
F.	Outline Ecological Management Plan	This outline plan would set out the measures and procedures for reducing impacts on ecological receptors. It would outline the procedures for any pre-development surveys, ground preparation, protection and management of ponds and watercourses and temporary or permanent measures for protected species.
G.	Dust and air quality Management Plan	A dust management and monitoring scheme would be re-established at suitably agreed revised locations. Locations would focus on those relevant receptors within 250m of the Works Area and subject to access and safety considerations. Monitoring would be undertaken for dust deposition and directional dust subject to a methodology to be agreed in advance with MTCBC.

18.2.5 A draft Record of Commitments (ROC) would also be provided. This would be used to keep track of all the relevant Scheme commitments and to ensure they are fulfilled. The ROC would list relevant commitments from legislation and commitments made within this ES (principally taken from the mitigation sections of each topic chapter).

18.2.6 The purpose of the CEMP would be to ensure that all restoration and aftercare activities (including demolition) carried out as part of the final restoration strategy would be carried out in a manner which minimises impact on the environment. The document would remind individuals working on the site of their responsibilities and to ensure that measures to prevent, reduce or mitigate potentially adverse environmental impacts identified in the EIA Report and this CEMP are carried out. The CEMP would be prepared to provide assurance to regulatory bodies and third parties that their requirements and expectations with respect to environmental legislation are met, whilst providing a mechanism for ensuring compliance with statutory consents.

18.2.7 **Aftercare, monitoring and management**

18.2.8 Proposed mitigation is provided in the Environmental Statement to address a particular environmental impact. There are three tasks required to carry out and ensure the proposed mitigation addresses the required task: Aftercare; Monitoring and Management.

Establishment Maintenance Period

18.2.9 An establishment maintenance period would apply to each phase of completed works carried out by MSW (or their appointed Contractor) for a period of up to five years. During that time, and in accordance with agreed budgets, MSW (or appointed Contractor) would carry out tasks such as grass cutting, weed control, replacement of dead plants, repair of fences, cleaning out ditches and monitoring of water quality. These tasks would be performed to ensure that the seeding and planting survive and successfully establish as new vegetation. At the end of the establishment maintenance period MSW would agree the completion of the period with MTCBC and no further maintenance would take place by MSW.

Monitoring and Management

18.2.10 Throughout the establishment maintenance period or other such duration as may be agreed with MTCBC, MSW would monitor the mitigation measures (with the support of experts if required) to:

- Ensure that planting/seeding of vegetation and natural regeneration of other areas continues to develop to meet expectations and functions (e.g. trees should grow as planned);
- Review whether they are likely to achieve the desired outcome in the required period, given the location, climate, species and management (e.g. will an area of planting and seeding develop fast enough to satisfy the requirement of a Protected Species Licence or function as Urban Common Land);
- Check for adverse or changing conditions that might compromise the effectiveness of mitigation (e.g. has a watercourse or culvert become blocked to change ground conditions, or has a third party or neighbouring landowner damaged a fence allowing access by livestock);
- Advise on any additional maintenance interventions that might be required if an issue is identified

Summary

- 18.2.11 In accordance with an approved restoration strategy and agreed budget parameters, MSW would be responsible for the environmental management of the final restoration scheme and would implement a scheme-specific EMS and a CEMP.
- 18.2.12 There would be several management plans within the CEMP which would be treated as 'live' documents which would ensure that design and mitigation measures from the EIA would be addressed in carrying out the works. The CEMP would identify those responsible for implementing the various management plans which would include regular reviews.

19 Summary and Conclusions

- 19.1.1 This Environmental Statement (ES) reports the findings of a full Environmental Impact Assessment (EIA) undertaken in accordance with the EIA Regulations and the regulatory process. The EIA has assessed what the likely environmental effects of an alternative restoration strategy proposed at the former surface mine at Ffos-y-Fran may have on the environment. This final restoration strategy has been developed in response to changes in environmental policies, sustainability best practice techniques, climate change resilience and economic viability and as an alternative scheme to the Ffos-y-Fran Land Reclamation Scheme that was previously approved under appeal in 2005 and with further modifications in 2015.
- 19.1.2 MSW identified that an alternative and final restoration strategy was required in readiness for when the mine would cease to be operational and commissioned the preparation of an alternative restoration strategy in summer 2023. The alternative strategy has since been developed in consultation with key stakeholders such as MTCBC, NRW, The Coal Authority, Welsh Government and the Gelligaer and Merthyr Commoners.
- 19.1.3 An alternative preferred scheme option emerged following several design iterations and a draft scheme prepared for the purposes of taking the scheme forward through the statutory process. The scheme was developed further in consultation with the key stakeholders and a preliminary assessment made of the likely environmental effects the revised scheme would have on the existing site and surrounding area.
- 19.1.4 Environmental surveys were progressed in summer 2023 ahead of the final closure and cessation of mining in November 2023. Following closure of the mine, the site has entered a care and maintenance period which has included statutory H&S inspections and environmental monitoring. An appointed team of suitably qualified environmental consultants were commissioned by MSW who have undertaken further and extensive monitoring and detailed investigations.
- 19.1.5 Draft proposals were prepared in sufficient detail to establish if the alternative restoration strategy would qualify as a relevant project under the EIA Regulations and would need to be taken through a formal Environmental Impact Assessment (EIA) process.
- 19.1.6 In September 2023 a request was made to Merthyr Tydfil County Borough Council for an EIA Screening Opinion and a response received in December 2023 confirming that in their opinion an EIA was required. Subsequently, a request for a Scoping Opinion to determine the extent and topic coverage of the EIA was submitted to

MTCBC on 22nd July 2024 and a response received from MTCBC on 4th October 2024⁸³ confirming the scope of the EIA which has been addressed by the environmental consultants in preparing this ES.

- 19.1.7 Technical Working Group (TWG) meetings have been held at MSW offices at the Cwmbargoed Disposal Point (CDP) during preparing the alternative final restoration scheme. This has provided the opportunity for MSW to present the alternative scheme and associated environmental and other considerations to the key stakeholders to enable them to gain a better understanding of the site, the emerging proposals, environmental monitoring and the EIA process. It has also provided the opportunity for stakeholders to visit and view the current layout of the site (if required) at the invitation of MSW.
- 19.1.8 The closure of the mine at the end of November 2023 has presented the EIA team with an opportunity to gather substantially more data in addition to the considerable amount of data gathered by MSW over the working life of the mine, to better inform the EIA process. Further topographical and ecological surveys have been undertaken and weather data recorded to consider with the rate of recharge of the groundwater. The rise and fall of the groundwater lake in the base of the void has been regularly monitored during 2023 and 2024 and a conceptual hydrological model prepared to better understand how the hydrogeology and hydrology of the site and surrounding catchments interact and by identifying potential discharge locations further downstream and outside of the site.
- 19.1.9 The EIA has subsequently examined the likely effects of the alternative and final restoration strategy on several environmental topics such as hydrogeology, hydrology, hydro-geochemistry, landscape and visual, heritage and ecology. The assessment has concluded that there would be no significant effects because of implementing the final restoration strategy on the environmental factors that have been covered by the assessment. Moreover, and by means of a comparative exercise at the end of this chapter, there is strong evidence that in implementing the alternative and final restoration scheme, there would be considerable environmental benefits over the approved scheme.

Geology and Soils

- 19.1.10 There have been ongoing geotechnical assessments of the mine during throughout its operational phases since coal mining operations commenced in 2007 until the cessation of coal extraction in November 2023.

⁸³ Response to request for Scoping Opinion received from MTCBC 04/10/2024

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- 19.1.11 The site, up until the latter stages of the operation, has been un-affected by any significant instabilities either within the above ground overburden tips or excavation faces formed through the solid measures. In the latter stages of operations, excavations affected two faults that generated some localised instability in the southern sidewall that was addressed as part of the mining operations.
- 19.1.12 Overburden mounds OB1, OB2 and OB3 have remained stable throughout their existence other than the western facing side of OB1 which in the summer of 2022 was affected by significant instability and localised rock falls.
- 19.1.13 During the later stages of coaling operations, and for a short period following the cessation, some of the remedial works as recommended by the appointed site geotechnical specialist were undertaken along various sections of rock face to improve long-term stability.
- 19.1.14 The final restoration proposals are to retain some residual rock faces of varying heights along the southern and eastern side slopes of the void for visual amenity and habitat creation for biodiversity benefits. The side slopes would be re-profiled at suitable gradients that would present no significant residual risks of instability.
- 19.1.15 Overburden mounds OB2 and OB3 have been constructed in accordance with the geotechnically approved designs and have remained stable throughout the life of the mine. These would remain as stable long term landscape features with minor works such as tree planting and overseeding undertaken on the side slopes and flanks.
- 19.1.16 Operations on the site during the restoration phase will be undertaken in compliance with the requirements of the Quarries Regulations 1999. Ultimately this is for the delivery of a site which is, upon the completion of the works be left in a safe condition. A geotechnical specialist would undertake periodic site inspections for the duration of the remaining works until completion of the final restoration phases. Once restoration is fully complete, official documentation will confirm that the site has been made safe and meets all legal requirements for long-term security.

Hydrogeology

- 19.1.17 The hydrogeology of the site is a complex subject but is focussed largely on the groundwater lake that has formed naturally in the base of the void. The lake is effectively the exposed groundwater that has always been there but was covered by the overlying geology before surface mining operations commenced.
- 19.1.18 In addition to groundwater, surface water from the land immediately surrounding the void would also drain overland into the lake, which would also receive direct rainfall onto its surface. Monitoring has shown that accumulated water in the lake drains gradually into the ground at a steady controlled rate before eventually finding

its way back into the surface water network to the west and south-west of the site, flowing onwards into the river Taff.

- 19.1.19 The assessment concludes that there will be no significant change in groundwater discharge to surface water bodies because of implementing the alternative final restoration scheme. It is estimated that the maximum level of the groundwater lake would reach around 285 metres AOD, a height well below the surrounding landform. This height has been proven to vary throughout the year and correlates to seasonal fluctuations and weather conditions with a range anticipated to be between 275 – 285 m AOD. In the event of a future and wetter climate, the water level within the lake would rise but remain well below the surrounding landform and as such there is negligible risk of the pit lake overtopping and causing flood risk further downstream. Due to the nature, level and location of the lake, advice has been sought which confirms it does not meet the criteria of a reservoir and will therefore not be subject to the requirements of the Reservoirs Act 1975.

Hydro-Geochemical

- 19.1.20 The main purpose of the hydro-geochemical assessment was to assess potential impacts that implementation of the restoration scheme may have on surface water and groundwater quality to both the lake and the waterbodies downstream.
- 19.1.21 The final restoration scheme retains all but one of the existing water bodies on site. Several of these have been genetically tested as positive for evidence of great crested newts. The retention of these water bodies will enable naturalisation of the ponds and marginal habitats over time. As such, monitoring has been suggested along with establishment of a planned settling pond management or enhanced wetland to ensure the removal of metals continues.
- 19.1.22 High concentrations of ammonia have been recorded in a perimeter borehole on the Trecatti landfill. This location is directly upgradient of the pit void. Groundwater monitoring has shown an increase in ammonia in some locations within the pit void, and the level of ammonia measured in the pit waterbody and modelled over a longer time, is found to be elevated, although the source is unlikely to be from the Ffos-y-Fran site. Although levels of ammonia are elevated, they are currently at a level that is considered low risk to human health and livestock. Water quality would continue to be monitored on a regular basis during the restoration and aftercare period.
- 19.1.23 In consideration of all the quality monitoring taking place at the mine, the hydrogeochemical impact assessment of the proposed restoration scheme implementation does not identify a high risk of significant effects to identified

recipient water quality that will require any significant adjustments to the proposed plans.

Hydrology

- 19.1.24 The design of the project has involved an iterative process between engineering and environmental teams, to ensure that potential impacts upon the baseline environment have been avoided or minimised wherever possible. Where significant effects are still likely, standard best practice measures are proposed which would be incorporated into the restoration and aftercare phases of the proposed development via the implementation of a Construction Environmental Management Plan (CEMP).
- 19.1.25 The programming of works will be carefully considered, and restoration activities will be carried out during periods of low rainfall where possible to reduce the risk of scour and erosion around structures and reduce runoff from the area of works.
- 19.1.26 The reprofiled surface mine void slopes and introduction of new drainage channels may alter surface water runoff patterns and localised flood risk within the site; however, the lake provides an excellent attenuating feature during storm events. Detailed hydraulic surface water modelling undertaken as part of the assessment confirm that the proposals will not increase flood risk elsewhere and do not introduce new surface water flow routes to offsite watercourses.
- 19.1.27 The assessment found that the final restoration scheme would have no effect on flood risk and hydrology outside the site and would not have a detrimental effect on water quality.

Ecology

- 19.1.28 The history of the Ffos-y-Fran site is one of considerable disruption resulting from mining activities and with the gradual reduction, and now cessation, of these operations the ecological baseline in the disturbed areas, while poor, is likely to continue improving with time. There are now several habitats and protected species that may otherwise not have existed, and it is necessary for the restoration to protect and retain them, particularly around the water features rather than attempting to return the site to a pre-mining condition.
- 19.1.29 The implementation of the final restoration strategy would see the restoration of the main void to a permanent water body and the re-profiling of the OB1 overburden tip and retention of the open cliff to the east of the pit lake. The remaining areas of the site would remain as they stand today, and a variety of habitats encouraged to develop naturally and developing habitats further enhanced.

Landscape and Visual

- 19.1.30 The site lies within the regional landscape character area of South Wales Valleys, a region marked by deep, urbanized valleys amidst a broad upland area renowned for its industrial history and cultural identity. On a more local level, the site lies within the Ffos-y-Fran Open Cast landscape character area and spans several neighbouring local landscape character areas such as Cwmblocks Farmland, Merthyr Common and Trecatti Landfill Site.
- 19.1.31 The assessment identified that from locations to the north and north-west, views to the northern part of the site would be affected by the earthwork's operations on the overburden mounds but that this would be limited due to the temporary nature of the works. Once completed and after the land has been restored to urban common with tree and hedgerow planting along the western flank of the site, the visual effect would be positive and a lasting improvement.
- 19.1.32 The lake would remain as a permanent landscape feature and with the side slopes planted with mixed woodland, would develop as a landscape for visual enhancement and general amenity with a network of paths for public access. Elsewhere within the site, land cover would predominantly be upland pasture with a mosaic of woodland, heath, waterbodies and scrub, with bare rock and scree slopes.

Cultural Heritage

- 19.1.33 The site lies within the Merthyr Tydfil Landscape of Outstanding Historic Interest in Wales that describes Merthyr as retaining its industrial landscape character as the most significant Welsh town of the Industrial revolution despite recent land reclamation and the resulting sanitisation of the surrounding waste tips.
- 19.1.34 During the operational phases of the surface mine at Ffos-y-Fran, extensive recording of heritage features was undertaken. While mitigation is known to have been carried out on many of the sites as a part of an earlier phase of the restoration, in some cases, aspects of the reporting remain incomplete.
- 19.1.35 The retention of many of the remaining sites associated with the Dowlais Free Drainage System such as Sarn Howell Pond, Penydarren Pond and Isaac Morgan Pond and other water bodies with features such as dams and least has enabled recording to be undertaken. The retention of these features has prevented the sanitisation of the site, as witnessed by many other reclamation schemes in the past and be in keeping with the landscape character of the surrounding industrial landscape.

Air Quality and Greenhouse Gases

- 19.1.36 The environmental effects of the approved scheme during the operational period of mining activity and coal extraction, was predicted to have little or no impact on air

quality to nearby residential properties or public health. Nevertheless, air quality monitoring during mining operations was a planning requirement imposed by a condition and was undertaken by MSW. The results of these indicate there were no recorded cases of air pollution throughout the operational period at Ffos-y-Fran.

- 19.1.37 The potential air quality issues identified for the approved scheme was primarily from dust generation associated the removal of overburden, colliery spoil and waste and the extraction and processing of coal. Odour from the early removal, storage and transport of waste from old landfill sites on the site was also identified as a potential air quality issue. These operations would have been taking place over the whole site as the coal was progressively extracted and transported to the coal washery and railhead at Cwmbargoed Disposal Point.
- 19.1.38 The alternative final restoration strategy involves significantly less operations than those required for the extraction and processing of coal during the operational period of the mine and the works required to implement the original restoration strategy. The areas affected by the works is also significantly less. The main earthworks operations required to implement the final restoration strategy occupies approximately 550,000 square metres, less than 15% of the total site area. Work will also be required in other areas, but these do not involve substantial earthmoving operations.
- 19.1.39 The operation of non-road mobile machinery would be limited, not only in area but also by numbers. It is anticipated that the earthworks operations would require the movement of approximately 2.5 million cubic metres of overburden material in and around the area of the void and OB1. In comparison, the approved scheme would require the excavation and replacement of 26 million cubic metres of bulk earthworks, over ten times the quantity of the proposed scheme.
- 19.1.40 Most of the restoration would be undertaken using several dozers of differing sizes at any one time. Some additional excavation works, and internal haulage would be required using excavators, articulated dump trucks and a tracked dozer. It is estimated that excavation, dozer, soiling and cultivation works would be carried out in several works packages over a 2–4-year period, particularly as some of the restoration works are seasonal and weather dependent. These operations are substantially smaller in scale than the surface mining operations or the original restoration scheme, and would involve substantially less plant, machinery and fuel. Therefore, the environmental risk is proportionately less and easier to control and manage offering benefits to air quality, whilst the fuel required will generate GHG emissions of 7,072 tCO₂e, a 90% reduction compared to the original restoration scheme.

Population and Human Health

- 19.1.41 The beneficial effects to human health and well-being that access to landscape and nature is widely known and linked with a lower level of mental ill health and levels of stress in both adults and children. Health benefits include lower levels of, fatigue, anxiety, and depression and are positively associated with an increase in the amount of green space in the living environment and the amount of time spent in the natural environment. Conversely, contact with areas of deprivation and with evidence of dereliction, fly tipping and litter can result in a negative feeling and symptoms of depression.
- 19.1.42 Air quality is the usual connection and factor that is considered to have a direct pathway and connection with the physical health of people and local communities. The main potential air quality impact of the surface mine when in operation was predicted as being potential dust nuisance on the local communities, however most nearby dwellings were reported to lie outside the recommended (100 to 200 metres) buffer zone or located where the risk of dust nuisance was considered low due to prevailing weather conditions.
- 19.1.43 The potential risks associated with air quality because of implementing the alternative final restoration scheme have been assessed and have proven to be negligible due to the reasons given above under air quality and greenhouse gases.
- 19.1.44 The wider benefits of the final restoration scheme on human health are less easy to measure and are reliant on the scheme being progressed and implemented. MSW are committed to the progressive restoration of the site as presented and have already undertaken some restoration measures in 2024, as agreed with MTCBC, following closure of the mine in November 2023.
- 19.1.45 The existing site area has been closed to the public now since mining operations began in 2007 and parts of the site will remain closed until the restoration and aftercare period is completed. It is anticipated that parts of the site and urban common would remain fenced off until the vegetation has established and is suitable for grazing livestock.
- 19.1.46 Following completion of the restoration scheme, a network of paths and tracks would be reinstated and registered as public rights of way. As agreed with MTCBC, a Byway Open to All Traffic (BOAT) would also be constructed on previously restored land on the western flank of the site.
- 19.1.47 The potential benefits of implementing the final restoration scheme on human health can only be positive with open access for well-being and general amenity. While the scheme may take time to establish and habitats develop, the potential

benefits for the local community would gradually develop in tandem with the natural restoration and regeneration of a wide range of habitats. The local community would be encouraged to visit the site, and no barriers or restrictions are foreseen to prevent the site from developing as a valuable area for general amenity and nature conservation, as well as some areas being returned to urban common for upland grazing.

Climate Change and Carbon

- 19.1.48 The approved Scheme requires significantly more carbon (64,692 tonnes) than the consented scheme (7,072 tonnes) and a less diverse habitat that would be less resilient to climate change. The retention of the waterbodies is considered a positive aspect of the alternative scheme by providing better resilience in dealing with episodes of dry weather and potential drought conditions.

Future Land Use

- 19.1.49 As the site becomes progressively restored and the landscape establishes and matures, there may be opportunities for alternative land uses to be considered for parts of the site. These could be areas of general amenity, recreation or nature conservation, or extensions of adjacent land uses such as the central ecological area. There may also be other development opportunities that are forthcoming from the renewables or housing sectors for example on the more accessible areas of the site and close to the existing road network. The western flank of the site will be reprofiled to contours which would allow for potential light industrial use by MTCBC in the future. In the meantime, this area would be covered with a thin layer of soil before cultivating and seeding with an approved mix.
- 19.1.50 The assessment has also compared the likely environmental effects of the approved scheme with the alternative final restoration scheme. These comparisons are summarised in **Table 19.1**.

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Table 19.1 Comparison of the likely effects of the approved scheme with the alternative final restoration scheme

Environmental Factors	Approved Scheme	Alternative Scheme	Summary
	Positives/Negatives	Positives/Negatives	
Geology and Soils	• Significant earthworks (approx. 26 million m³) required to restore landform in accordance with the approved scheme. • Works would require removal of OB1, OB2 and OB3 and extensive earthmoving operations taking a minimum total period of 2-2.5 years depending on shift patterns and weather conditions.	• Significantly less earthworks (approx. 2.5 million m³) required to re-profile slopes surrounding void • OB2 and OB3 would be retained, and earthworks would be undertaken to OB1 and the side slopes of the void using significantly less plant, taking around 1-2 years, depending on weather conditions and seasons to undertake cultivations.	The Alternative Scheme would require approximately 2.5 million m³ of earthworks compared to approximately 26 million m³ for the consented scheme and take significantly less time, using significantly less plant and cause less disruption, both generally and environmentally.
Hydrogeology	• The approved scheme would be likely to return the hydrogeological conditions like that of pre-surface mining conditions with all groundwater contained underground in the backfill which would prohibit ongoing monitoring.	• The alternative Scheme would be likely to return the hydrogeological conditions like that of pre-mining conditions. Groundwater would collect to form a lake feature which would assist in providing a biodiverse landscape and could be monitored for quality on an ongoing basis.	The alternative Scheme would cause no adverse changes to the quantity or quality of groundwater discharges to surface water bodies and would provide a more biodiverse landscape.
Hydro-Geochemical	• Unlikely that groundwater or discharges would cause any adverse effects on groundwater and there would be a low risk of AMD problems occurring. Could only monitor groundwater quality at source via deep boreholes.	• The alternative scheme contains a permanent body of groundwater water in the main void. This has no adverse effects on groundwater quality and presents a low risk to AMD issues arising. Quality of groundwater at source easily accessible and can be monitored	The water quality of the groundwater would remain unaffected by the final restoration proposals and would return to similar levels recorded prior to the surface mining operations. The main difference is that the groundwater is now left exposed by the excavation of the coal and overburden and visible as a permanent lake.
Hydrology	• The surface water drainage regime would return to that of pre-surface mining and drain into the adjacent watercourses to the west and south. Cwm Blacks catchment reduced to improve off-site drainage however, Nant Morlais catchment increased in size and required significant attenuation during storm events to prevent off-site flooding. • The consented scheme would increase the amount of disturbed soil during earthworks operations and potential risks to surface water run off to downstream contamination of watercourses.	• The surface water catchment area of the northern section of the site would be modified and much of the surface water would drain into the groundwater at the pit lake and drain gradually or reduce through evapotranspiration. The lake would provide sufficient attenuation during storm events to control off-site drainage in the Nant Morlais catchment.	The Alternative Scheme does not introduce new surface water flow routes off-site and does not increase the risk of flood elsewhere with the lake providing significant attenuating capacity during storm events. The retention and enhancement of existing water bodies and water treatment areas left post-surface mining operations is likely to result in betterment of water quality and improve biodiversity.
Ecology	• Implementing the consented scheme would result in loss of existing waterbodies, including water treatment areas known to support wetland habitats and great crested newts and other priority species and the loss of valuable baseline habitat that has established on the site during progressive restoration (acid flush and wetland) • Biodiversity would be reduced with most of the restored land used for upland grazing. • The approved scheme would likely cause risk to air borne pollution through major earthworks operations with plant and machinery and associated effects on local habitat and the central ecological area (SINC)	• The Alternative Scheme follows the Stepwise approach and principles of DECCA that avoids and minimises adverse effects on protected species and biodiversity, which would be significantly enhanced. • Significantly reduced plant and earthworks lowers the potential risks of air borne pollution.	The alternative Scheme would result in a significantly more varied landform and topography than the consented scheme and provide more opportunities for a diverse landscape with a wide range of habitats and potential biodiversity reserve.
Landscape and Visual	• Implementing the consented scheme would return the landscape primarily to upland grassland and urban common with limited visual amenity or indicators of seasonal change. Overburden mounds were to be removed or reduced in size and reprofiled.	• Adopting the alternative Scheme would result in a significantly more diverse landscape than that of the consented scheme, that would mainly consist of upland grassland returned to urban common. The alternative Scheme would provide a groundwater and surface water fed lake and retain some of the post surface mining features such as open cliff and water bodies and provide a diverse landscape framework for visual amenity and recreational opportunities	The alternative restoration scheme would represent an honest and transparent interpretation of landscape character with evidence of previous surface mining activity documenting the industrial land use of the past. The restoration would result in several physical landscape features that would enhance visual amenity and biodiversity, whilst also providing recreational opportunities for the future.
Cultural Heritage	• Implementing the approved scheme would see the removal or potential damage to potential industrial heritage assets of the future associated with existing watercourses and water treatment areas (e.g. ponds, dams, leats etc.) All known archaeological features recorded during working with certain features relocated or protected before works commenced (e.g. aqueduct).	• The alternative Scheme would retain the existing water courses and water treatment areas many of which contribute to the record of the Dowlais Free Drainage System and are a record of the previous surface mining activities at Ffos-y-Fran. All known archaeological features recorded during working with certain features relocated or protected before works commenced (e.g. aqueduct).	The final restoration strategy would see the remaining and potential future industrial heritage assets be left in-situ with opportunities for further recording if required. These assets would form areas of interest for people accessing PRoW and the urban common.
Air Quality and GHG	• The approved scheme would require extensive earthworks to excavate and move around 26 million m³ of material. This has the potential to generate dust and present other risks to air quality and would result in substantial GHG emissions from the operation of plant & equipment.	• Significant reduction in the potential to generate air borne dust and other risks to air quality through significantly less bulk earthworks operations, undertaken by significantly less plant & equipment. Around 90% reduction in GHG emissions from the burning of fuel.	The alternative restoration strategy will move around 10% of the material required to implement the approved scheme. This will in turn significantly reduce the plant required and potential for air borne dust and other risks to air quality, in addition to a 90% reduction in GHG emissions from the burning of fuel used by plant & equipment.
Population & Human Health	• Restoration of Common Land – the consented scheme returns more land to urban common than the alternative scheme and does not maximise opportunities for biodiversity.	• The alternative scheme provides more benefits and opportunities for recreation and education through significantly improving opportunities for habitat diversity • Significant reduction in the potential for air borne dust and other risks to air quality through less bulk earthworks operations, in addition to a significant reduction in GHG emissions.	The Alternative Scheme offers increased benefits for recreation and educational opportunities through improved habitat diversity, which can be delivered with significantly lower risks of airborne pollution from dust or other potential hazards such as GHG emissions.
Climate Change	• The approved Scheme requires significantly more carbon (64,692 tCO2e) than the consented scheme (7,072 tCO2e) and a less diverse habitat that would be less resilient to climate change.	• The Alternative Scheme provides greater resilience to climate change and through the formation of a groundwater and surface water fed lake creates a permanent body of water for livestock and mammals during drought.	The alternative scheme offers significant benefits as the earthworks require around 7,072 tCO2e to complete, compared to 64,692 tCO2e for the approved scheme, a reduction of around 57,620 tCO2e, which represents a saving of around 90%.

- 19.1.51 The alternative final restoration scheme presents an opportunity to change and improve the approved scheme by implementing a pragmatic and sustainable alternative with significantly less adverse environmental effects and more opportunities for biodiversity enhancement.
- 19.1.52 The alternative scheme has a significantly reduced carbon footprint compared to the approved scheme that would represent a saving of around 90% of CO2 emissions. This accords with new approaches to best practice and Welsh Government environmental policies.
- 19.1.53 Conversely, the approved scheme does not align well with new approaches to nature conservation or national planning policies. To implement the approved scheme would see the destruction of waterbodies and wetland habitat that developed on the site during the operating period and that now support great crested newt and meadow orchids.
- 19.1.54 The footprint of the final restoration strategy is significantly less than the approved scheme with just over an eighth of the overall site being affected by most of the earthworks needed for the restoration. This can be delivered in works packages at the most appropriate times of year and due to its seasonal nature is a more flexible approach than a bulk earthworks programme associated with previous land reclamation projects such as the original scheme.
- 19.1.55 The alternative final restoration strategy aligns well with the stepwise approach advocated in PPW by avoiding and minimising potential loss and damage to elements of biodiversity while promoting opportunities for mitigation. It is therefore considered that the alternative restoration scheme has many environmental merits and advantages over the approved scheme and that the application to amend the current scheme is therefore approved.



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