



**FFOS-Y-FRAN
LAND RECLAMATION SCHEME**

RESTORATION PLAN

**RESTORATION STRATEGY
CONDITION 50
A-PP 152-07-014**

PHASE 1

Date: November 2015

Our Ref OXF8150

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1 PREAMBLE

- 1.1 Miller Argent (South Wales) Limited submits the following Restoration Plan for Phase 1 of the progressive restoration of the Ffos-y-fran Land Reclamation Scheme (FLRS) which has been project managed by, and designed in accordance with advice and recommendations from RPS Group Planning & Development. Within this report, specific contributions have also been made by Leek & Weston (on planning matters), WYG Group (landscape issues) and Amec Foster Wheeler (hydrological matters). This preamble sets out the background and rationale for the design of the restoration for Phase 1.
- 1.2 Conditional planning permission for the FLRS was originally granted by the National Assembly for Wales on 11th April 2005. The planning reference for the permission is 'A-PP 152-07-014' and the original planning conditions can be found at Appendix 1.
- 1.3 Conditions 50 and 51 of that permission required a 'Restoration Strategy' for the restoration and management of the site to be approved by the Planning Authority before development commenced and that the site be reclaimed progressively in accordance with that strategy:

Original Planning Permission for FLRS - Ref: A-PP 152-07-014

Conditions 50 & 51 (A-PP 152-07-014)

"RESTORATION

- 50 *No development shall commence until a Restoration Strategy for the restoration and management of the site has been approved by the Planning Authority. Such a scheme shall detail the sequence and phasing of backfilling and reclamation showing clearly their relationship to the working scheme and shall include appropriate landscape mitigation and restoration, taking into account the historic landscape character, features of ecological interest and intended after-use of the land.*

REASON

To protect and conserve the heritage and biodiversity value of the site.

51. *The site shall be reclaimed (progressively) in accordance with the Restoration Strategy.*

REASON

To enable the Planning Authority to adequately control the development and to ensure that the land is restored to a condition capable of beneficial use and in the interests of amenity."

- 1.4 The Restoration Strategy for the scheme was submitted to the planning authority for approval on 24th October 2005 and was confirmed as approved on 4th November 2005, thereby discharging Condition 50.
- 1.5 On 6th January 2009, proposed revisions were submitted to the planning authority relating to the provision and availability of lapwing nesting areas. The revised Restoration Strategy was formally approved on 26th February 2009.

Variation of Condition 37 (A-PP 152-07-014)

- 1.6 In July 2008 Miller Argent applied under Section 73 of the Town and Country Planning Act 1990 for variation of Condition 37 of permission A-PP 152-07-014 to permit the limited dispatch of up to 100,000 tonnes of coal per annum by road via Cwmbargoed Disposal Point. The proposal was subsequently amended in July 2009 to reduce the tonnage and planning permission was eventually granted on appeal permitting the movement of a maximum of 50,000 tonnes of coal per year from the FLRS by road from Cwmbargoed Disposal Point. The varied planning permission is dated 6th May 2011, referenced APP/U6925/A/10/2129921 and is attached at Appendix 2. This is the current planning permission for the FLRS.
- 1.7 In relation to land restoration, Conditions 50 and 51 of the current planning permission read as follows, the already discharged Condition 50 of the original permission being deleted:

Current Planning Permission for FLRS - Ref: APP/U6925/A/10/2129921

Conditions 50 & 51 (APP/U6925/A/10/2129921)

“Land restoration

50. *(Deleted)*

51. *The development hereby permitted shall not be carried out other than wholly in accordance with the strategy for progressive restoration and management approved by the Local Planning Authority in accordance with condition 51 of permission APP 152-07-014.*

Reason

To ensure that the land is restored to a condition capable of beneficial use in the event of the early cessation of coal extraction, and for the protection of visual amenity.”

- 1.8 The restoration of the site is therefore to be carried out in accordance with the revised Restoration Strategy as approved on 26th February 2009.

Approved Restoration Strategy

- 1.9 The Restoration Strategy, as approved on 26th February 2009, is attached at Appendix 3. Paragraph 1.4 of the strategy states:

“1.4 This strategy sets out the principles of restoration. The site will be reclaimed progressively in accordance with the strategy as required by Planning Condition 51. A detailed Restoration Plan for each phase of the restoration will be submitted to the Planning Authority at least 6 months prior to the cessation of replacement of overburden in that phase. This Restoration Plan will show the final landform; soil profile characteristics for establishment of wildlife habitats and common grazing; specifications for soil placement and sources of soil or soil forming material to be replaced; details of watercourse and pond locations and construction, for that phase. The phases of working are shown in the Progressive Restoration Plans at Appendix A. The phases are as follows:

Phase 1 Preliminary operations (excavation of box cut)

Phase 2 Excavation to maximum void

Phase 3 Excavation to end of coaling

Phase 4 Final void restoration”

- 1.10 Paragraph 3.9 states:

“Land Use after Restoration

3.9 The primary land use proposed on the restored site will be to return it to its former use as urban common land for stock grazing, with public access for air and exercise. Bryn Caerau Farm will be returned to agricultural use, where disturbed, and nature conservation measures will be incorporated throughout the restoration scheme. The site will be predominantly restored to grassland and moorland vegetation associated with the open areas of the common, with particular attention being given to reinstating the acid grassland presently adjacent to the Tair Carreg Moor Site of Interest for Nature Conservation (SINC) that is located outside the eastern boundary north of the Bogey Road. The final distribution of land uses across the site, however, will be dependent upon the soil and soil-forming resources available.”

- 1.11 The restoration strategy is set out in plan form on Figure 4 of Appendix 3.
- 1.12 The following Restoration Plan for Phase 1 of the progressive restoration of the site has been drawn up in accordance with paragraph 1.4 of the approved Restoration Strategy.

Detailed Restoration Plan for Phase 1 of the Progressive Restoration

- 1.13 This restoration plan for Phase 1 details the design of the final landform for that area; the resources of soil and soil forming material, their profiles, placement, handling and treatment; the design and establishment of a suitable surface water drainage regime for the restored landform, all in preparation for the eventual establishment of the intended after uses for the land.
- 1.14 The final restoration design reflects the strategic proposals for the restoration of the Ffos-y-fran Land Reclamation Scheme as set out in the approved Restoration Strategy, whilst recognising changes to surrounding land uses since the scheme began, local authority aspirations for the future development of the area and recent changes to various regulatory and environmental controls,

Future Aspirations for the Area

- 1.15 There are acknowledged aspirations for the improvement of passenger rail services in the area. One such aspiration pertinent to the design of the Phase 1 Restoration Scheme is the reintroduction of the Ystrad Mynach to Dowlais Top freight line to passengers. This is acknowledged in the Merthyr Tydfil Local Development Plan and the First Review of the Caerphilly Local Development Plan, which reflect current and emerging planning policy aspirations for future Ystrad Mynach to Dowlais rail transport.
- 1.16 Corresponding cross-boundary discussions have taken place between Caerphilly and Merthyr Tydfil County Borough Councils and Miller Argent has been approached by the Merthyr Tydfil planning authority to consider their aspirations in the design for the reinstatement of earthworks at FLRS. It is stressed, however, that it is not proposed that Miller Argent makes any change to the proposed afteruses set out in the approved Restoration Strategy for the site. It is merely a request to create a landform that would accommodate the local authorities' longer-term aspirations for the area at a later date.
- 1.17 The following passages are taken from the relevant Local Development Plan documents:

Caerphilly LDP (First Review)

- 1.18 Paragraphs 7.23 and 8.20 of the Preferred Strategy for the First Review of the Caerphilly Local Development Plan refer to strategic initiatives for rail passenger transport, including the use of the mineral railway line to Cwmbargoed:

7.23 The Cwmbargoed line, whilst operating as a freight line for the Ffos-y-Fran mineral extraction works, remains as the last significant rail line within the county borough that does not have passenger services."

8.20 The rail network and access to it for passengers is a key cross boundary issue in respect of Newport and Merthyr. Specifically the reintroduction of the Caerphilly-Machen-Newport line to passengers and the Ystrad Mynach to Dowlais Top freight line to passengers. The Caerphilly LDP safeguards both routes for future use."

Merthyr Tydfil LDP

- 1.19 Policy AS11: “Public transport – rail”, provides support for development proposals that lead to the improvement of the passenger rail network.

Policy AS11: Public transport – rail

Development proposals that lead to the improvement of passenger rail services to/from Merthyr Tydfil will normally be supported including:-

- 1) upgrading track and signalling*
- 2) increasing frequency and speed of service*
- 3) improving station facilities and environments at Quakers Yard, Merthyr Vale, Troedyrhiw and Pentrebach*
- 4) expanding rail feeder bus services, particularly to /from Taff Bargoed*
- 5) providing a comprehensive range of passenger information.*

- 1.20 Paragraph 4.11.2 of the supporting statement to Policy AS11 recognises the importance of upgrading, improvement and promotion of the rail network in encouraging a move away from car journeys to work and, in particular, states that:

4.11.2 The land use implications arising from improvements to the passenger rail network will be supported by the Council providing that detailed planning considerations can be met.

- 1.21 Paragraph 4.11.3 of the supporting statement to Policy AS11 recognises the feasibility of and longer-term aspirations to introduce a passenger rail service to/from Taff Bargoed (i.e. the Trelewis area) where the mineral line crosses into Caerphilly and provides a link to Nelson and the main line at Ystrad Mynach:

1.22

4.11.3 Preliminary investigations have indicated that the introduction of a passenger rail service to/from Taff Bargoed may be feasible in future. However, the line, which currently only carries mineral traffic, would require significant investment to facilitate the reintroduction of a regular passenger service and would need to demonstrate a consistent and appropriate level of patronage in order to be considered viable. Therefore, the Council accepts that, during the LDP period, a rail feeder bus service is the most cost effective way of ensuring the communities of Taff Bargoed continue to be part of an integrated passenger transport network and this position is supported through the provisions of Policy AS11 above.

- 1.23 Part of the area for the Phase 1 Restoration Scheme has been allocated as New Business/Employment Site, ‘E5 Ffos-y-Fran’, by Policy AS14. The area forms part of the Primary Growth Area identified by Policy BW1 of the local plan and is allocated for B1, B2 and B8 uses.

Employment Site E5 and the land to the north of it are in the ownership of Merthyr Tydfil County Borough Council. It is envisaged that the terminus for the eventual passenger line would lie to the north of the E5 Employment Site within the land owned by the local authority.

- 1.24 Employment Site E5 has is allocated in accordance with Policy BW14: “Managing employment growth”; is protected by Policy AS24: “Employment sites protection”; and identified as an Area of Search for Waste Management Facilities by Policy AS7: “Waste management facilities – locations of choice”.

Discussions

- 1.25 The above LDP Policy being in place, the reinstatement of an Ystrad Mynach to Dowlais passenger railway service has been the subject of further discussion between Caerphilly and Merthyr Tydfil Councils and a feasibility study has been funded by the Welsh Government to look into the matter. Miller Argent were made aware of the initiative during discussions with Merthyr Tydfil planning officers about the Restoration & Aftercare Schemes for Phase 1 of the progressive restoration of the FLRS. They were advised of discussions between Caerphilly’s Highways and Engineering Department and Merthyr Tydfil’s Regeneration and Planning Division and asked to consider the feasibility and practicability of reinstating the final landform at FLRS in a manner that would be sympathetic to such longer-term initiatives, which lie beyond the current local plan period.
- 1.26 Miller Argent were asked to consider the inclusion of features into the restored landform at FLRS to principally accommodate potential for the future development of a rail link between Cwmbargoed and the A4060(T) trunk road on the west of the site south of Dowlais Top. This would form the most northerly section of the intended passenger line from Ystrad Mynach to Dowlais referred to in the local development plans, referred to above.
- 1.27 It was also requested that the landform includes plateaux on the area of land alongside the A4060(T) that is owned by Merthyr Tydfil County Borough Council to accommodate its potential future development as a Business Park. The terminus for the passenger line, possibly incorporating a ‘Park and Ride’ facility, would potentially be incorporated on the northern end of the business park.
- 1.28 Merthyr Tydfil has retained the southern part of this area in its Local Development Plan as a New Business/Employment Site (E5) and has now requested that the whole of Merthyr Tydfil County Borough Council’s land, incorporating the E5 site, be restored to a landform that allows the whole of the area, not being common land, to be further developed as a Business Park, rather than being partially restored to open mountain grazing land.
- 1.29 Miller Argent, having considered the initiative and investigated in some detail the land use and drainage issues associated with meeting them, in liaison with Merthyr Tydfil officers, has agreed to put forward the following Restoration scheme for Phase 1 of the progressive restoration of the FLRS.
- 1.30 The proposal is to reinstate the area to upland mountain grazing and urban common land in accordance with the Restoration Strategy for the FLRS, while at the same time incorporating a landform that could accommodate the local authorities’ longer-term aspirations for the area at some time in the future.
- 1.31 In doing so, however, whether or not those longer-term aspirations are achieved, the eventual restored landform would, in effect, more closely reflect the heritage of this part of the site, which

incorporated an old and long-disused railway line along the same general route. Whilst not replicating the route precisely, the formation would mark the heritage of this area and form a natural extension to the heritage works and strategic restoration proposals already being put in place along the route of the old railway line and its associated bridges and aqueducts that have been retained and/or refurbished as part of the FLRS, along with the heritage park that is proposed alongside the railway line to the north of the Sarn Howell Pond Scheduled Monument. The heritage and history of the railway would form part of the displays to be erected within the heritage park and the restored landform would play its part in setting out that story.

Phase 1 Restoration Plan

- 1.32 Miller Argent has prepared the following Restoration Plan for Phase 1 of the FLRS, within which appropriate features have been incorporated in the final landform at the request of the planning authority to facilitate the potential future development of the business park and railway line. However, Miller Argent stress that development of the business park and railway line do not form part of the Phase 1 Restoration Plan. It would be for someone other than Miller Argent to make separate proposals and applications for such developments at some time in the future. The afteruse of the land for Phase 1 of the FLRS is for urban common and upland grazing land with grassed flood storage areas and some shelter belting, all in accordance with the approved Restoration Strategy.

2 INTRODUCTION AND LOCATION OF RESTORATION

PHASE 1

- 2.1 This document provides the Restoration Plan for Phase 1 of the FLRS in accordance with paragraph 1.4 of the approved Restoration Strategy for the scheme (Appendix 3).
- 2.2 Phase 1 of the progressive restoration of the site comprises approximately 115 ha of land that is situated on the south western side of the working area and is identified in Figure 1, which shows the distribution of land uses proposed within the Phase 1 Area as part of the overall restoration scheme.
- 2.3 The report includes the following information relevant to the restoration of Phase 1:
- Proposed land use
 - Landform
 - Drainage provision and location of flood storage areas
 - Soil Reinstatement proposals
 - Public Access considerations

3 PROPOSED LAND USE

3.1 The proposed land uses within Phase 1 are illustrated on Figure 1, and include:

- Upland Grassland for use as urban common for stock grazing and public access;
- Grassland with woodland planting (Merthyr Tydfil CBC land);
- Flood storage areas, watercourses and ponds.

4 LANDFORM

- 4.1 Prior to operations commencing, some 342.7ha of the Site was classified as being in agricultural use. This consists of enclosed permanent pasture in the south west, common rough grazing in the east and centre of the Site, rough grazing on old tips in the west and an area of a restored opencast coal site (Trecatti) in the north.
- 4.2 The primary land use proposed on the restored Site will be to return it to its former use as mountain grassland or urban common land for stock grazing, with public access over the urban common for air & exercise. The Site will be predominantly restored to grassland and moorland vegetation associated with the open areas of the common. It is therefore proposed that the majority of the land will be used for upland grazing as urban common as illustrated on Figure 1 and the restored landform of Phase 1 reflects this aim.
- 4.3 The landform of the restored site will generally reflect that of the surrounding hillsides, with an overall rounded form, with smaller scale variations. The land will rise from a low point of about 286m AOD at Mountain Hare Roundabout in the western most point of the site to a rounded dome at around the 405m AOD level. The A4060 defines the north western boundary, which rises to 352m AOD at the northernmost point of the site.
- 4.4 A key aim of the approved Restoration Strategy is to produce a varied surface, giving general areas of light, shadow, texture and grain to the landscape. In general, it includes 'micro features' and minor variations in terrain, soil depth, drainage and micro climate. Such micro features will support the aim of developing variety, by providing suitable conditions for different habitats.
- 4.5 Figure 1 defines an area of approximately 115 hectares of land (highlighted as Phase 1), the landform of which has been designed to meet with the overall aims set out in the approved Restoration Strategy.
- 4.6 Within the broad landform structure, variations will be introduced into the landform as described in Paragraph 4.4. Following placement of the backfill, a micro-topography of smaller rises and falls will be deliberately created within the landform to mimic the natural local micro-topography, which will also include the creation of small shelter-pockets for livestock.
- 4.7 The final landform for Phase 1 will consequently incorporate a range of topographic features, including those designed to accommodate the longer term local authority aspirations for a passenger rail link and business park. However, Miller Argent will restore the area as mountain grazing and urban common land, as set out in this Restoration Plan and in accordance with the approved Restoration Strategy.
- 4.8 The aftercare for the restored Phase 1 landform is set out in the Phase 1 Aftercare Scheme.

5 SURFACE WATER MANAGEMENT

- 5.1 The FLRS encompasses four small catchments, namely: the Cae Harris, the Nant Morlais, the Cwm Blacs and the Bargoed Taff. Only the Nant Morlais and Cwm Blacs catchments are relevant to this particular phase (i.e. Phase 1) of the Ffos-y-fran restoration scheme and have been considered and analysed in more detail.
- 5.2 Both the Nant Morlais and Cwm Blacs flow to the west of the Site where they converge with the Afon Taff. The Cae Harris catchment, located to the north of the Site, also flows west to the Afon Taf. The Bargoed Taf catchment drains the eastern and south eastern half of the Site and the whole of this catchment will be reviewed & considered again in more detail as part of a later phase of restoration, although the Phase 1 plans include the permanent route of the upper reaches of the Bargoed Taf watercourse along its current alignment, to include tree planting along its margins.
- 5.3 Prior to operations commencing at FLRS, the small number of streams flowing within the Site were largely confined to the southern section of the site and all flowed to the south. Most were of an upland character with stony or rocky bottoms and flowed in moderately steep sided valleys.
- 5.4 Given the importance of establishing a suitable and sustainable permanent drainage network as part of these Restoration proposals, Miller Argent (South Wales) Limited commissioned suitably experienced & qualified Consultants (Amec Foster Wheeler Environment & Infrastructure Limited) to undertake a detailed review and analysis of the hydrology on site, in particular with respect to any impacts it may have on the proposed Phase 1 Restoration Plan and off-site receiving watercourses.
- 5.5 Therefore a full and comprehensive analysis of the whole of the Cwm Blacs and Nant Morlais catchments was carried out and considered the following;
- (i) an overview of the existing water management arrangement together with the development & description of the proposed Surface Water Management Plan (SWMP), including the configuration of major drainage pathways, sub-catchments, location and size of attenuation ponds and outfalls;
 - (ii) Data and information regarding catchment characteristics required to undertake the hydrological analysis;
 - (iii) calculations of peak surface water runoff from the FLRS and associated off-site catchments;
 - (iv) an assessment of the hydraulic capacity of the off-site receiving watercourses in order to ensure that surface water discharged from FLRS does not result in off-site flooding for the design event (1 in 100 years +30% climate change allowance);
 - (v) calculations of on-site attenuation storage requirements in order to provide the necessary control of site discharges so as not to increase the off-site flood risk and to indicate the size, location & design of on-site attenuations ponds.
- 5.6 The FLRS Hydrological Analysis Report (Appendix 4) and SWMP (Figure 3) are based on the findings of that review.

- 5.7 By reference to Appendix 4 it is proposed that two primary watercourses of approximately 2km in length will be constructed to effectively drain the Morlais B sub-catchment in this part of the Site, within the Phase 1 area. These watercourses converge into two water management ponds prior to discharging at a controlled rate via a single outfall to the Morlais B culvert westwards beneath the A4060. Outside this Phase 1 area a large part of the Morlais A sub-catchment will be drained by suitably located primary watercourses channelling storm water run-off to a series of water management ponds, through Phase 1 to the Morlais A outfall which also discharges to the west beneath the A4060.
- 5.8 To ensure that there will be no off-Site flooding, the Hydrological Analysis has calculated that the water management ponds will need to provide a total attenuating capacity of approximately 20,000m³ within the Morlais B sub-catchment and a total of approximately 78,000m³ in the Morlais A sub-catchment, prior to discharge. Design details of the watercourses and ponds within the Phase 1 area are included with this submission however, the details provided outside the Phase 1 area are indicative at this stage and will be subject to further detailed review in due course as part of a later stage of restoration. The SWMP shows the proposed location of these water management ponds.
- 5.9 The primary watercourses will have a number of smaller contour drain tributaries (known as grips) to ensure that no substantive volumes of runoff are able to accumulate un-channelled in order to manage runoff from the restored areas and protect seeded areas from excessive and erosive runoff, thus enabling them to establish successfully. Drainage grips would be seeded, and would be constructed to blend in as far as is reasonably practicable, with the surrounding landscape.
- 5.10 As well as operating as functional attenuation ponds, the water management ponds will also be developed to provide aquatic habitats as far as is reasonably possible, thus enhancing the amenity value and biodiversity of the SWMP and restoration scheme in general. However, as the ponds will only be fed by storm reactive watercourses, which may be dry for certain periods of the year, the margins of the ponds may also be susceptible to dry conditions at certain times of the year and therefore consideration will have to be given to address this factor. Additionally, the ponds outside the Phase 1 area (within Morlais A sub-catchment) may be constructed as dry detention basin features which would include the creation of grassed flood plains around the margins of the ponds wherever practicable, however this will be subject to further detailed review as part of the next phase of restoration.
- 5.11 So far as is reasonably practicable given the fluctuation in flow rates in the watercourses, in particular as their prime function is flood control, the Nant Morlais A and B watercourses will be constructed in such a way so as to encourage some biodiversity. Wherever practicable, any stone used in the creation of watercourses would be locally sourced from the mining operations and would be of an appropriate size to meet the engineering design criteria. Some small pools may be introduced where feasible, or necessary to slow water speeds in the watercourse, which could provide opportunities for variations in the aquatic habitat however, due allowance will have to take account of the fact that the main watercourse channels may be dry for certain periods of the year.
- 5.12 The design details and plans of watercourses and water management ponds within Phase 1 are included at Appendix 4.
- 5.13 It should be noted that the current proposed design in respect of the water management ponds assumes that it will be necessary to line the base of the ponds using an artificial liner. It is the intention of Miller Argent (South Wales) Ltd. to undertake further detailed site and geotechnical

investigation works prior to construction commencing, to assess the slope stability and integrity of the ponds and to establish whether a liner is actually required or if an alternative lining system is more appropriate than the one proposed (e.g. using natural boulder clay).

- 5.14 Similarly, the design for the construction of the watercourses will be dependent on Miller Argent (South Wales) Ltd recovering suitable and sufficient volumes of durable blockstone (and loose stone) armour, of a suitable size from the mining operations. It is proposed to use an artificial liner beneath the stone armouring to help protect the channel from scouring, as shown by the plans (in Appendix 4). However, alternative methods will be considered and may be utilised if suitable quantities of natural 'clay' type material were readily available from the operations. It is proposed to undertake a trial to construct a short 100 metre section of blockstone (and/or loose stone) armoured watercourse channel, where various options can be considered in respect of their suitability, durability, ease of construction and cost effectiveness.

6 SOIL REINSTATEMENT AREAS AND SPECIFICATIONS

Soils Balance and Proposed Soil and Soil Forming Material Thicknesses for Phase 1

- 6.1 The Phase 1 Area includes land within the following Soil Reinstatement areas as identified in the 2009 Restoration Strategy:
- 4S and 4M – to be reinstated to Upland Grassland (76.8 ha)
 - 4N – to be reinstated to grassland (17.3ha), and woodland planting (5.2ha)
 - 2 – to be reinstated to Upland Grassland (8.9ha)
- 6.2 Figure 2 shows the distribution of these Soil reinstatement areas across the proposed Phase 1 area and Figure 4 shows the proposed restoration schedule.
- 6.3 In 2013, in preparation for the placement of soils onto part of the Phase 1 area, an audit of the heaps of topsoil, subsoil and soil forming materials currently stored on the FLRS was undertaken to provide an assessment of the volumes of materials currently available for the restoration of the site. This is an approach recommended in “best practice” guidance issued by MAFF, DoE and DEFRA, as it provides the opportunity to ensure that materials that have been recovered on site can be effectively used to produce the best quality of restoration possible and to avoid a shortfall of restoration materials.
- 6.4 Having completed the Site audit, the volumes of the different available materials were then compared with the indicative restoration specifications identified in the 2009 Restoration Strategy to see how the volumes of materials recovered on site compared with these pre-working draft estimates. At this stage, all of the available natural in-situ topsoil and subsoil materials had been stripped on the Site. However, the volume of SFM would still be subject to change, as addition SFM was still being recovered within the excavation. The volumes available on the site at this Stage are summarised in Appendix 5, together with a spreadsheet that provides a summary of the volumes of materials required to fulfil the restoration specification for each of these areas compared with the current volume of available materials on site.
- 6.5 The audit identified that:
- the recovery of all available subsoil resources on the site did not match the volumes of such material that the restoration strategy had originally been anticipated pre-working, with an approximate shortfall of 264,000 m³, as the subsoil resource was not present; and
 - there was a shortfall in the availability of topsoil materials of approximately 41,000m³.
- 6.6 Having identified the shortfall of subsoil at an early stage it was therefore identified that this shortfall could be effectively addressed by the appropriate substitute use of SFM and this strategy was discussed with Welsh Government Natural Environment team in August 2013 (with the knowledge of MTCBC) and then with MTCBC representatives and Welsh Government team in detail in October 2013.

- 6.7 It was recognised that if the use of SFM was to be adopted to address the shortfall in available subsoil, this would, in turn require an adjustment to the depth of SFM to be placed onto the early phases of the restoration of the western upland grassland areas (4M, 4N and 4S in Phase 1 Area) of the site, where only SFM is to be used. This would ensure that sufficient SFM materials would be available to restore the remaining areas of the site, including areas where SFM would need to be used as a substitute for required subsoil horizons, based on current volumes.
- 6.8 It was therefore proposed that for the initial placement of SFM on part of Phase 1 in 2013, that a thickness of 350mm of suitable SFM would be placed over suitably prepared backfill material. This represented a reduction of 150mm of SFM in the original specification compared to the original 2005 outline Restoration Strategy but still represented a good depth of material for the establishment of the upland grassland habitat in this area.
- 6.9 The placement of SFM onto part of the Phase 1 area in 2013 therefore included a thickness of 350mm SFM using the methods described below. Following initial cultivation and seeding of this area, a further technical review meeting was held with representatives from Welsh Government and MTCBC in July 2014 to review the progress of this area and the techniques currently being applied on a further area of land within Phase 1 where soil placement was due to take place. It was agreed at this meeting that the establishment of the grass within the SFM replacement area on the 350mm of SFM was good and that monitoring of the development of the SFM and the sward should continue. A similar review meeting took place with WG Natural Environment and Agriculture team and MTCBC representatives in March 2015 to review the progress of the 2013 and 2014 placement areas. At this meeting it was similarly agreed that the progress of the areas was good and that the techniques being applied were appropriate. It was agreed that once the whole of Phase 1 was formally entered into the aftercare period that the formal process of aftercare meetings and review would commence.
- 6.10 The shortfall in the proportion of topsoil materials recovered during the stripping process, identified in the comprehensive site audit also affects the specification that is proposed for Soil Reinstatement Area 2 as shown on Figure 2.
- 6.11 The original specification for the restoration of Soil Reinstatement Area 2 within the 2009 Restoration Strategy comprised, for the most part 165mm of organic peaty topsoil and 165mm of subsoil material.
- 6.12 When Miller Argent carried out the initial 2013 inventory, discussions were held with representatives from Welsh Government Natural Resources Department and Merthyr Tydfil County Borough Council in August 2013 to consider options to address shortfalls in topsoils and subsoils available on the Site. It was agreed that:
- The topsoil depths should be reduced slightly to 150mm in areas (including Area 2) to ensure that a suitable depth of topsoil can be maintained across the required areas of 1, 2, 2AG and 2T,
 - It was agreed that priority areas for the use of natural subsoil materials should include:

Area 2WH – wet heath, where a natural clayey subsoil material would be important in forming the base to the organic topsoil material to be restored in this area; and

Area 1 – Improved grassland areas, which are to be restored to enclosed agricultural use and where natural subsoil use should be maximised as far as possible.

- 6.13 With the use of the natural subsoils on site concentrated on to these areas, it was agreed that SFM would need to be used as a substitute for natural subsoils in other areas.
- 6.14 It was therefore proposed that the restoration specification for the 8.9ha of Area 2 reinstatement within the Phase 1 Area will be 165mm of SFM overlain by 150mm of topsoil.
- 6.15 A further audit of volumes of material has been carried out in 2015 and the spreadsheet attached at Appendix 5 shows how the volumes identified in 2013 compare to the current volumes in store and those still likely to be generated.
- 6.16 The audit shows that the availability of SFM in store and conservatively estimated for future generation would be sufficient to meet the shortfall in subsoil materials on site.
- 6.17 In terms of topsoil volumes, the generation from the Trecatti landfill site has now been included in the calculations beyond the volumes shown in 2013, which it is estimated could generate a total of 21,390m³ soil material. However, this material is “restored topsoil” and the exact nature of this material and its best use within the restoration has yet to be determined. It is therefore proposed that, at this stage until the quantity and quality of the restored material is determined in more detail, the slight reduction in topsoil depths (from previously undisturbed in situ soils) as recommended and discussed in 2013 should be maintained in the Phase 1 area. Further tests will be carried out on this material to determine its quality as a soil resource in 2016.
- 6.18 In summary, therefore, the adjustments to the original proposed depths of soil reinstatement materials from the 2009 Restoration Strategy, based on the 2013 and 2015 audit of available topsoil, subsoil and SFM are as follows:

Unit	2009 Strategy Topsoil Thickness	Phase 1 Area Proposed Topsoil Thickness	2009 Strategy Subsoil Thickness	Phase 1 Area Proposed Subsoil Thickness	2009 Strategy SFM Thickness (mm)	Phase 1 Area Proposed SFM Thickness (mm)
4M Grassland					500	350
4S Grassland					500	350
4N Woodland					650	650
2 Grassland	165	150	165	0	0	165

Areas 4S and 4M – Replacement Techniques

- 6.19 This section describes the techniques that will be applied to this area for the Handling and Placement of SFM, identified as the materials to be used for the restoration of these areas in the 2009 Restoration Strategy.

Preparation of Area

- 6.20 The final 1m of mine backfill will be selectively placed and created so as to provide an acceptable substrate for the replacement of the SFM. In particular, the inclusion of large stones and boulders will be avoided, as far as is reasonably practicable in this final layer. Additionally following placement of the backfill, a micro-topography of small rises and falls will be deliberately created within the landform to mimic the natural local micro-topography. This includes the creation of small shelter-pockets for livestock. These features will be created only by the modification of the backfill surface onto which a uniform thickness of SFM will be placed rather than creating them by modifying the thicknesses of spread SFM. This also minimises the need to handle the SFM more than is absolutely necessary.
- 6.21 The loosening of the backfill material will be carried out immediately prior to the placement of SFM. This operation will be done using a multi-tined ripper, or similar equipment, mounted on the rear of a bulldozer which operates and loosens the backfill in two directions, both down and across the slope. An image of one such type of machinery that has been successfully trialled on site and is suitable to be used is provided below:



SFM Removal from Storage Mounds

- 6.22 SFM will be excavated (removed) from the storage mounds by the method described in Sheet 3 Excavation of Soil Storage Mounds with Excavators and Dump Trucks of the Guide (Appendix 6).
- 6.23 SFM will be dug out by an excavator standing on top of the mound loading into dump-trucks running on the adjacent stripped area (as shown in Figure 3.1 of Sheet 3, Appendix 6, and below).

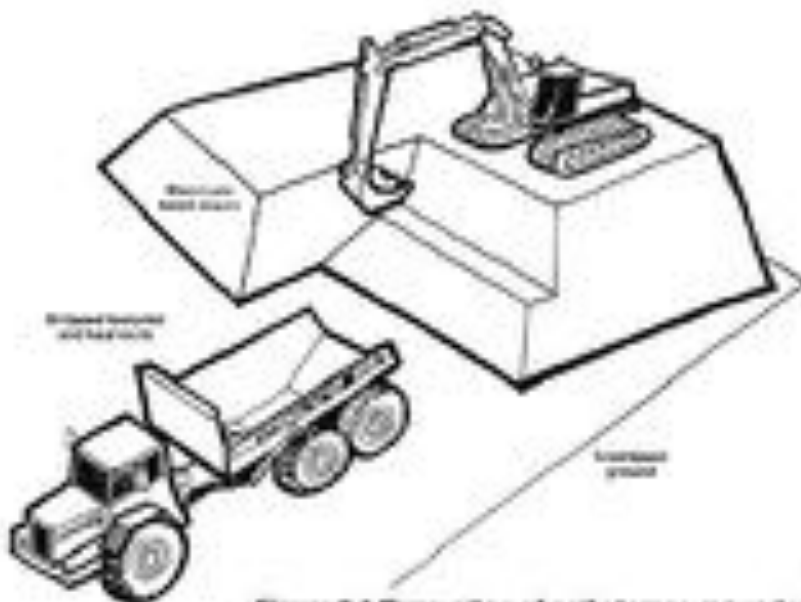
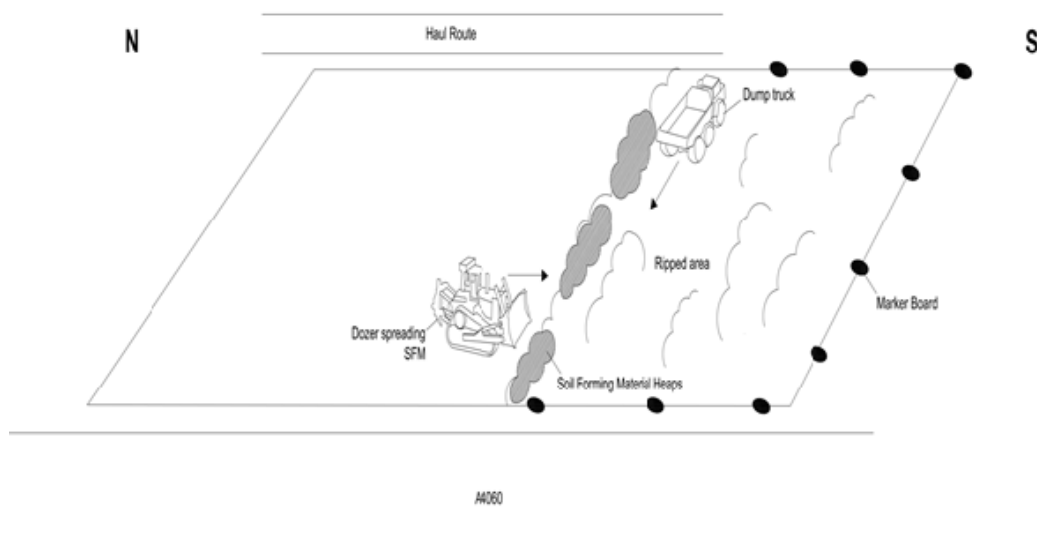


Figure 3.1 Excavation of soil storage mound with excavators and dump trucks; Single tier mound

SFM Placement

- 6.24 The SFM will be replaced in accordance with the loose tipping method for subsoil described in the Guide, Sheet 15 Soil Replacement with Bulldozers and Dump Trucks (Appendix 7). In this method the soil is delivered by dump trucks and levelled out by a light low ground pressure (LPG) tracked bulldozer to the required thickness of 350mm.
- 6.25 This procedure will generally be carried out in small sections approximately 20m by 20m with marker boards set up round the edges to indicate the depth of SFM required. An illustration of this operation is provided below



- 6.26 In normal circumstances this operation should be sufficient to reduce, as far as possible, any compaction caused to the SFM during spreading. If, however, any significant compaction remains which cannot be alleviated by subsequent agricultural cultivations, it will be removed by "combing" the surface with a toothed bucket on an excavator arm as per Sheet 18 Loosening with Excavator Bucket of the Guide (Appendix 8).
- 6.27 Following the spreading of SFM, under normal circumstances no other vehicles will travel on top of the SFM except for the agricultural vehicles carrying out cultivations and aftercare works.

Supervision

- 6.28 The DEFRA Code for the Sustainable Use of Soils on Construction Sites includes in its recommendations for Soil Planning and Management that there should be a person responsible for supervising soil management on site.
- 6.29 Miller Argent have such an employee who is currently on site who has been, and will be, supervising soil handling, including identifying when materials are dry enough to be handled and how to make the most sustainable use of the SFMs on site, including the identification of fresh sources of such materials from the excavation areas.

Area 4N

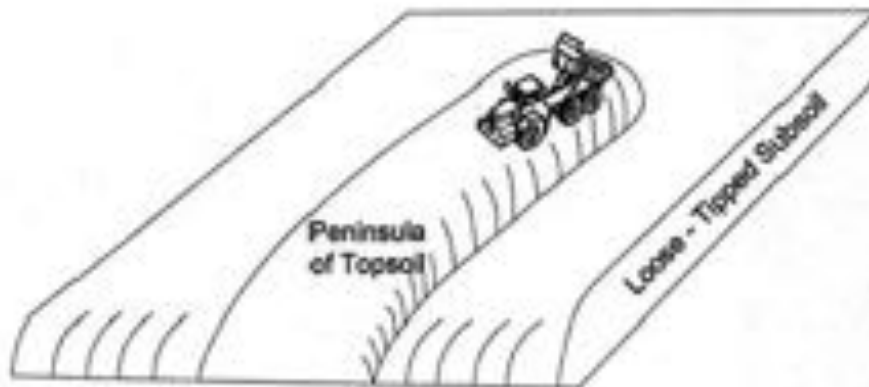
- 6.30 This section describes the techniques that will be applied to this area for the Handling and Placement of SFM, identified as the materials to be used for the restoration of this areas in the 2009 Restoration Strategy.
- 6.31 The specification for the replacement of restoration materials onto this area has been slightly amended, taking into account the potential long term aspirations of the landowner, Merthyr Tydfil County Borough Council, as set out in the Preamble at Section 1. Whilst the proposed land uses within this area remain as grassland and woodland, as in the 2009 Restoration Strategy, the specification for the restoration materials to be used in this area have been adjusted as follows:
- Grassland – It is proposed that these areas should comprise only backfill material where stones larger than 300mm in the longest direction have been removed and where a suitably levelled surface has been prepared (following loosening of the backfill using a multi tined ripper or similar) to enable hydroseeding to commence.
 - Woodland Planting. It is proposed that the specification for these areas would be the same as proposed in the 2009 Restoration Strategy. The specification would comprise prepared backfill, covered with a depth of 650mm SFM material. The techniques to be applied to the preparation of the backfill material and the SFM placement are the same to those described in Paragraphs 6.20 – 6.29 above

Area 2

- 6.32 The techniques for the preparation of backfill and placement of the 165mm thickness of SFM are the same as described in Paragraphs 6.20 to 6.29 above. It is proposed that the 150mm thickness of topsoil would be laid in the following way.

Replacement of Topsoil by the Modified Loose Tipping Procedure

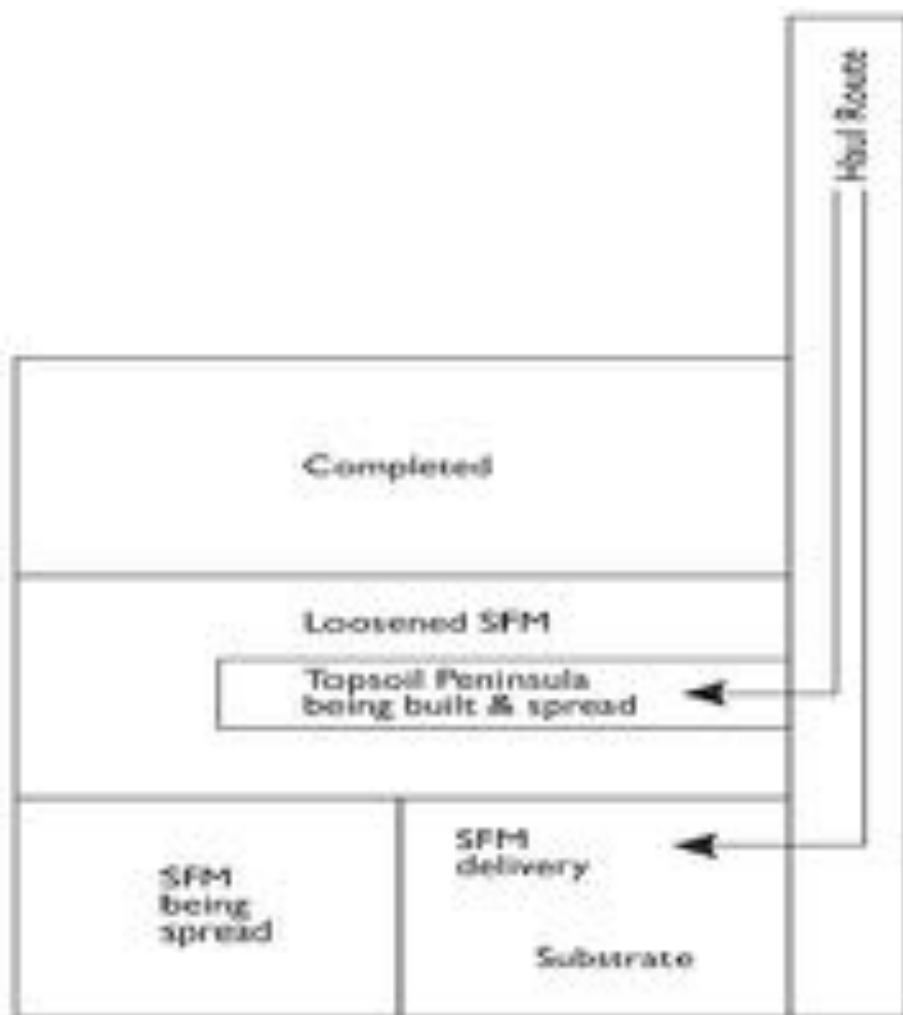
- 6.33 Topsoil is delivered either to the edge of the area that to be restored or to a so-called "peninsula", built out over the centre of the re-spread subsoil. In both cases the operations work towards the furthest point of the area being reinstated. The dump trucks reverse either along the topsoil "peninsula" and loose tip the topsoil at the end, thus progressively extending the "peninsula" or build out a lateral heap in the same general manner.



- 6.34 When all the soil needed has been delivered, a light tracked bulldozer would be used to spread out the soil from the "peninsula" or lateral heap to the required thickness over the rest of the section.



- 6.35 In normal circumstances this operation would remove any compaction caused to the topsoil during the building of the "peninsula" or lateral heap. If, however, any significant compaction remains a separate loosening operation would be carried out as described in Paragraph 6.26 above.
- 6.36 The operation would then be repeated as necessary as shown below



7 PUBLIC ACCESS CONSIDERATIONS

- 7.1 The approved Restoration Strategy identified a number of proposed footpath routes to be established as part of the final restoration of the FLRS. As it is not currently possible to establish a usable entire route that will link into the existing network, it is not intended that these routes will be implemented as part of the Phase 1 works, but some will be established with appropriate signposting within in the next detailed phase of the restoration proposals, as agreed with the Local Planning Authority.

REFERENCES

DEFRA Good Practice Guide for Handling Soils. This is now available only as a download from the National Archives website at

webarchive.nationalarchives.gov.uk/20090306103114/http://www.defra.gov.uk/farm/environment/land-use/soilguid/index.htm (note there is no “e” at the end of “soilguid”)

DEFRA (2009) Construction Code of Practice for the Sustainable Use of Soils on Construction Sites This can be obtained as a hard copy from DEFRA, Soils Policy Team, 3C Nobel House, London SW1P 3JR or, as at November 2011, can be downloaded from the DEFRA Archives website at:-

archive.defra.gov.uk/environment/quality/land/soil/built-environ/documents/code-of-practice.pdf

and archive.defra.gov.uk/environment/quality/land/soil/built-environ/documents/toolbox-talks.pdf

Please note that the documents listed above as available on the DEFRA Archives website may, in future, be moved to a new DEFRA website under construction

APPENDICES

APPENDIX 1

Ffos-y-fran Land Reclamation Scheme
Original Planning Conditions – Planning Ref: A-PP 152-07-014

**TOWN AND COUNTRY PLANNING ACT 1990: SECTION 77
APPLICATION BY MILLER ARGENT (SOUTH WALES) LIMITED FOR THE FFOS-Y-FRAN
LAND RECLAMATION SCHEME, INCORPORATING THE EXTRACTION OF COAL BY
OPEN CAST METHODS, AND BEING THE FINAL PHASE OF THE EAST MERTHYR
RECLAMATION SCHEME**

**PLANNING CONDITIONS ATTACHED TO PLANNING PERMISSION OF 11 APRIL 2005 IN
RESPECT OF PLANNING APPLICATION REF. 030225 DATED 30 APRIL 2003**

COMMENCEMENT OF WORKS

1. The development to which this permission relates shall commence not later than the expiration of 5 years beginning with the date of this permission.

REASON

To comply with Section 91 of the Town and Country Planning Act 1990 and prevent any protracted delay in the start of works.

2. Written notification of the date of commencement of development shall be submitted to the Planning Authority 56 days BEFORE commencement.

REASON

In the interests of visual and residential amenity.

DURATION OF WORKS

3. All coal extraction shall cease within 15 years 3 months from commencement of development.
4. Final restoration shall be completed within 17.5 years from commencement of development, and aftercare shall be undertaken for a period of not less than 5 years upon certification of completion of each phase of the progressive restoration scheme.
5. Any building, plant, machinery, hardstanding or other works associated with the coal extraction (or any discrete phase thereof) shall be removed off site within 42 days of completion of restoration and the affected areas shall be reinstated in accordance with a scheme to be submitted to and approved in writing by the Planning Authority. The

scheme shall be submitted no later than 56 days prior to cessation of mineral extraction, (or any discrete phase thereof).

REASON

To minimise the duration of the development hereby approved to protect residential amenity.

APPROVED PLANS/DOCUMENTS

6. The development to which this permission relates shall be carried out in accordance with the details shown on the submitted drawings and in accordance with the submitted Environmental Statement and supporting documents, unless subsequently amended with the written approval of the Planning Authority.

REASON

For the avoidance of doubt as to the extent and nature of the development hereby approved.

INSPECTION OF APPROVED PLANS/DOCUMENTS

7. From the commencement of development to completion, a copy of this planning permission, including all documents hereby approved and any other documents subsequently approved in accordance with this permission, shall be permanently maintained and available for inspection at the site office/offices.

REASON

To ensure the operators of the site and any other appropriate officers have ready access to the relevant documents on site as required, to avoid ambiguity as to the nature and extent of this permission.

METHOD OF WORKING

8. No development shall commence until a Method of Working Statement has been submitted to and approved in writing by the Planning Authority. Any works undertaken shall be fully in accordance with the approved scheme, which shall include the siting, design and external appearance of all surface structures, details of fencing, and the working method and treatment of overburden, soil and soil-forming material storage areas, and all other embankments, bunds and mounds.

REASON

To ensure satisfactory implementation and completion/restoration of the scheme.

AREAS OF EXCAVATION FOR COAL EXTRACTION

9. The surface areas of coal extraction shall not extend beyond the orange pecked lines as indicated on Plan FLRS/PA1 (Planning Application Site Area).

REASON

To define and limit the surface area of the consented development, to protect residential amenity and other acknowledged interests.

DEPTH OF WORKING

10. No coal extraction shall take place below the Lower 4 Feet (basal) seam for the principal extraction area, below the Hafod seam in the northeast coal extraction area, or below 10 metres (below existing ground level) in the southwest and southeast coal extraction areas (as indicated on Plan FLRS/PA1).

REASON

To define the vertical extent of this consent, to limit the effect of the approved development, to protect the hydrogeology and to protect residential amenity.

DIRECTION OF WORKING

11. The direction of working shall be south to north, as indicated on Plans FLRS/ES3/1 - 4.

REASON

The direction of working, south to north, lessens the potential impact upon residential amenity and results in earlier reclamation for those residential areas closest to the development.

HEIGHT OF OVERBURDEN MOUNDS

12. The northern overburden mound shall not exceed 475m AOD.
The southern overburden mound shall not exceed 410m AOD.
The eastern overburden mound shall not exceed 465m AOD.

REASON

To ensure that the visual impact of the overburden mounds is not greater than assessed, in the interests of visual amenity.

HOURS OF OPERATION

13. Except in emergencies (i.e. circumstances in which the operator has reasonable cause for preventing injury to persons or serious damage to property), in order to maintain the safe operation of the site (notification of which shall be given to the Planning Authority as soon as is practically possible) or unless the Planning Authority has agreed otherwise in writing, no operations (i.e. any physical works including the starting/warming/revving of any internal combustion engine, motor vehicle or other machinery), other than water pumping or servicing to water pumps or environmental monitoring, shall be carried out at the site, except between the following times:-

- Hours of operation (other than those activities specified below):

Monday – Friday 0700 – 2300 hrs.

Saturday 0700 – 1700 hrs

- Hours of coal haulage:

Monday – Friday 0700 – 1900 hrs.

Saturday 0700 – 1300 hrs.

- “Time Windows” within which blasting is permitted:

Monday – Friday 1000 – 1300 hrs, 1400 – 1600 hrs.

Saturday 1000 – 1300 hrs.

- Hours for removal of Existing Waste Tips:

Monday – Friday 0800 – 1900 hrs.

Saturday 0800 – 1300 hrs.

- Hours for the formation and removal of baffle mounds and the stripping and replacement of soils within a 300 metre radius of any residential dwelling:

Monday – Friday 0800 – 1900 hrs.

Saturday 0800 – 1300 hrs.

No work shall be undertaken on Sundays or Public/Bank Holidays.

REASON

To protect residential amenity.

DUST

14. No development shall take place until a detailed scheme and programme of measures to suppress dust and a programme of air quality monitoring have been submitted to and approved in writing by the Planning Authority. The mitigation measures shall be based upon those set out in the Environmental Statement accompanying the application. Such mitigation/suppression measures shall be implemented in accordance with the approved scheme.
15. To assist and mitigate any potential effects of dust nuisance, adequate dust suppression measures are to be employed using Best Available Technology Not Entailing Excessive Cost (BATNEEC) for the monitoring and control of dust which may arise directly or indirectly as a result of site activities.

The approved scheme shall ensure that:

- A sufficient number of spraying units are provided and maintained in efficient working order so as to ensure that haul routes and other areas traversed by vehicles are kept damp during dry weather.
- Spraying vehicles have an adequate water supply at all times.
- There is regular and effective maintenance of haul roads.
- The exhausts and through-body exhaust systems of plant vehicles are such as to prevent exhaust gases being emitted downwards.
- Effective dust collection systems are fitted to all blast hole drilling machines before such machines are operated.
- Prior to blasting, all arisings from blast hole drilling are bagged and disposed of safely.
- Tipping or removal of overburden is to temporarily cease or be relocated within the overburden storage area when the Planning Authority considers that wind strength and direction may result in a significant dust nuisance.
- Construction of baffle mounds is to temporarily cease or be relocated when the Planning Authority considers that the wind strength and direction may result in significant dust nuisance.

- A sufficient number of vapour masts are to be provided and maintained where necessary, so as to ensure that an effective vapour can be produced at any point in the site.
- Baffle bunds are to be sealed and seeded as soon as practicable after they have been constructed in order to minimise wind blown material affecting adjoining properties.

REASON

To protect the amenities of residents from the potential effects of dust arising from the development approved.

AIR QUALITY

16. An air quality monitoring scheme shall be undertaken as approved in writing by the Planning Authority. This shall include:
- Baseline monitoring to establish background levels of dust and particulates which must be carried out prior to commencement of operations.
 - Dust monitoring to be carried out at suitably agreed locations within the community using dust deposition gauges or sticky pads to identify nuisance dust.
 - A weather station shall be set up and operated for the duration of the project at Cwmbargoed DP to measure (a) rainfall; (b) wind speed; (c) wind direction and (d) temperature. Such information to be made available to the Planning Authority on request.
 - PM₁₀ and PM_{2.5} monitoring to be undertaken using a methodology agreed in writing by the Planning Authority. Such monitoring to be carried out prior to commencement of works and continue for a minimum period of 12 months after coal winning commences. If it is established such monitoring is not required as a result of site activities after such a period, the monitoring shall then cease, subject to the written agreement of the Planning Authority.

REASON

To protect the amenities of residents from the potential effects of dust arising from the development approved.

NOISE

17. (a) With the exception of those activities cited in conditions 18 and 22 below, noise arising from operations shall NOT exceed the following $\text{dBL}_{\text{Aeq, 1hr}}$ by reference to the following specific noise monitoring locations.

Ref No	Location	0700-1900 HRS	1900-2300 HRS
1	Blaen Dowlais	55	42
2	Japonica Drive	54	42
3	Mount View	55	42
4	Incline Side	55	42

- (b) A scheme for monitoring noise levels shall be submitted to and approved in writing by the Planning Authority prior to commencement of works. The monitoring shall be undertaken in accordance with the approved scheme.
18. During Baffle Mound construction and removal, soil stripping and removal of soil heaps, noise levels shall not exceed a daytime noise level of $70 \text{ dBL}_{\text{Aeq, 1hr}}$ over periods not exceeding eight weeks in one year.
19. Efficient silencing equipment shall be fitted to and used by all vehicles and machinery on site and shall be efficiently maintained in accordance with the manufacturer's recommendations.
20. All haul roads in direct line of sight and within 500 metres of any residential dwelling shall be adequately screened, where practicable, to attenuate noise levels.
21. Equipment operating on a 24 hour basis such as pumps shall be placed in acoustic enclosures and positioned away from noise sensitive locations where practicable.
22. The rating level of noise emitted from such pump enclosures shall not exceed the existing background noise level by more than $0 \text{ dBL}_{\text{Aeq, 1hr}}$ at the nearest noise sensitive locations.

REASON

To protect residential amenity.

BLASTING

23. At all times, blasting shall be designed so that the ground vibration measured as peak particle velocity (PPV) shall not exceed 8mm per second at any residential or similar sensitive property. However, the design limit shall ensure that the ground vibration for at least 95% of all blasts in any 20 week period shall not exceed a PPV of 6mm per second.
24. Blasting shall be limited to four blasts a day between the hours of 1000 to 1300 and 1400 to 1600 hours (two blasts per time window). Blasting shall not be carried out on Sundays, Bank/Public Holidays, nor in the hours of darkness.
25. Vibration monitoring stations are to be placed at locations to be approved in writing by the Planning Authority. All monitoring data is to be made available to the Planning Authority on request.
26. No blasting shall be carried out within the 300m Blast Exclusion Zone indicated upon Drawing No. MMAG/BLAST/01.

REASON

To protect the amenities of the local environment, including residential amenity.

27. The level of vibration at the railway boundary shall not exceed a maximum peak particle velocity of 12mm/sec.

REASON

To maintain the integrity of the railway infrastructure.

HIGHWAYS

28. There shall be no vehicle access to or from the public highway for the approved works other than at the designated access points “X” & “Y” indicated on the submitted Plan FLRS/PA1.
29. Other than at the indicated crossing point there shall be no movement of plant on the public highway without the express consent of the Planning Authority. Access point “X” shall only be used for crossing the highway and no vehicles shall be permitted to turn onto the highway at this point.

30. Use of access point “Y” shall be confined solely to the entry and exit of plant and support vehicles and shall not be used for general access of personnel or other vehicles.
31. No development shall commence until a scheme has been submitted to and approved in writing by the Planning Authority indicating full engineering details of access points “X” and “Y” and details of traffic controls of access point “X”. The access works shall be completed in accordance with the approved scheme before other development commences.
32. The internal road leading off access point “X”, together with the access point to Cwmbargoed Disposal Point opposite access point “X”, shall be surfaced to a standard approved in writing by the Planning Authority before coal extraction commences, for a distance and width of not less than 100 x 6.0 metres. The same shall also be applied to access point “Y” but for a distance and width of not less than 50 x 6.0 metres.
33. A scheme for facilities for wheel cleansing shall be submitted to and approved in writing by the Planning Authority before any construction works commence on site. The facilities shall be provided in accordance with the approved scheme before the main earthworks commence.
34. A scheme for all associated highway engineering works required shall be submitted to and approved in writing by the Planning Authority prior to commencement of such works. The scheme to be submitted shall include details of the road diversion and improvement works to the Bogey Road.

REASON

In the interests of highway safety and residential amenity.

PARKING

35. A scheme for parking all employee vehicles shall be submitted to and approved in writing by the Planning Authority before any construction works commence on site. Parking shall be provided in accordance with the approved scheme on implementation of the development.

REASON

In the interests of highway safety.

TRANSPORTATION OF COAL

36. All vehicles shall enter the highway from the site in a clean condition.

REASON

To ensure that vehicles entering the highway from the site do not deposit deleterious material on the highway which could prejudice highway safety.

37. No coal shall be transported from the site except to the Cwmbargoed Disposal Point for onward transmission by rail.

REASON

To define the means of coal transportation, to ensure onward transmission by rail, in the interests of highway safety, residential amenity and sustainability.

IMPORTATION OF MATERIALS

38. No waste material (controlled or otherwise) or minerals for blending purposes shall be imported to the site, except with the advance written approval of the Planning Authority.

REASON

To clearly define the extent of this permission in order to prevent development on a scale or of a nature not envisaged and not considered acceptable for planning purposes, particularly amenity, at the time that the planning application was determined, but allowing for the continuation of current authorized activities at the existing rail siding within the application site.

PREPARATION/STORAGE OF MATERIALS

39. No materials, including minerals excavated from the site, shall be stocked on site other than within the designated areas on the approved plans, other than those necessary for enabling works.

REASON

To protect residential amenity.

PLANT AND MACHINERY

40. Cranes and jibbed machines, used in connection with the works, must be so positioned that the jib or any suspended load does not swing over railway property, or within 3 metres of the nearest rail if the boundary is closer than 3 metres.

41. All cranes, machinery and constructional plant must be so positioned and used to prevent the accidental entry onto railway property of such plant, or loads attached thereto, in the event of failure.

REASON

For the safety of rail traffic.

ENVIRONMENTAL MANAGEMENT PLAN

42. Prior to the commencement of each phase of development, an Environmental Management Plan (EMP) shall be submitted for the written approval of the Planning Authority for each phase of the development. The EMP shall be implemented in accordance with the approved scheme, save as otherwise specified in specific conditions.

REASON

To protect the environment.

GROUNDWATER

43. Prior to the commencement of work on the former landfill sites, a site investigation report shall be provided to the Planning Authority detailing the potential for ground/groundwater contamination at the three former landfill sites within the development boundary. This shall include an assessment of risk to the aquatic environment together with appropriate site specific values for the re-use of material on site and a methodology for the screening of unsuitable materials.

REASON

To prevent pollution of the aquatic environment.

44. Details of a groundwater monitoring scheme shall be submitted to and approved in writing by the Planning Authority prior to development commencing. This shall include the location, number and depth of monitoring wells as well as the frequency of monitoring of groundwater levels and quality, together with determinants for analysis, to cover the periods prior to, during and after excavation and restoration.

REASON

To protect groundwater resources.

45. If during the development any contamination of a nature not previously identified is encountered, representative samples shall be tested to determine the nature and extent of the contamination in order to evaluate the risk it might present to controlled waters. If the contamination could materially affect controlled waters at/below the site and cannot be dealt with by methods outlined in the Method Statement, then no further development in the relevant area (unless otherwise approved in writing by the Planning Authority) shall be carried out until the developer has submitted, and obtained written approval from the Planning Authority for, an addendum to the Method Statement. This addendum to the Method Statement must detail how this unsuspected contamination shall be dealt with and shall be implemented prior to continuation of development.

REASON

To ensure that the development complies with approved details in the interests of protection of Controlled Waters.

CONSTRUCTION PHASE WORKS

46. No development approved by this permission shall commence until a detailed Method Statement(s) describing the works to be undertaken and details of any necessary pollution prevention measures during the construction phase, has been submitted to and approved in writing by the Planning Authority. The Method Statement(s) must identify as a minimum:

- all fuels, oils and chemical storage facilities.
- details of surface water drainage arrangements to be installed to intercept and treat contaminated surface water run-off.
- details of measures to ensure there is no polluting discharge from haul roads and disturbed areas; and
- details of the nature, type and quantity of materials to be imported on-site.

REASON

To prevent pollution of the aquatic environment.

FOUL AND SURFACE WATER DRAINAGE

47. Development shall not commence until a scheme for disposal of foul sewage has been submitted to and approved in writing by the Planning Authority. The scheme shall be implemented as approved.
48. No development approved by this permission shall commence until detailed plans for a comprehensive drainage and lagoon system to intercept and treat surface water run-off from the area have been submitted to and approved in writing by the Planning Authority. The system shall be installed in accordance with the approved scheme.

REASON

To prevent pollution of the water environment.

ILLUMINATION

49. Before development commences a scheme shall be submitted to and approved in writing by the Planning Authority indicating the position, design, type and hours of operation of all illumination facilities to be employed at the site and the measures to be incorporated to minimise glare and nuisance. The lighting scheme as approved shall be implemented for the duration of the development and removed upon completion of the development.

REASON

To minimise undue glare and distraction in the interests of residential amenity and highway safety.

RESTORATION

50. No development shall commence until a Restoration Strategy for the restoration and management of the site has been approved by the Planning Authority. Such a scheme shall detail the sequence and phasing of backfilling and reclamation showing clearly their relationship to the working scheme and shall include appropriate landscape mitigation and restoration, taking into account the historic landscape character, features of ecological interest and intended after-use of the land.

REASON

To protect and conserve the heritage and biodiversity value of the site.

51. The site shall be reclaimed (progressively) in accordance with the Restoration Strategy.

52. In the event of a cessation of winning and working of coal prior to the achievement of the completion of the approved Restoration Strategy, which in the opinion of the Planning Authority constitutes a permanent cessation within the terms of paragraph 3 of Schedule 9 of the Town and Country Planning Act 1990, a scheme for approval shall be submitted in writing to the Planning Authority within 6 months of the cessation of winning and working and shall include details of reclamation and aftercare. The approved scheme shall be fully implemented within 3 years (excluding any aftercare) of the written approval, unless otherwise approved in writing by the Planning Authority.

REASON

To enable the Planning Authority to adequately control the development and to ensure that the land is restored to a condition capable of beneficial use and in the interests of amenity.

AFTERCARE

53. An aftercare scheme for each phase of the restoration, requiring that such steps as may be necessary to bring each phase of the land reclaimed to the required standard for use for agriculture, amenity and conservation, shall be submitted for the written approval of the Planning Authority not later than 6 months prior to the completion of restoration (including soil spreading) of each phase.

REASON

To comply with the requirements of Schedule 5 of the Town and Country Planning Act 1990 and to ensure that the reclaimed land is correctly husbanded and to bring the land to the standard required for agricultural, amenity, and conservation use.

AGRICULTURAL WATER SUPPLIES

54. The developer shall ensure that any flow of water used for agricultural purposes that is adversely affected by the development is reinstated in a satisfactory manner, including the provision of alternative supplies during the course of operations.

REASON

To ensure that agricultural use is maintained.

ARCHAEOLOGY

55. No development shall take place until a “Programme of Archaeological Work” has been submitted to and approved in writing by the Planning Authority. The programme shall be implemented as approved.
56. The applicants shall retain an archaeologist approved by the Planning Authority, who shall undertake a “Watching Brief” of recognised archaeological features throughout the excavation and restoration period.

REASON

To protect or record the archaeological features on site, in accordance with the provisions of the 1979 Ancient Monuments and Archaeological Areas Act, and Welsh Office Circular 60/96 (“Planning and the Historic Environment - Archaeology”).

PROTECTED SPECIES

57. Where any species listed under Schedules 2 or 4 of the Conservation (Natural Habitats, etc.) Regulations 1994 is present on the site in respect of which this permission is hereby granted, no works of site clearance, demolition or construction shall take place in pursuance of this permission unless a licence to disturb any such species has been granted in accordance with the aforementioned Regulations and a copy thereof has been produced to the local planning authority.

REASON

To safeguard the protected species within and around the application site.

LIAISON COMMITTEE

58. Before development commences, the developer shall establish a Liaison Committee, the composition of which shall be approved in writing by the Planning Authority. The purpose of the Liaison Committee shall be to ensure that the local community has an understanding of the work being carried out and that the developer and contractor are aware of local community concerns.

REASON

To ensure all stakeholders are properly represented, to protect residential amenity.

ENVIRONMENTAL LIAISON OFFICER

59. Prior to commencement of works on site, an Environmental Liaison Officer shall be appointed to oversee soil stripping/storage, the restoration scheme, habitat recreation

and landscape works. The role, functions, experience and professional requirements of the Environmental Liaison Officer shall be approved in writing by the Planning Authority beforehand.

REASON

To ensure that the site is reclaimed in an acceptable manner to a condition capable of beneficial afteruse, in the interests of visual amenity, the public benefit and residential amenity.

APPENDIX 2

Ffos-y-fran Land Reclamation Scheme
Current Planning Conditions – Planning Ref: APP/U6925/A/10/2129921

Schedule of Conditions

Commencement of development

1. The development hereby permitted shall start not later than the expiration of 2 years from the date of this decision.

Reason

To comply with Section 91 of the Town and Country Planning Act 1990 and to prevent any protracted delay in the implementation of this permission.

2. Written notification of the date of the proposed start of the development hereby permitted shall be submitted to the Local Planning Authority not less than 56 days beforehand.

Reason

In the interests of clarity as to which permission is being implemented.

Duration of works

3. All coal extraction from the development hereby permitted shall cease no later than 06 September 2022.
4. Final restoration of the land shall be completed no later than 06 December 2024 and aftercare shall be undertaken for a period of not less than 5 years upon certification of completion of each phase of the progressive restoration scheme.
5. Any building, plant, machinery, hard standing or other works associated with the coal extraction hereby permitted (or any discrete phase thereof) shall be removed from the land within 42 days of the completion of restoration, and the affected areas shall be reinstated in accordance with a scheme to be submitted to and approved in writing by the Local Planning Authority; and that scheme shall be submitted no later than 56 days prior to the cessation of coal extraction (or any discrete phase thereof).

Reason

To co-ordinate the duration of the development hereby permitted with the end dates permitted under APP 152-07-014.

Approved plans and documents

6. The development hereby permitted shall not be carried out other than wholly in accordance with the details shown on the submitted drawings; with the details approved pursuant to condition 6 of permission APP 152-07-014; and in accordance with the 2003 Environmental Statement and supporting documents, unless the Local Planning Authority gives written consent to any variation.

Reason

For the avoidance of doubt as to the extent and nature of the development hereby permitted.

Availability for inspection of approved plans and documents

- 7(1) From the start of the development hereby permitted until the completion of the restoration and aftercare of the land, a copy of this planning permission, together with all relevant plans and documents already approved and any other plans and documents subsequently approved in accordance with this permission, shall be permanently kept and made available for public inspection during normal working hours at both any site office and at the offices on the Cwmbargoed Disposal Point.
- 7(2) Before the development hereby permitted starts there shall be submitted to the Local Planning Authority for their approval in writing a compendium of all plans and other documents approved pursuant to conditions imposed on permission APP 152-07-014; and the approved compendium shall be made available for public inspection in accordance with condition 7(1) above.

Reason

To ensure that the site operator, the Local Planning Authority and members of the public have access to the relevant documents on site, and to avoid ambiguity as to the nature and extent of this permission.

Method of working

8. The development hereby permitted shall not be carried out other than wholly in accordance with the Method of Working Statement approved by the Local Planning Authority pursuant to condition 8 of permission APP 152-07-014.

Reason

To ensure satisfactory implementation, completion and restoration of the permitted land reclamation scheme.

Areas of excavation for coal extraction

9. The surface areas of coal extraction hereby permitted shall not extend beyond the orange pecked lines indicated on Plan FLRS/PA1 and as required by condition 9 of permission APP 152-07-014.

Reason

To define and limit the surface area of the permitted coal extraction, and to protect residential amenity.

Depth of working

10. No coal extraction hereby permitted shall take place below the Lower 4 Feet (basal) seam in the principal extraction area, below the Hafod seam in the northeast coal extraction area, or below 10 metres (below existing ground level) in the southwest and southeast coal extraction areas, as indicated on Plan FLRS/PA1 and as required by condition 10 of permission APP 152-07-014.

Reason

To define the vertical extent of the permitted coal extraction, to limit the environmental effect of the development, to protect the hydrogeology of the site and to protect residential amenity.

Direction of working

11. The direction of opencast working hereby permitted shall be from south to north, as indicated on Plans FLRS/ES3/1-4, and as required by condition 11 of permission APP 152-07-014.

Reason

To minimise the potential impact on residential amenity and to achieve early reclamation of those areas of the site closest to residential areas.

Overburden mounds

12. The northern overburden mound of the development hereby permitted shall not exceed 475m AOD; the southern overburden mound shall not exceed 410m AOD; and the eastern overburden mound shall not exceed 465m AOD.

Reason

For the protection of visual amenity.

Hours and days of operation

- 13(1). Except in emergencies (i.e. circumstances in which the site operator has reasonable cause for preventing injury to persons or serious damage to property) in order to maintain the safe operation of the site (notification of which shall be given to the Local Planning Authority in writing as soon as is practically possible) or unless the Local Planning Authority has agreed otherwise in writing, no operations (i.e. any physical works including the starting/warming/revving of any internal combustion engine, motor vehicle or other machinery) other than water pumping or servicing to water pumps or environmental monitoring, shall be carried out on the site, except between the following times:-

- Normal site operations (other than those activities specified below)

Monday – Friday:	0700 – 2300 hrs
Saturday:	0700 – 1700 hrs

- On-site coal haulage

Monday – Friday:	0700 – 1900 hrs
Saturday:	0700 – 1300 hrs

- Blasting:

Monday – Friday	1000 – 1300 hrs and 1400 – 1600 hrs
Saturday	1000 – 1300 hrs

- Removal of existing waste tips

(Deleted)

- Formation and removal of baffle mounds, and the stripping and replacement of soil within a 300 metre radius of any dwelling

Monday – Friday	0800 – 1900 hrs
Saturday	0800 – 1300 hrs

- 13(2). No work shall be undertaken on site in connection with the development hereby permitted on Sundays or Public/Bank Holidays, except in the case of emergencies as specified in the first paragraph of condition 13(1).

Reason

For the protection of residential amenity.

Dust control

14. The development hereby permitted shall not take place other than wholly in accordance with the dust suppression and air quality monitoring scheme approved by the Local Planning Authority in accordance with condition 14 of permission APP 152-07-014 and based on the measures set out in the 2003 Environmental Statement referred to in condition 6 of that permission.
15. The dust suppression measures to be employed shall use the Best Available Technology Not Entailing Excessive Cost for the monitoring and control of dust which may arise directly or indirectly as a result of site activities. In particular:
- A sufficient number of spraying units shall be provided and maintained in efficient working order so as to ensure that haul routes and other areas traversed by vehicles are kept damp during dry weather.
 - All spraying vehicles shall have an adequate water supply at all times.
 - There shall be regular and effective maintenance of haul roads.
 - The exhausts and through-body exhaust systems of all vehicles and other plant shall be fitted so as to prevent exhaust gases being emitted downwards.
 - Effective dust collection systems shall be fitted to all blast hole drilling machines before such machines are operated.
 - Prior to all blasting, all arisings from blast hole drilling shall be bagged and disposed of safely.
 - The tipping or removal of overburden shall cease temporarily or be relocated within the overburden storage area whenever the Local Planning Authority considers that wind strength and direction may result in a significant dust nuisance, and notifies the site operator accordingly.
 - The construction of all baffle mounds shall cease temporarily or be relocated whenever the Local Planning Authority considers that the wind strength and direction may result in significant dust nuisance and notifies the site operator accordingly.
 - The site operator shall provide and maintain a sufficient number of vapour masts so as to ensure that an effective vapour screen can be produced at any point in the site.
 - All baffle bunds shall be sealed and seeded as soon as practicable after they have been constructed in such a way as to minimise wind blown material from adversely affecting nearby dwellings.

Reason

To protect the amenity of local residents from the potential effects of dust arising from the permitted development.

Air quality

16. The development hereby permitted shall be monitored in accordance with the air quality monitoring scheme approved by the Local Planning Authority in accordance with condition 16 of permission APP 152-07-014.

Reason

To protect the amenities of local residents from the potential adverse effects of dust arising from the permitted development.

Noise

- 17(1) With the exception of those activities indicated in conditions 18 and 22 below, any noise arising from the development hereby permitted shall not exceed the following dBLAeq, 1hr by reference to the following specific noise monitoring locations.

Ref No.	Location	0700-1900 hrs	1900-2300 hrs
1	Blaen Dowlais	55	42
2	Japonica Drive	54	42
3	Mount View	55	42
4	Incline Side	55	42

- 17(2) The development hereby permitted shall be monitored by the site operator in accordance with the scheme approved by the Local Planning Authority in accordance with condition 17(b) of permission APP 152-07-014.
18. During baffle mound construction and removal, soil stripping and removal of soil heaps, noise levels shall not exceed a daytime noise level of 70 dBLAeq, 1hr over periods not exceeding eight weeks in any one year.
19. Efficient silencing equipment shall be fitted to and used by all vehicles and other plant and machinery on site and shall be efficiently maintained in accordance with the manufacturer's recommendations.
20. All haul roads in direct line of sight and within 500 metres of any dwelling shall be adequately screened, where practicable, to attenuate noise levels.
21. Equipment operating on a 24-hour basis, such as pumps, shall be placed in acoustic enclosures and positioned away from noise sensitive locations where practicable.
22. The rating level of noise emitted from such pump enclosures shall not exceed the existing background noise level by more than an amount to be agreed in writing by the Local Planning authority before the development hereby permitted starts.

Reason

To protect the residential amenity of neighbours.

Blasting

23. All blasting required for the development hereby permitted shall be designed so that the ground vibration measured as peak particle velocity (PPV) shall not exceed 8mm per second at any residential or similarly sensitive property; and the design limit shall ensure that the ground vibration for at least 95% of all blasts in any 20 week period shall not exceed a PPV of 6mm per second.
24. Blasting shall be limited to four blasts a day between the hours of 1000 to 1300 and 1400 to 1600 hours (two blasts per time window) and no blasting shall be carried out on Sundays or Bank/Public Holidays, nor in the hours of darkness.
25. The development hereby permitted shall not be carried out other than wholly in accordance with the type of vibration monitoring station required by condition 25 of permission APP 152-07-014; all vibration monitoring stations shall be retained in the locations approved in writing by the Local Planning Authority; and all monitoring data shall be made available for inspection by the Local Planning Authority on request.
26. No blasting shall be carried out within the 300m blast exclusion zone indicated on Dwg No MMAG/BLAST/01 as required by condition 26 of permission APP 152-07-014.

Reason

To protect the amenity of the local environment, including of neighbours.

27. The level of vibration at the boundary of the adjoining railway land shall not exceed a maximum peak particle velocity of 12mm per second.

Reason

To maintain the integrity of the adjoining railway line.

Highways

28. There shall be no vehicle access in connection with the development hereby permitted to or from the public highway other than at points X & Y shown on Dwg No FLRS/PA1; and there shall be none for coal lorries associated with the development hereby permitted other than at point Z on the plan attached to the section 106 obligation which accompanies this permission.
29. Other than at crossing point X there shall be no movement of lorries or plant from the development hereby permitted to/from the Cwmbargoed Disposal Point on the public highway unless otherwise agreed in writing by the Local Planning Authority.
30. The use of access point Y by vehicles and other plant shall be restricted solely to the entry and exit of plant and support vehicles associated with the development hereby permitted.
31. The development hereby permitted shall not take place other than wholly in accordance with the engineering details of access for points X and Y required by permission APP 152-07-014.
32. The surface of the highway crossing at point X shall be retained in good condition for a distance and width of not less than 100 x 6 m in accordance with the details approved by the Local Planning Authority in accordance with condition 32 of permission APP 152-07-014; and the access at point Y shall be similarly retained in good condition for a distance and width of not less than 50 x 6m.

33. All vehicles using access points X and Y in connection with the development hereby permitted shall pass through the wheel cleaning facilities provided in accordance with condition 33 of permission Ref APP 152-07-014; and the vehicle cleaning facility at point Z on the Cwmbargoed Disposal Point shall be retained in good working order for the duration of the transportation of coal from the development.

Reason

For the protection of highway safety and of residential amenity.

34. (Deleted)

Parking provision

35. Employee parking for the development hereby permitted shall be in accordance with the requirements of condition 35 of permission APP 152-07-014; and such parking provision shall be retained for the duration of the development.

Reason

For the protection of highway safety.

Transportation of coal

36. All vehicles entering the highway from the development hereby permitted shall ~~do so~~ in a clean condition; and all vehicles transporting coal from the land reclamation scheme entering the Bogey Road from the Cwmbargoed Disposal Point shall ~~first~~ have their wheels and undersides cleaned on site in the existing vehicle cleaning facility on that land.

Reason

To avoid the deposit of loose material on the highway.

- 37(1). Except as permitted by condition 37(2) all coal from the development hereby permitted shall be taken to the Cwmbargoed Disposal Point for onward transmission by rail.
- 37(2). No more than 50,000 tonnes of coal a year from the development hereby permitted shall be transported from the Cwmbargoed Disposal Point by road.
- 37(3). All vehicles transporting coal from the development hereby permitted shall leave the Cwmbargoed Disposal Point at point Z shown on the plan attached to the section 106 obligation which accompanies this permission; and all vehicles arriving at the Cwmbargoed Disposal Point to transport such coal shall also use this same access.
- 37(4). No more than 20 vehicles transporting coal from the development hereby permitted shall leave the Cwmbargoed Disposal Point each day; and no more than 5 such lorries shall leave this disposal point in any one hour.
- 37(5). All vehicles transporting coal from the development hereby permitted from the Cwmbargoed Disposal Point shall have their loads covered in accordance with details to be first approved in writing by the Local Planning Authority.
- 37(6). All vehicles transporting coal from the development hereby permitted from the Cwmbargoed Disposal Point shall have their wheels and undersides cleaned before leaving this land in accordance with details to be first approved in writing by the

Local Planning Authority; and the approved means of vehicle cleaning shall thereafter be retained in good working condition until the transportation of all such coal ceases.

- 37(7). Before any coal from the development hereby permitted is transported by road from the Cwmbargoed Disposal Point, there shall be in force a Traffic Regulation Order in respect of that length of this road determined appropriate by the Merthyr Tydfil County Borough Council; and if at any time that Order ceases to have effect all transportation by road of such coal shall cease until a replacement order comes into force or unless the Local Planning Authority gives written consent to any variation.
- 37(8). Before any coal from the development hereby permitted is transported by road from the Cwmbargoed Disposal Point, there shall be submitted to the Local Planning Authority for their approval in writing details of signage to be erected at the exit from that land informing the drivers of vehicles transporting such coal of the need to observe the requirements of the TRO and to advise them of the route which they should follow to the A465(T) Heads of the Valleys Road; the approved signage shall be erected before any coal from the development hereby permitted is transported by road from the disposal point; and all such signage shall thereafter be retained until the transportation of all such coal ceases.

Reason

To define the means of coal transportation from the land reclamation site via the disposal point, and in the interests of the achievement of sustainable transport and for the protection of highway safety and residential amenity.

Importation of materials

38. No waste material (statutorily controlled or otherwise) or minerals for blending purposes shall be imported either to the land reclamation scheme hereby permitted or the Cwmbargoed Disposal Point except with the prior written approval of the Local Planning Authority.

Reason

To define the scope of this permission and in order to prevent development on a scale or of a nature not presently envisaged and not considered acceptable for planning purposes, particularly in terms of amenity but allowing for the continuation of lawful activities at the existing rail siding within both the permitted land reclamation scheme and the disposal point.

Preparation and storage of materials

39. No materials, including minerals excavated from the development hereby permitted shall be stocked on the land other than within the designated areas shown on the plans approved under permission APP 152-07-014, other than those necessary for enabling works.

Reason

For the protection of amenity.

Plant and machinery

40. All cranes and other jibbed machines used in connection with the development hereby permitted shall be so positioned that the jib or any suspended load shall not swing

over railway land, or within 3 metres of the nearest rail track if the boundary of the railway land is closer than 3m from the permitted scheme.

41. All cranes, machinery and construction plant used in connection with the development hereby permitted shall be so positioned and used to prevent the accidental entry onto railway land of such plant, or loads attached thereto, in the event of failure.

Reason

For the protection of the safety of rail traffic.

Environmental management plan

42. Before the development hereby permitted starts an Environmental Management Plan [EMP] shall be submitted for the written approval of the Local Planning Authority for each phase of the development, as required by condition 42 of permission APP 152-07-014; and the EMP shall be implemented in accordance with the approved scheme, save as otherwise provided for by other conditions of this permission.

Reason

For the protection of the environment.

Groundwater monitoring and protection

- 43 (Deleted)

44. Once the development hereby permitted starts the groundwater monitoring scheme approved by the Local Planning Authority in accordance with condition 44 of permission APP 152-07-014 shall continue for the duration of the development.

Reason

To prevent pollution of the water environment.

45. If during the course of the development hereby permitted any contamination of a nature not previously identified is encountered, representative samples shall be tested by the site operator to determine the nature and extent of any such contamination in order to evaluate the risk it might present to controlled waters; if the contamination could materially affect controlled waters at/below the site and cannot be dealt with by measures set out in the Method Statement, then no further operations shall be carried out in the affected area until the site operator has submitted to the Local Planning Authority for their written approval an addendum to the Method Statement or unless the Local Planning Authority give written consent for any variation; and this addendum shall specify how this contamination must be dealt with and what measures must be implemented before operations continue.

Reason

To ensure that the development complies with the details approved under permission APP 152-07-014 for the protection of controlled waters.

Construction phase works

46. The development hereby permitted shall not be carried out other than wholly in accordance with the Method Statement approved by the Local Planning Authority in accordance with condition 46 of permission APP 152-07-014.

Reason

For the protection of amenity

Foul and surface water drainage

47. The development hereby permitted shall not be carried out other than wholly in accordance with the scheme for the disposal of foul sewage approved by the Local Planning Authority in accordance with condition 47 of permission APP 152-07-014.
48. The development hereby permitted shall not be carried out other than wholly in accordance with the detailed plans for a comprehensive drainage and lagoon system to intercept and treat surface water from the land reclamation site approved by the Local Planning Authority in accordance with condition 48 of permission APP 152-07-014.

Reason

To prevent pollution of the water environment.

Site illumination

49. The development hereby permitted shall not be carried out other than wholly in accordance with the scheme of illumination approved by the Local Planning Authority in accordance with condition 49 of permission APP 152-07-014; the approved lighting scheme shall be retained in good working condition for the duration of the development; and shall then be removed upon its completion.

Reason

To minimise undue glare and distraction in the interests of residential amenity and highway safety.

Land restoration

50. (Deleted)

51. The development hereby permitted shall not be carried out other than wholly in accordance with the strategy for progressive restoration and management approved by the Local Planning Authority in accordance with condition 51 of permission APP 152-07-014.
52. In the event of a cessation of the extraction of coal prior to the completion of the approved restoration and management strategy, and which constitutes a permanent cessation within the terms of paragraph 3 of Schedule 9 of the Town and Country Planning Act 1990, within 6 months of the cessation of such extraction there shall be submitted to the Local Planning Authority for their approval in writing a scheme for the restoration of the land which shall include details of reclamation and aftercare; and the approved scheme shall be implemented within 3 years of such approval (excluding any aftercare measures) unless the Local Planning Authority gives written consent to any variation.

Reason

To ensure that the land is restored to a condition capable of beneficial use in the event of the early cessation of coal extraction, and for the protection of visual amenity.

Aftercare

53. The development hereby permitted shall not be carried out other than wholly in accordance with the phased aftercare schemes to be approved by the Local Planning Authority in accordance with condition 53 of permission APP 152-07-014.

Reason

To comply with the requirements of Schedule 5 of the Town and Country Planning Act 1990 and to ensure that the reclaimed land is correctly husbanded to bring it to the standard required for agricultural, amenity, and conservation use.

Agricultural water supplies

54. The site operator shall ensure that any flow of water used for agricultural purposes that is adversely affected by the development hereby permitted is reinstated in a satisfactory manner, including the provision of alternative supplies during the course of such remedial operations.

Reason

To ensure that agricultural use can be maintained.

Archaeology

55. The development hereby permitted shall not be carried out other than wholly in accordance with the phased Programme of Archaeological Work approved by the Local Planning Authority in accordance with condition 55 of permission APP 152-07-014.
56. For the duration of the development hereby permitted the site operator shall retain the services of an archaeologist approved by the Local Planning Authority who shall undertake a watching brief over recognised archaeological features throughout the excavation and restoration period of the land reclamation scheme.

Reason

To protect or record the archaeological features on the site.

Protected habitats and species

57. The development hereby permitted shall not be carried out other than wholly in accordance with the requirements of Schedules 2 and 5 of the Conservation of Habitats and Species Regulations 2010 in respect of any protected habitats or species on the land reclamation site, as required by condition 57 of permission APP 152-07-014 but as may be modified by the 2010 Regulations.

Reason

To safeguard any protected habitats or species within or around the permitted land reclamation scheme.

Liaison committee

58. Once the development hereby permitted starts the site operator shall continue to organise the site liaison committee established in accordance with condition 58 of permission APP 152-07-014.

Reason

To ensure that the local community has an understanding of the work being carried out on the land reclamation and opencast coal site, and that the site operator and any contractor are aware of local community concerns.

Environmental liaison officer

59. Once the development hereby permitted starts the site operator shall continue to employ an environmental liaison officer approved in writing by the Local Planning Authority who shall oversee all soil stripping/storage, the restoration scheme, habitat re-creation and landscaping works, as required by condition 59 of permission APP 152-07-014.

Reason

To ensure that the site is reclaimed in an acceptable manner and to a condition capable of beneficial afteruse, in the interests of the protection of residential and visual amenity, and for general public benefit.

Abbreviations used in the above Decision

ACW	Aberthaw Cement Works
APS	Aberthaw Power Station
CDP	Cwmargoed Disposal Point
DSC	Dry Steam Coal
EIA	Environmental Impact Assessment
ES	Environmental Statement
LRS	Land Reclamation Scheme
MINTAN2	Minerals Technical Advice Note 2 (on coal)
MPPW	Minerals Planning Policy Wales
PDB	Planning Decisions Branch
PTS	Port Talbot Steelworks
TAN 18	Technical Advice Note 18 : Transport
TRO	Traffic Regulation Order

APPENDIX 3

Restoration Strategy

Our Ref: 4533-082L
Your Ref:

E-mail: jonesk@rpsgroup.com
Direct Dial: 01235 448773
Date: 6th January 2009

Rolf Brown
Countryside Officer
Merthyr Tydfil County Borough Council
Ty Keir Hardy
Riverside Court
Avenue De Clichy
Merthyr Tydfil
CF47 8XF

Dear Rolf

**TOWN AND COUNTRY PLANNING ACT 1990
FFOS-Y-FRAN LAND RECLAMATION SCHEME
CONDITIONAL PLANNING PERMISSION A-PP 152-07-014**

**PLANNING CONDITION 50
REVISION TO RESTORATION STRATEGY**

Further to our meeting on 14th November, when we discussed the programme for maintaining lapwing nesting habitat during the operation of the site, I now enclose the revisions to Appendix C of the agreed Restoration Strategy for the site. These comprise a revised table "Lapwing Breeding Areas and Phasing of the Works" and revised Figures 4 to 6. These changes are required because the northern overburden mound will not be available for the lapwings until the 2010 breeding season.

The principal change is the provision of an additional area, to the east of the East Merthyr Land Reclamation Scheme Phase 2 area, which will be improved for the lapwings over this winter so as to be available for the lapwings during the 2009 breeding season. This area is marked in red on Figure 4. The improvements to this area have been discussed on site with the RSPB and their final recommendations are expected shortly. The work will then be carried out during January.

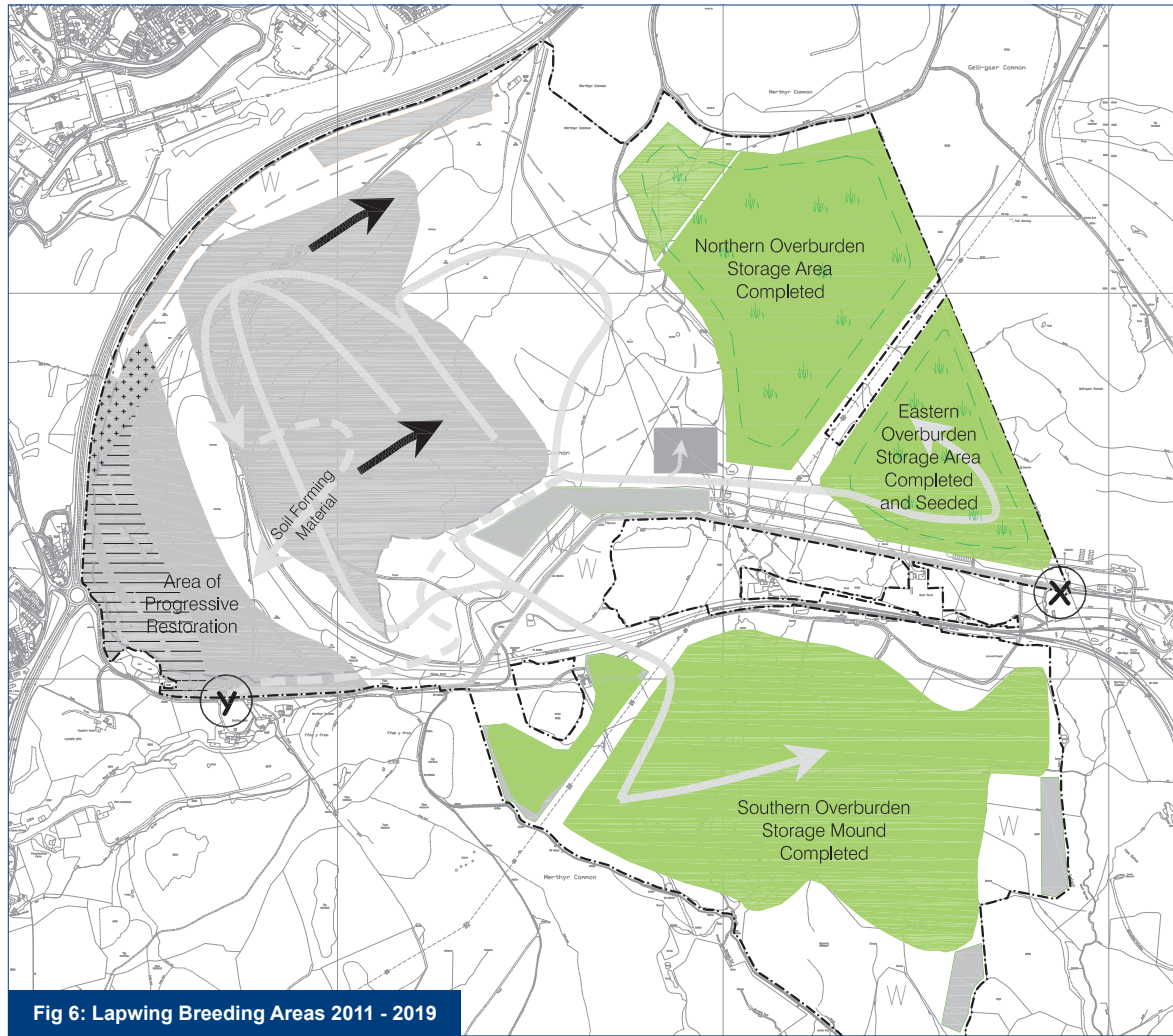
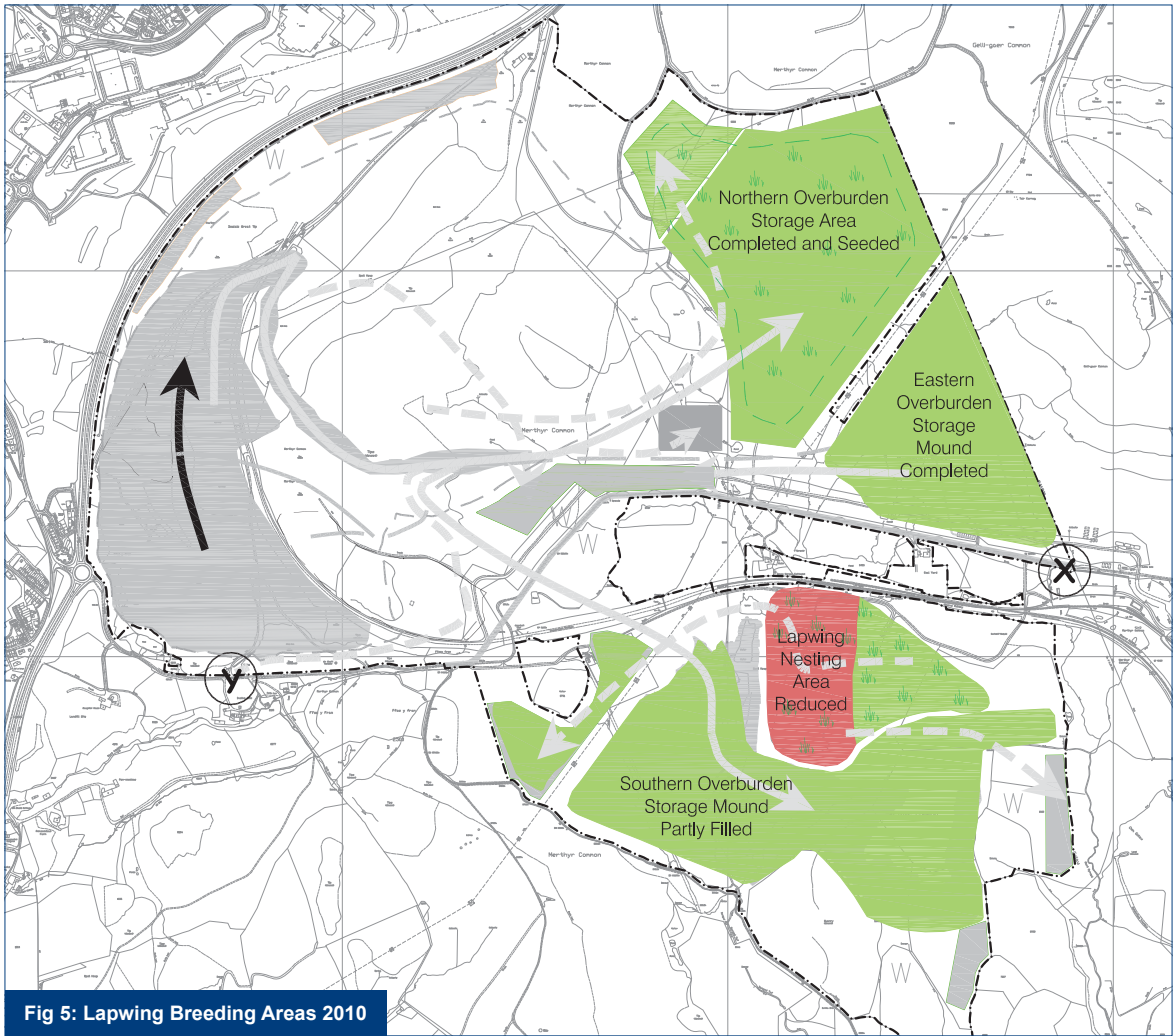
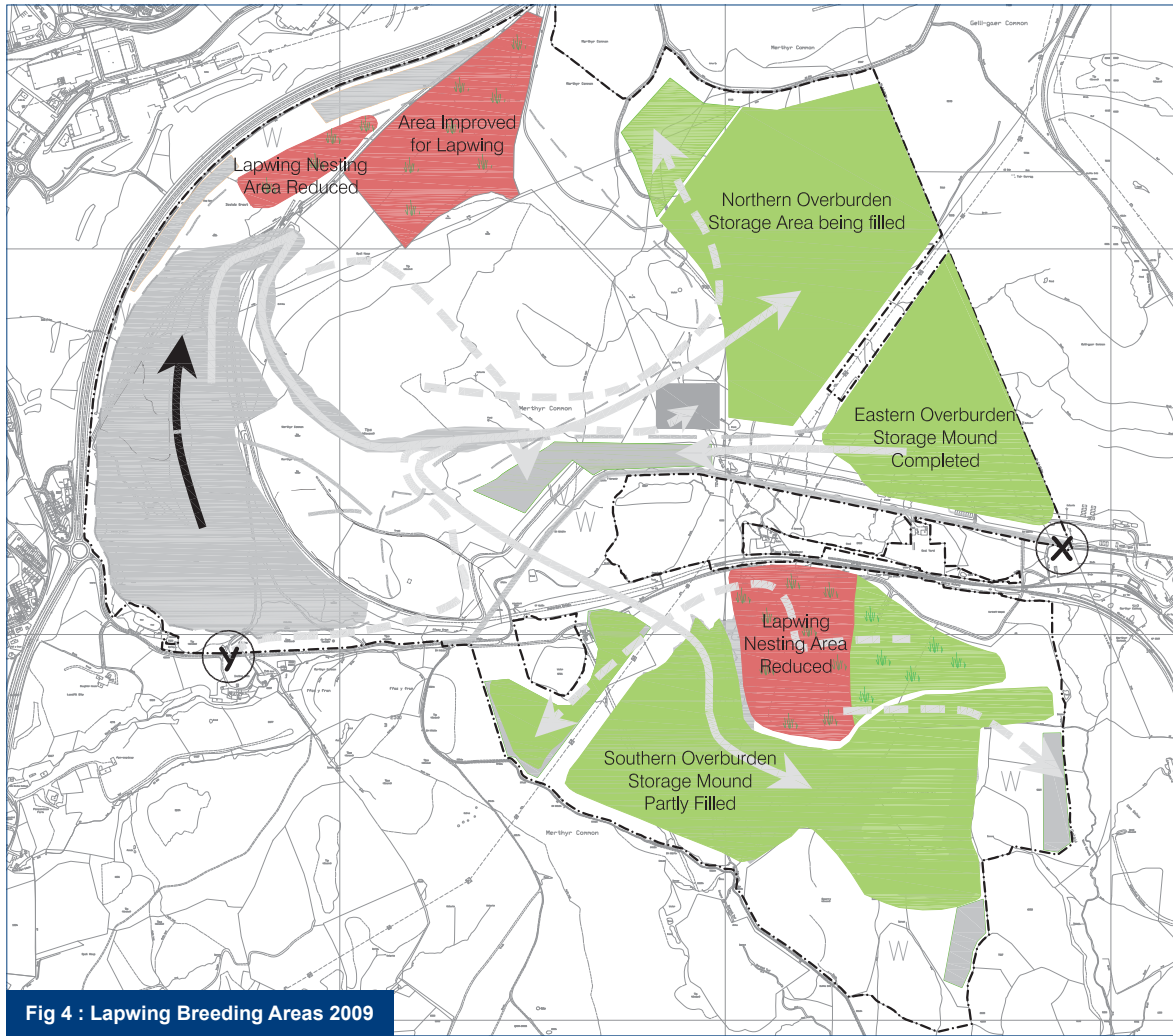
In so far as the Restoration Strategy forms part of the Environmental Management Plan for Phase 1 of the scheme approved under Planning Condition 42, these changes also represent revisions to that plan.

We look forward to your confirmation that this revision to the Restoration Strategy (and the Environmental Management Plan) is satisfactory.

Yours sincerely
for RPS Planning and Development

**Keith Jones
Senior Director
Environmental Sciences**

Cc	Norman Davies	Head of Planning MTCBC
	Camilla Smith	RSPB
	Steve Tillman	Miller Argent (London)
	David Mason	Miller Argent (Cwmbargoed)
	Kylie Jones	Miller Argent (Cwmbargoed)
	James Poyner	Miller Argent (Normanton)
	Roger Leek	Leek and Weston
	Brian Chilcott	RPS



- Legend**
- Lapwing Nesting Habitat
 - Site Boundary
 - Limit of Excavation
 - Direction of Working
 - General material or plant movement direction dashed where intermittent
 - Intermittent Movements to Relocate Tip 13, Hoover and Merthyr Tip Materials

Rev:	Date:	Amendment:	Name:	Checked:	

Source: -

Status: FINAL

Notes: Contractors are not to scale from this drawing. All dimensions to be checked on site and any discrepancies, ambiguities and/or omissions between this drawing and information given elsewhere must be reported to this office. If in doubt, ask.

RPS

Mallams Court 18 Milton Park Abingdon Oxon OX14 4RP
T 01235 838888 F 01235 820351 E rps@rpsgroup.com W www.rpsgroup.com

Client:-

Project: Ffos Y Fran - Land Reclamation Scheme

Title: Provision of Lapwing Habitat

Date: Dec 08 Scale: NTS Original Paper Size: A3

Drawn: AVG Checked: KJ Job ref: JR4533

Figure Number: 4-6 Rev: -

Lapwing Breeding Areas and Phasing of the Works

Revised January 2009

Year	Area				
	EMLRS Phase 2 Restoration	Ryan's Tip	Northern Overburden Storage Mound	Eastern Overburden Storage Mound	Southern Overburden Storage Mound
2006	The current breeding area to the east of the A4060 would not be affected	Previous breeding site and the adjoining grassland area to the east, would be made more attractive as lapwing breeding habitat by levelling of existing mounds of spoil, and creation of shallow scrapes during late summer			
2007	Lapwings (and other ground nesting birds) would be deterred from breeding in the southern section which would be excavated as part of the initial box cut. The northern part would remain undisturbed during the breeding season. From August onwards soil storage mounds and a water treatment lagoon would be constructed along the western margin alongside the A4060.	Lapwings would be encouraged to breed by use of decoys. This area would remain undisturbed during the breeding season.	Construction of the overburden mound would commence.	Construction of the overburden mound would commence.	
2008	Lapwings (and other ground nesting birds) would be deterred from breeding in a further strip of land which would then be excavated.	The area would remain undisturbed during the breeding season. Lapwings would be encouraged to breed by use of decoys.	Construction of the overburden mound would continue.	Construction of the overburden mound would continue.	Soils would be stripped over the western and southern parts of the overburden storage area.
2009	Lapwings (and other ground nesting birds) would be deterred from breeding in a further strip of land which would then be excavated. An additional area of land to the east of the Phase 2 area would be improved for lapwings early in 2009 in time for the 2009 breeding season.	The lapwing breeding area would be reduced in size through construction of the southern overburden storage mound. Lapwings (and other ground nesting birds) would be deterred from breeding in the area which would be affected. Lapwings would be encouraged to breed in the remainder of the area by use of decoys.	Construction of the overburden mound would be completed during 2009 and the mound seeded. The top of the mound would be prepared to provide lapwing breeding areas by provision of clay lined depressions (which would hold surface water) and scrapes. Application of organic matter, such as farmyard manure would be considered to encourage development of soil invertebrate populations.	Construction of the overburden mound would be completed during 2009.	Construction of the overburden mound would commence.
2010	Lapwings (and other ground nesting birds) would be deterred from breeding in the remainder of this area, including the land to the east of the Phase 2 area, which would then be excavated.	The lapwing breeding area would be further reduced in size through construction of the southern overburden storage mound. Lapwings (and other ground nesting birds) would be deterred from breeding in the area which would be affected.	Lapwings would be encouraged to breed in this area by use of decoys. Habitat management would be carried out as necessary	The top of the mound would be seeded and prepared to provide lapwing breeding areas by provision of clay lined depressions (which would hold surface water) and scrapes. Application of organic matter, such as farmyard manure would be considered to encourage development of soil invertebrate populations.	Construction of the southern overburden mound would continue.
2011 - 2019		The lapwing breeding area would be lost through completion of the southern overburden store. Lapwings (and other ground nesting birds) would be deterred from breeding in the area which would be affected.	Lapwings would be encouraged to breed by use of decoys. Habitat management would be carried out as necessary	Lapwings would be encouraged to breed by use of decoys. Habitat management would be carried out as necessary	The southern overburden mound would be completed.
2020			Lapwings would be encouraged to breed by use of decoys. Habitat management would be carried out as necessary	Lapwings would be encouraged to breed by use of decoys. Habitat management would be carried out as necessary	The northern part of the southern overburden mound would be removed and the area restored to provide a lapwing breeding area.
2021			Overburden would be removed and the area restored. Lapwings would be deterred from breeding in this area if necessary.	Overburden would be removed and the area restored. Lapwings would be deterred from breeding in this area if necessary.	Lapwings would be encouraged to breed by use of decoys. Habitat management would be carried out as necessary
2022					Habitat management would be carried out as required.

**Final Agreed
Revised Dates
22.5.07**

FFOS-Y-FRAN LAND RECLAMATION SCHEME

**Incorporating Extraction of Coal by Opencast Methods
Being the Final Phase of the East Merthyr Reclamation Scheme**

MERTHYR TYDFIL

Planning Application Number: P/03/0225

RESTORATION STRATEGY

Prepared in accordance with Planning Condition 50

by RPS Planning, Transport and Environment

in association with Leek and Weston Limited, Peter Brett Associates, White Young Green Planning, and International
Heritage and Conservation Management

May 2007

**Miller Argent (South Wales) Limited
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1.0 Introduction

- 1.1 The Ffos-y-fran Land Reclamation Scheme at Ffos-y-fran, Merthyr Tydfil, incorporates extraction of coal by opencast methods and is the final phase of the East Merthyr Reclamation Scheme. The site area is shown on Figure 1.

- 1.2 This report has been prepared to satisfy the requirements of Planning Condition 50 which states:

“No development shall commence until a Restoration Strategy for the restoration and management of the site has been approved by the Planning Authority. Such a scheme shall detail the sequence and phasing of backfilling and reclamation showing clearly their relationship to the working scheme and shall include appropriate landscape mitigation and restoration, taking into account the historic landscape character, features of ecological interest and intended after-use of the land.”

- 1.3 Section 2.0 of this report describes the Ffos-y-fran Land Reclamation Scheme site. Section 3.0 describes the working and restoration of the site, including the sequence and phasing of backfilling and reclamation in relation to the working scheme, landscape mitigation and restoration. Section 4.0 describes the strategy for stripping, storage and respreading of soils and soil forming materials, and establishment of vegetation. Section 5.0 explains how existing landfills within the site boundary will be managed as part of the site operations. Section 6.0 describes the existing ecology of the site and the measures which will be taken in relation to nature conservation through the working and restoration of the site. In section 7.0 the strategy for archaeology and the historic landscape is explained, and in section 8.0 the provisions for public access during working and restoration. Conclusions with respect to the restoration strategy are drawn in section 9.0.

- 1.4 This strategy sets out the principles of restoration. The site will be reclaimed progressively in accordance with the strategy as required by Planning Condition 51. A detailed Restoration Plan for each phase of the restoration will be submitted to the Planning Authority at least 6 months prior to the cessation of replacement of overburden in that phase. This Restoration Plan will show the final landform; soil profile characteristics for establishment of wildlife habitats and common grazing; specifications for soil placement and sources of soil or soil forming material to be replaced; details of watercourse and pond locations and construction, for that phase. The phases of working are shown in the Progressive Restoration Plans at Appendix A. The phases are as follows:

Phase 1	Preliminary operations (excavation of box cut)
Phase 2	Excavation to maximum void
Phase 3	Excavation to end of coaling
Phase 4	Final void restoration

- 1.5 The Restoration Plan for the completed site is shown on Figure 4

- 1.6 As required by Condition 53, an Aftercare Scheme for each phase of the restoration will be submitted for the written approval of the Planning Authority not later than 6 months prior to the completion of restoration of each phase. The After Schemes will provide details of vegetation establishment (including the nature and timing of any cultivations and stone picking operations; content and origin of seed mixtures; proposed seed rates and timing of sowing; and any proposed fertilizer and lime rates based on the results of soil analysis), vegetation management (including the timing and frequency of cutting and proposed grazing regime), tree and hedge establishment (including ground preparation; planting details including species, type of stock, establishment methods, planting density and timing; and maintenance

including beating up, weed control, fertiliser application, protection from grazing animals and pruning/thinning) and monitoring which may be required..

The East Merthyr Reclamation Scheme

- 1.7 The East Merthyr Reclamation Scheme was the initiative of the former Merthyr Tydfil Borough Council and Mid Glamorgan County Council and has sought to reclaim the derelict land to the east of Merthyr Tydfil by way of opencast coal mining operations, restoring the land to beneficial use at no cost to the public purse. The scheme is included in the current local plan. Phases I and II of the scheme have been implemented and the 'Ffos-y-fran Land Reclamation Scheme' will complete the Scheme. The Application Area, together with the previous Phases of the East Merthyr Reclamation Scheme are shown on Figure 2.
- 1.8 Whilst planning consent for Phase III was granted in November 1988, the then permitted scheme would not have dealt with all the dereliction in the area and would have sterilised as large a reserve of coal as it would have won. It was therefore proposed in 1994 that the scheme be revised to recover the larger proven reserve in line with government guidance, whilst simultaneously addressing a number of environmental concerns not originally addressed in the Phase III proposals. The revised scheme was referred to as "Phase IIIA" and it is the area of this proposal that is reflected in the local plan. However, the planning application was withdrawn in May 1999 in the run up to a compulsory purchase inquiry.
- 1.9 The Ffos-y-fran Land Reclamation Scheme has been designed to replace the previous Phase IIIA proposal whilst fully addressing the more stringent environmental requirements of the present day.

The Ffos-y-fran Land Reclamation Scheme

- 1.10 The extent and setting of the Ffos-y-fran land Reclamation Scheme are shown on Figure 3. The site occupies high ground approximately 1.5 kilometres to the east of Merthyr Tydfil town centre and comprises mainly urban common land forming part of the Merthyr & Gelligaer Commons at levels between 280m and 450m above Ordnance Datum (AOD). It is bounded to the north-west by the recently re-aligned A4060 trunk road, to the north-east by the Trecatti refuse void, to the east by the Unitary Authority boundary between Merthyr Tydfil and Caerphilly, to the south-west by the Mountain Hare to Fochriw Common road (the 'Bogey Road'), extending approximately 1km to the south of the 'Bogey Road' and to the south west of the Cwmbargoed to Treharris mineral railway line.
- 1.11 The purpose of this document is to explain the progressive restoration strategy which has been developed for the Ffos-y-fran Land Reclamation Scheme, as required by Planning Condition 50. In doing so it draws on the relevant sections of the Environmental Statement which accompanied the Planning Application.
- 1.12 Restoration is an integral part of the working of the site and there is no distinct operational separation between the extraction of coal by opencast methods, which would finance the scheme, and the progressive restoration of the site. However, this document seeks to explain the measures which will be adopted to achieve the satisfactory restoration of the surface of the site. The proposed restoration seeks to achieve a balance between a number of sometimes conflicting interests, in particular agriculture, Rights of Common (including commoners' rights and the public right to walk the urban common for air and exercise), landscape, nature conservation, cultural heritage and recreation.
- 1.13 It is recognised that there can be conflicts between the interests of agriculture and nature conservation, and that this has been a problem of commons management in the past, both on the Gelligaer and Merthyr Commons, and on many other upland commons. However, it is important that a suitable grazing regime is achieved

across the site both in the short and long term. It is of course the case that the developer has control over the land which will revert to the Common for the operational and aftercare period only. The developer has limited control over the Common Land once handed back to the Commoners. However the operational period is for some 17 years, and over that time there is the opportunity to establish habitats of nature conservation value, whilst still addressing the needs of the commoners whose grazing rights will be reinstated on completion of the scheme.

- 1.14 It is also recognised that the recent Gelligaer & Merthyr Commons Management Plan has been written in line with DEFRA's recent consultation on The Agricultural Use and Management of Common Land, which is anticipated to influence legislation relating to Commons in the future. The Single Farm Payment, which was launched on 1st January 2005, and the enhanced suite of agri-environment schemes is expected to have an impact on grazing regimes, influencing the type and numbers of livestock grazing land.
- 1.15 Therefore, in the long term, it is anticipated that grazing regimes will become more beneficial for biodiversity and that the parts of the Ffos y Fran site, when returned to Common land, will be managed in a way which is more appropriate to conservation management for biodiversity than has been the case in the past.
- 1.16 An Environmental Management Plan will be prepared for each phase of the development and submitted for approval, as required by Planning Condition 42, and implemented for the Ffos-y-fran operations. This will include the requirements for mitigation of environmental impacts. The plan will form an integral part of the contract for the operations and will be prepared in sufficient time for its requirements to be taken into account by those tendering for the work. Environmental specialists will attend pre-works meetings to ensure that the contractor is familiar with site conditions and environmental compliance requirements. All site personnel will be made familiar with the environmental requirements of the works at induction courses and tool-box talks, as necessary.
- 1.17 Site works will be monitored by an Environmental Liaison Officer who will call on the project's environmental specialists, where necessary, to ensure that the environmental requirements are fulfilled.
- 1.18 A Technical Working Group will be established. Representation will be invited from Merthyr Tydfil County Borough Council, the Welsh Assembly Government Technical Services Division, the Environment Agency, the Countryside Council for Wales, CADW, and the Gelligaer and Merthyr Commoners Association, together with Miller Argent and the main contractor, to provide advice as and when required throughout the duration of the scheme and aftercare period.

Consultations

- 1.19 During preparation of this strategy, the following organisations have been consulted:
- Merthyr Tydfil County Borough Council
 - Countryside Council for Wales
 - Environment Agency
 - CADW
 - Glamorgan and Gwent Archaeological Trust
 - Welsh Assembly Government Department for Environment, Planning and Countryside (Agriculture Section)
 - Gelligaer and Merthyr Commoners Association
- 1.20 The Merthyr Tydfil Biodiversity Partnership was also consulted. The full Biodiversity Partnership membership was invited to comment on the strategy following a presentation to the partnership by Miller Argent (South Wales) Limited, and the comments received were collated by Merthyr Tydfil County Borough Council.

2.0 The Existing Site

Introduction

- 2.1 The site comprises three main areas:
- The Western Shoulder
 - The Open Moorland
 - Bryn Caerau Farm Area
- 2.2 The first two areas broadly represent the land which lies within the previously consented Phase III of the East Merthyr Reclamation Scheme.

The Western Shoulder

- 2.3 The area of the site to the north-west of the abandoned route of the former A4060(T) remains not fully restored following Phase II of the East Merthyr Reclamation Scheme in the expectation that Phase III would follow.
- 2.4 From the line of the former A4060(T) to the top of the shoulder of high ground to the west of the reclaimed Trecatti opencast site, the site is characterised by old re-vegetated colliery shale tips. Extensive areas of the old re-vegetated mine spoil tips to the west of the disused railway, which runs southwards from the former A4060(T), have been over-tipped with mine waste from former tip washing operations. The landform steps down in a series of irregular terraces towards the west. The new A4060(T) roundabout at Mountain Hare has cut into the base of the westernmost spoil tip. Whilst vegetation is present on the older spoil tips, the newer 'Ryan's' tips remain largely unvegetated and are being actively eroded at their margins.
- 2.5 To the east of the disused railway line are two areas of recent spoil tipping. The first is immediately to the south of the former A4060(T). This area was tipped with mine waste from the Merthyr Vale colliery spoil tips. It is a long terraced landform with a flat top, and whilst it has been grass seeded, the quality of the sward it supports is poor. A small valley has been left between this spoil tip and the natural ground that rises to form the ridgeline overlooking Merthyr. To the south-east of this valley there is another area of spoil resulting from tip washing. This spoil tip is also unvegetated and eroded. The other area of tipping to the east of the old mineral railway line is a former local authority landfill site close to the Bogey Road. This area does not rise above adjacent ground levels, but forms a somewhat unnatural terrace where the land would otherwise slope naturally towards the valley running to Cwm Blacks Farm.
- 2.6 From these tip areas and the disused railway line the natural ground rises to the ridgeline overlooking Merthyr. This landform is characterised by re-vegetated surface mine workings along the outcropping coal bearing strata. The area also has a number of old crown-holes resulting from former collapses into shallow underground working voids. This gives the hillside an irregular appearance, set above the prominent level terraces formed by the tips and railway embankments and tracks, although most of the workings are not readily visible from the settlements below. The top of the ridgeline is characterised by 17th-19th century shallow opencast ironstone workings and is now used by motorcycle scramblers. This area is well vegetated, except where scarred by the motorcyclists and by access tracks driven for coal prospecting operations.
- 2.7 There are three former refuse landfills in this area that are understood to contain both household and industrial waste. They are commonly referred to as 'Landfill Tip 13', 'Hoover Landfill' and 'Merthyr Landfill'. Landfill Tip 13 and the Hoover Landfill are to be completely excavated and dealt with during the proposed scheme. Part of the Merthyr Landfill which lies within the excavation area will also be removed. However, the south eastern part of this landfill will be capped and will remain.

The Open Moorland

- 2.8 The second area has been defined as the open moorland to the north and west of Cwmbargoed. To the north of the Bogey Road the landscape is typically bleak and exposed, consisting of unimproved acid grassland and areas of marshy flushed acid grassland in wetter parts. There are small ponds, small colliery spoil heaps, ditches, old fence lines and telegraph poles, together with a number of old building bases and foundations along the edge of the road. A haul route, built to link Phase II of the East Merthyr Reclamation Scheme to Cwmbargoed Disposal Point, runs parallel to the Bogey Road. To the north, man-made ponds have been formed behind earth dams. The water levels of the ponds vary throughout the year leaving bare and somewhat barren 'beach' areas at their upper edge. Some of the earth dams have been breached leaving a redundant landform that is typically incised by an eroded gully. This landscape is dominated by the National Grid 400kV overhead pylon line that crosses the area in a north-east/south-west direction.
- 2.9 The Bogey Road varies in width and condition, with sharp bends and steep changes of gradient. It passes between the tips at the western edge of the site and crosses over the disused mineral railway line on a very narrow single carriageway bridge, before entering a steep hairpin bend enclosed by recently formed earth bunding.
- 2.10 On the open higher ground the road is aligned in straight sections which follow the local irregularities in contour. The edge of the road is disturbed where vehicles have overrun its edge. A series of simply constructed passing places have been added. Extensive fly-tipping occurs along the length of this road.
- 2.11 Part of the former Trecatti opencast site, is included within the northern part of the site to the south of the landfill void. This reclaimed area, with its simple landform and gentle gradients, forms a discordant element within the overall mixed character of the open moorland area. It is a rather exposed area of land set to improved pasture with no shelter or enclosure.
- 2.12 To the south of the Bogey Road the land falls gently southwards to the disused railway. This corridor and the strip of land beyond it have a disturbed urban fringe character with a number of scattered buildings of varied styles, tips and man-made ponds. Much of this area is excluded from the scheme in recognition of the archaeological and nature conservation interests of the area.
- 2.13 To the south of this corridor there is a large area of tipping, which extends between Isaac Morgan Cottages and Tai Cwmbargoed. It occupies the spur of land between two small tributary streams of the Bargod Taf and extends close to the edge of the site boundary along the access road to Bryn Caerau Farm. The landform of this spoil tip is artificially elevated, irregular and unvegetated with a large pond on one of its upper terraces and smaller ponds at its edges, some of which are of ecological value.
- 2.14 To the south of Tai Cwmbargoed, extending between the northern part of this spoil tip and the northern limit of Cwm Golau to the east, is a flat-topped spoil tip with steep sides. At one time this formed part of the adjacent working, but has now been grassed and is used for grazing.
- 2.15 To the west of the spoil tip between Isaac Morgan Cottages and the Bryn Caerau Farm access road is an area of open moorland. This is crossed by an old incline which used to serve Pen-y-Darren pits in the valley bottom to the west of the track leading to Bryn Caerau farm. At the top of the incline is the now derelict Incline Top House together with its enclosures and access track.
- 2.16 There is also an almost square shaped man-made pond which formed part of the Dowlais Free Drainage System. The pond and some nearby associated leats and drainage channels have been designated a Scheduled Ancient Monument (SAM), the

Sarn Howell Pond and Watercourses, consisting of three separate areas of interest (see Figure 3). This has been excluded from the scheme.

- 2.17 There is a small spoil tip south of the Bogey Road at the western edge of the site area which forms part of the Ffos-y-fran spoil tips further west. Fly-tipping currently takes place at the highpoint of the track leading south from the Bogey Road near this boundary. The overhead power lines cross this area.
- 2.18 Further to the south-east and south of the Ryan's Tip, an Iron Age Settlement lies immediately adjacent to the Bryn Caerau access road. This was discovered during site investigations for the Ffos-y-fran Land Reclamation Scheme. The site, although within the planning application area, has been excluded from the working area.

Bryn Caerau Farm Area

- 2.19 The third landscape area includes the northernmost extension of the valley landscape of the Bargod Taf. Bryn Caerau Farm is located at the southern apex of Garth Fawr, the main spur of land which forms this part of the site. The farm is located at approximately 285m AOD at the confluence of the Bargod Taf and Nant Gyrawd, in a well wooded and little disturbed setting. The site boundary crosses this main spur at approximately 325m AOD before dropping into Cwm Golau and rising again to the railway line to the northeast. The site boundary is approximately 400 metres from Bryn Caerau Farm.
- 2.20 A pattern of fields extends from Cwm Golau to the north of Bryn Caerau Farm. The Nant Gyrawd, which flows south within Cwm Golau, enters a narrow gorge clothed with broad-leaved woodland that extends up to the 320m contour within the valley bottom. Broad-leaved trees and shrubs form field boundaries which radiate from this central core. Due to the nature conservation interest of this wooded valley, it has been excluded from the scheme and lies east of the site area.
- 2.21 The remnant hedgerows to the west of the valley are discontinuous and fragmented. The field boundary trees diminish in size and number with increased elevation and exposure. Improved upland grazing fields also extend from this central core and from the south, with pasture and rough grazing on the higher more exposed ground.
- 2.22 The main area of sheltered fields with wooded boundaries lies to the south of the site and the landscape becomes increasingly wooded further south within Cwmbargoed. Only the northern limits of the fields are within the site boundary where shelter is provided by broken sections of remnant hedgerow and occasional individual trees. Beyond the remnant hedgerows, the open fields on Garth Fawr have an exposed character. There is a low area at the head of Cwm Golau which is poorly drained rough grazing land.

3.0 Working and Restoration

- 3.1 The Ffos-y-fran Land Reclamation Scheme comprises the final phase of the East Merthyr Reclamation Scheme. 317ha of the 367ha of Derelict Land Sites DL14, DL15 and DL52 of the Priority Reclamation Programme identified in Policy GR2 of the adopted Merthyr Tydfil Borough Local Plan will be reclaimed at no cost to the public purse. The other 50ha (which was excluded from the application) consists mainly of the Scheduled Ancient Monument areas (shown on Figure 3), and the area to be retained as the Central Ecological Area area between the Bogey Road and the mineral railway. Whilst identified as derelict they are of archaeological and ecological interest and are to be preserved. The proven reserve of some 10.8 million tonnes of recoverable coal will be comprehensively worked by a programme of opencast mining operations followed by the progressive restoration and aftercare of the land.
- 3.2 In working the coal reserves, excavations will encounter and remove the derelict shafts and adits that occur on the western flank of the site. Within the excavation area, there are 52 known shafts and 39 known adits associated with previous iron ore and coal workings in this area. 3 of these recorded shafts and 3 adits have already been excavated during working of Phase 2 of the East Merthyr Reclamation Scheme. There are a further 9 shafts and 18 adits within the site, many of which will need to be stabilised as part of the works. These account for almost all the identified derelict mine workings remaining at East Merthyr, though other unrecorded shafts, adits and old workings are likely to be present within the working area.

Existing Land Use

- 3.3 Some 342.7ha of the site has been classified as being in agricultural use. This consists of enclosed permanent pasture in the south west, common rough grazing in the east and centre of the site, rough grazing on old tips in the west and an area of a restored opencast coal site (Trecatti) in the north.
- 3.4 The common land is grazed by stock belonging to the Gelligaer and Merthyr Commoners; the stock consists mostly of sheep with some cattle and horses. Stocking rates are generally high on both the common and the restored Trecatti land. Stock will be removed and common rights suspended for the duration of the reclamation scheme.
- 3.5 The enclosed permanent pasture in the south east, Bryn Caerau, is mostly grazed by sheep. The land has been generally improved.
- 3.6 The remaining land consists of non-agricultural land, urban land, open water and other unclassified land.
- 3.7 A further area of non-agricultural land comprises poorly restored refuse landfills constructed by the former Merthyr Tydfil Borough Council, now returned to the common for grazing.

Contaminated Land

- 3.8 Three former waste disposal landfills associated with the former Merthyr Tydfil Borough Council, the Hoover Factory and other unknown sources are known to lie within the western sector of the site. Apart from the eastern section of the Merthyr Landfill, which lies immediately north west of the Bogey Road bridge over the disused mineral railway line, these will be removed during opencast operations, sorted and treated. It is anticipated that most of the waste will be suitable for recycling to an engineering specification and will be used for engineering works (such as road construction) within the site. Residual waste (non-inert material) which cannot be so used will be removed from the site and disposed of to the nearby licensed landfill site.

Any hazardous material will be removed for disposal off site at suitably licensed facilities.

Land Use after Restoration

- 3.9 The primary land use proposed on the restored site will be to return it to its former use as urban common land for stock grazing, with public access for air and exercise. Bryn Caerau Farm will be returned to agricultural use, where disturbed, and nature conservation measures will be incorporated throughout the restoration scheme. The site will be predominantly restored to grassland and moorland vegetation associated with the open areas of the common, with particular attention being given to re-instating the acid grassland presently adjacent to the Tair Carreg Moor Site of Interest for Nature Conservation (cSINC) that is located outside the eastern boundary north of the Bogey Road. The final distribution of land uses across the site, however, will be dependent upon the soil and soil-forming resources available.
- 3.10 There is a limited amount of soils across the site, much having been destroyed by the old mining activities and/or buried beneath spoil tips. It has been estimated that, in order to satisfactorily restore the land, an additional 1.6 million tonnes of suitable soil or soil-forming material is required. Opencast operations will provide a unique opportunity to recover such volumes of suitable soil-forming material from below ground level, enabling the efficient and comprehensive restoration of the site. It is proposed that the majority of the restored land will be used for upland grazing as urban common land as illustrated on the restoration plan on Figure 4.

Phased Working and Restoration

- 3.11 The restoration scheme will work progressively from south to north across the site in accordance with this strategy as required by Planning Condition 51. The duration of the scheme will be determined by the annual rate of coal production, which in turn is determined by the sales contract with the end user for the coal. The optimum annual output for the safe and efficient operation of this Scheme is between 750,000 and 1 million tonnes of coal per year.
- 3.12 Detailed restoration plans for each phase of the scheme will be submitted for the approval of the Planning Authority at least six months prior to the cessation of the replacement of overburden in that phase. The plans will show the final landform details, soil profile characteristics for establishment of wildlife habitats (including woodland and wetland areas) and common grazing; details of soil placement and sources of soil or soil forming material to be replaced; details of watercourse and pond locations and construction; and all necessary agricultural facilities for that phase, and will include written specifications.
- 3.13 The proposed restoration profile for the site is shown on the Restoration Plan (Figure 4). Drawings numbered A1, A2, A3 and A4 in Appendix A show the progressive restoration of the site. As can be seen from these drawings, the site will be progressively restored after the completion of the initial Box Cut. Based on an extraction rate of 1 million tonne of coal per year, some 26 ha will have been restored at the end of Phase 2 (approximately 6 years after the start of excavation), 68 ha at the end of Phase 3 (after approximately 12 years), and 146 ha at the end of Phase 4 (after approximately 13 years). The remaining 255 ha will be restored within the following two years.
- 3.14 Plans A1-A4 in Appendix A illustrate the progressive implementation of the restoration during the four main phases of operation. In Phase 1 the preliminary works to prepare for coal extraction would be carried out, during which no restoration would be feasible.
- 3.15 Restoration would commence in Phase 2. The landform would be re-established in the western-most part of the site and along the edge of the site bordering the western

section of the Bogey Road. An initial area of woodland planting would be established along the boundary with the A4060. A baffle mound constructed to mitigate potential noise impacts on the nearby settlement would be retained in the west of the site, until the final phase of restoration. The direction of working and therefore of restoration, allows the area closest to the nearby settlements to be restored first, so that even the relatively limited area to be restored in Phase 2 would have an immediate effect and provide a foreground in views from the west of the continuing operations.

- 3.16 During Phase 3 backfilling after extraction will allow the areas of restored land in the west to extend eastwards. As haul roads between the extraction area and the southern overburden mounds were reduced to one route, an additional area between Bogey Road and the main east-west haul road may be restored, and a further area of woodland established in the west of the site. The eastward progression of restoration would continue through Phase 4, including extension of the woodland planting.
- 3.17 The major part of the site restoration would be carried out after coaling had ceased, with the return of the stored overburden to the final void, restoration of the lands occupied by the overburden mounds, the soil storage mounds, the water treatment areas, haul roads, and plant and offices. Water treatment areas, where appropriate, would be restored as ponds and wetland, and watercourses, new ponds and reservoirs formed. The footpath network would be laid out in this final phase also. The progress of habitat establishment and of conservation of heritage features is outlined in Sections 6 and 7 respectively.
- 3.18 The final profile, although based on the restoration plan at Figure 4, may have to be amended throughout the working of the site due to any fluctuation between the actual levels of bulkage and coal volumes extracted, and those anticipated. Regular surveys will be carried out to check the balance of the quantities excavated and the material available for restoration, to ensure that the final restoration scheme balances, i.e. to ensure that neither a void nor a dump is left at the end of working.
- 3.19 After the completion of coaling, overburden restoration will take approximately 24 months to complete. The southern overburden dump will be restored first, followed by the north eastern and north western dumps.

Soil Placement

- 3.20 On completion of overburden restoration, the remaining soil forming material, subsoil, and topsoil in store, will be restored to complete the restoration stage of the site. Soils can only be re-spread when weather conditions are suitable, generally between April and September, and because of this, if sufficient time is not available to complete the restoration of these soils in a particular season then the final restoration will be delayed until the following year. Soil resources on site are very limited and soil-forming material won from the excavation area will be utilised to make up any shortfall.
- 3.21 Soils stripped from areas of particular ecological interest will be stored separately and restored to specific locations identified for their re-instatement. In particular, the soils adjacent to the Tair Carreg Moor Site of Importance for Nature Conservation (SINC) will be re-spread over much the same location to provide the basis for creation of a similar wet acid grassland. In restoring this area, clay bunds and contour ditches will be constructed to retain water within the soil profile where required.
- 3.22 A number of the water treatment areas will be retained throughout the restoration and aftercare stages of the site. These areas will act as storm storage “buffer” zones, controlling water discharge off site until natural retention is established in the restored landform and vegetation cover over the period of the aftercare.
- 3.23 As shown on the restoration plan (Figure 4), some of the residual water treatment areas could be converted into permanent water features on completion of the

aftercare as part of the final restoration scheme. Prior to the removal, or otherwise, of the water treatment areas, all accumulated silt will be removed and disposed of on site (either buried, or spread and dried, and used as soil forming material if appropriate and suitable). The design of these features will be discussed with the Environment Agency.

- 3.24 Nature conservation interest and habitat creation will be incorporated as a feature of the reinstated landscape. Areas of conservation value that lie within adjoining land and within the site boundary, but which will not be affected by the working operations, will be protected and managed to retain and enhance their archaeological and nature conservational value.

Aftercare

- 3.25 An Aftercare Scheme for each phase of the restoration will be submitted for the approval of the Planning Authority not later than six months prior to the completion of restoration (including soil spreading) of each phase as required by Planning Condition 53.
- 3.26 The Aftercare Schemes will provide details of vegetation establishment (including the nature and timing of any cultivations and stone picking operations; content and origin of seed mixtures; proposed seed rates and timing of sowing; and any proposed fertilizer and lime rates based on the results of soil analysis), vegetation management (including the timing and frequency of cutting and proposed grazing regime), tree and hedge establishment (including ground preparation; planting details including species, type of stock, establishment methods, planting density and timing; and maintenance including beating up, weed control, fertiliser application, protection from grazing animals and pruning/thinning) and monitoring which may be required..
- 3.27 The programme of maintenance and aftercare will follow the restoration of the working areas; this will be carried out for a period of 5 years after the restoration works are satisfactorily completed as certified by the LPA. Particular attention will be paid to grazing control, appropriate fertiliser application, soil structure development and drainage necessary to achieve the range of wildlife habitats and the standards of agricultural land required by the local planning authority and the Agricultural & Rural Affairs Department of the National Assembly for Wales.
- 3.28 The Aftercare Schemes will recognise the need for careful control of vegetation establishment in areas where nature conservation is the priority. In these areas suitable habitat conditions will be achieved through sensitive reinstatement (including soil replacement, seed mixtures and grazing regimes). In these areas fertilizer will not be applied unless this is essential for the satisfactory establishment of vegetation, and only with the written approval of the Planning Authority. Across the wider site, the aim of aftercare will be to encourage the development of biodiversity in association with agricultural use, and aftercare management will reflect this objective. In particular use of fertilizers will be carefully controlled.
- 3.29 Weed control will be undertaken in accordance with the guidance provided in English Nature's *Herbicide Handbook – Guidance on the Use of Herbicides on Nature Conservation Sites*.
- 3.30 Since the Common Rights will be suspended during the working of the scheme, management, including any fencing which may be required, will be entirely in the control of the operator.
- 3.31 Monitoring of restored areas will be implemented during the aftercare period. The scope of monitoring will be agreed with the LPA. In addition to species specific monitoring of great crested newt (as required by the WAG Licence) and breeding lapwing, other monitoring may include assessment of vegetation establishment, surveys of breeding birds, terrestrial and aquatic invertebrates.

- 3.32 As explained at paras 6.6 and 6.11, management plans for retained areas of nature conservation interest at Cwm Golau and the central ecological area, between the Bogey Road and the railway line, will be prepared and implemented following commencement of the scheme. These management plans will specify requirements for monitoring of habitats and species. Monitoring of vegetation, hydrology and hydrogeology of the Tair Carreg Moor SINC to the east of the site has commenced, in accordance with a methodology agreed with Caerphilly County Borough Council, and will continue for the duration of operations.
- 3.33 Following implementation of the works, and at the same time as the management plans for the retained areas of nature conservation interest, a Biodiversity Map will be prepared for the completed scheme, identifying the biodiversity enhancements which are expected to arise as a result of the restoration. This will serve as a tool for monitoring habitat changes and species occurrence as the restoration proceeds, and for ensuring that the restoration scheme achieves its objectives. Species specific monitoring, and assessment of vegetation establishment, during the aftercare period will also be specified.
- 3.34 On completion of the 5 year aftercare period, and provided that the land has been restored to a standard acceptable to the local planning authority, fences will be removed and the site will be returned to Common, Agricultural Tenants, or other Landowners, as required to meet any legal constraints or agreements.

The Restoration Plan

- 3.35 The restoration plan has regard to Merthyr Tydfil County Borough Council's objectives and policies for the landscape. In particular the following objectives have been adopted:
- i. The restoration design aims to develop a range of landscape character appropriate to the different parts of the site, and to integrate it with the surrounding landscape
 - ii. The northern and north-western slopes are part of the landscape setting of Merthyr Tydfil, and their restoration treatment aims to enhance that setting.
 - iii. The project includes restoration of public access routes. Their enjoyment will be enhanced through improved signage and information, and indications of routes linking places or providing circular walks.
- 3.36 The Environmental Statement provided a broad scheme upon which the Restoration Plan has been based (Figure 4). The restoration design is described by reference to the proposed landform and drainage pattern, the vegetation to be established, features to be incorporated and access. A key aim of the proposals is to produce a varied surface giving areas of light and shadow, and texture and grain to the landscape. It includes "macro features", such as valleys and stream courses, and minor variations in terrain, soil depth, drainage and micro-climate. Such "micro" features are frequently absent from older reclamation sites, and will support the aim of developing variety, by providing suitable conditions for different habitats. Some of the larger features, such as main watercourses, will be designed-in and constructed during overburden placement. Smaller features, such as small ponds, scrapes and hedgebanks will be constructed during or after soil placement. The use of bio-engineering techniques, for example as an alternative to stone lining of drainage channels, will be considered.
- 3.37 The detailed restoration proposals for the phases of the Ffos-y-fran Restoration Scheme will provide full specifications for such features in the form of drawings and written specifications.

Previous Restoration Experience in South Wales

- 3.38 Appendix B contains a photographic record over the past 8 years of the restoration of opencast coal sites across South Wales. Several of the sites had already been restored for some years at the time of the earliest of the photographs, in 1997, and some are currently under restoration, demonstrating the latest restoration techniques. The sites illustrated represent both lowland and upland sites, with restoration to a range of after-uses comprising agriculture, nature conservation or amenity. These examples show how similar techniques and features to those proposed at Ffos-y-fran have been successfully implemented elsewhere.
- 3.39 At Parc Slip, to the west of Aberkenfig near Bridgend, restoration aftercare was completed in 1992. It is now a nature reserve, managed by, and the headquarters of, the Wildlife Trust of South and West Wales. The main features of the restoration were lakes and ponds with associated wetland, and rushy and wildflower meadows. There are also areas of woodland and hedgerows. The area is accessible to the public, and provided with footpaths and seating areas.
- 3.40 At Llanilid West, where coaling ceased in 1997 and restoration aftercare is still in progress, the restoration is to agricultural fields with hedgerows. Early experience in restoring hedgerows, which did not establish successfully, led to the adoption of alternative approaches as work progressed to trial different techniques.
- 3.41 At Banwen, an upland site to the north of Glyn-neath, aftercare ceased in 1998. Restoration included marshy grassland, ponds and water courses.
- 3.42 Coaling is still in progress at Nant Helen opencast site, further to the north of Banwen near Abercraf, but restoration of earlier phases is being carried out progressively. This is also an upland site, rising to 285m AOD. As well as extensive areas of open common upland grassland, as is proposed at Ffos-y-Fran, ponds, streams, wetland and heather bog have also been successfully restored.
- 3.43 Coaling ceased at Brynhenllys in 2003, but restoration commenced on previous phases in 1996, mainly to enclosed agricultural land and woodland, with areas of marshy grassland.
- 3.44 The photographs show not only successful establishment of a range of restoration types, they also illustrate how manipulation of landform and ground conditions on a small scale within the overall strategy can produce variations of vegetation, such as rush colonised depressions, which add diversity and visual interest.

Landform

- 3.45 The landform of the restored site will reflect that of the surrounding hillsides, with an overall gently rounded form, with smaller-scale variations. The land will rise from a low point of about 286m AOD at Mountain Hare roundabout in the western-most point of the site to a rounded dome at about 400m AOD. The A4060 defines the north-western boundary, which rises to 352m AOD at the northern-most point of the site. A distinct valley feature will separate the dome from the land rising to the boundary with Trecatti and Tair Carreg Moor in the north and north-east of the site. To the east and south of these main landform features, the restored land will fall gently to the Bogey Road.
- 3.46 South of the Bogey Road, the restored landform is governed to the north by the retained and undisturbed areas in the central area. To the south of the mineral railway, it will rise to a low east west ridge to the east and form a north-south valley in the centre, similar to the current Bargod Taf valley. To the west the land will rise slowly from the valley to the Sarn Howell Pond, which is to be retained undisturbed. In the south of the site, the landform is to be restored to similar levels to the existing.

- 3.47 Within this broad landform structure, variations are introduced. As noted in the Environmental Statement, the north-western part of the site is characterised today by the line of the former railway that linked Cwmbargoed with Penydarren and Dowlais. In this north-western area, the lines of the former railway and A4060 are to be retraced by proposed public paths, and the overall landform will be modified to produce a terraced effect, to allow the line of the former railway to be “read” in views to the site. The landform is further modified in the north-eastern and north-western areas to accommodate small valleys for watercourses and ponds. As explained above, the larger features will be constructed during overburden placement, and smaller features during or following soil placement. Full detail of the proposed construction and materials to be used in such features will be provided in the detailed restoration plans.
- 3.48 Examples of the introduction of such features in a restored landscape are shown in Photographs 29, 31, and 32 of Appendix B.

Drainage pattern

- 3.49 The landscape restoration plan shows the main surface/storm water drainage proposed. The watercourses will be varied in detail to include cascades, which could be formed in block stone recovered during the operations, and used to line the new watercourses where necessary. Examples of such cascades are shown at Photographs 11 and 30 of Appendix B. Stone used in creation of watercourses will be locally sourced and of appropriate size to encourage habitat creation for aquatic invertebrates. Ponds will be introduced where feasible or necessary to slow water speeds in the watercourse and provide variations in aquatic habitat. Such a watercourse with ponds is shown in Photograph 32 of Appendix B.
- 3.50 Streams will drain the western and north-western areas, to ponds, before linking into the surrounding watercourses. In the north-eastern area and on the eastern flank of the domed hill in the west of the site, the drainage system proposed is in the form of leats and reservoirs similar to those of the Dowlais Free Drainage System, a large section of which survives on Tair Carreg Moor. The drainage channels, or leats, in the east of the site will be linked with those in Tair Carreg Moor or to those in the central area, restoring the existing pattern of drainage. Flows of watercourses draining the site would be ameliorated through ponds or cascades as necessary to prevent adverse impacts on the receiving watercourses.
- 3.51 A stream will follow the valley in the central area, connecting with the Bargod Taf on the south-western boundary, west of the iron Age Settlement, with a tributary draining the eastern ridge.
- 3.52 New ponds are proposed in the locations of the water treatment areas for the operational phase of the reclamation scheme by modifying the form of the water treatment areas. The pond margins, and water depths within these areas, will be designed to provide for the successful establishment of diverse habitats, including marsh and bog habitats. For ponds, established good practice is to form a shallow sloping margin, about 15m wide, with deeper water beyond, and an indented shoreline composed of irregular bays. This approach provides a variety of conditions to allow the establishment of a progression of marginal and aquatic vegetation which in turn provides food and cover for a variety of fauna. A range of suitable aquatic and marginal plant material will be sourced from other ponds within and adjacent to the site and introduced into the new ponds. The design of these features will be discussed with the Environment Agency. Examples of similar ponds are shown in Photographs 1, 3, 9, 10, 12, 28 and 33 of Appendix B.
- 3.53 The ponds in the north-eastern part of the site, will have retaining earthworks on their downhill sides.

Vegetation

- 3.54 The majority of the site is to be restored to upland grassland suitable for common grazing. The techniques for soil distribution and seeding are described in section 4. On the shallower slopes north of the Bogey Road, the soils and the after care will produce a substantial area of acid grassland, while on the eastern boundary with Tair Carreg Moor, an area of wet heath is to be established, as a continuation of the vegetation of the adjacent moor (which is a Site of Interest for Nature Conservation). As explained in section 4, soils originally stripped from this area will be replaced within areas confined by clay bunds which will serve to retain water in the same way as the existing contour ditches in this area. The area of acid grassland to the south of the wet heath will include features designed to retain water and provide a mosaic of wet and dry habitats. Seed of Welsh provenance will be used in re-establishment of vegetation in this area of wet heath, unless found to be not practicable and with the approval of the Planning Authority.. The practicability of using locally sourced seed is being investigated and the Planning Authority will be advised on the progress and outcome of these investigations.
- 3.55 Examples of restoration to grassland/moorland vegetation are shown in Photographs 13, 22, 23, 24, 26, 29, 31, 32, 33, 34, 35, 36, 39, 40, 41, and 43 of Appendix B.
- 3.56 In the enclosed fields in the south of the site, the restoration will be to improved grassland.
- 3.57 Blocks of woodland are proposed along the north-western boundary, which is not common land. It is designed to integrate with the existing and developing woodland along the slopes to the west of the A4060, with the aim of enhancing the road's setting and the view from the settlements towards the road and the site. Another block of woodland is proposed in the valley of the restored section of the Bargoed Taf. Attention will be given to the design of the woodland edges so as to provide a varied structure using appropriate shrub species. No woodland is proposed on the higher land or the common land, whose character will be open upland moorland, similar to the surrounding hillsides.
- 3.58 Woodlands will be established using traditional methods of planting forestry transplants and root trainers. A minimum depth of 600mm of free draining and friable rootable soil or soil forming material will be required for planted areas. This will be provided from stored soils stripped from the site, overburden and suitable soil forming material as described in section 4. The potential for collection of seed from local woodlands, and raising transplants to be introduced to the site, will be investigated and implemented if practicable. This will potentially form part of the activities at the proposed visitor centre.
- 3.59 Hedgerows are proposed to the field boundaries in the south of the site. These will be established as hedgebanks consisting of earth banks constructed of sub-soil. The sides will be seeded with a suitable seed mix into the sub-soil, which provides nutrient poor conditions suitable for the establishment of wild flowers. Should any access track be required for agricultural purposes, the potential for providing hedgerows along both sides of the track would be considered.

Other features

- 3.60 It is possible that a portion of the high wall of the excavation void may be retained in the north-eastern part of the site. If feasible, the backfilled landform will be modified to leave a 6-8m high exposure where the high wall is in visually and geologically interesting rock formation.
- 3.61 If suitable stone is recovered during the operations, field boundaries in the south of the site will include some in the dry stone construction found in the fields of Bryn Caerau Farm, reflecting the cultural heritage and providing landscape interest. If

sufficient stone is available, the boundary between the enclosed fields and the open moorland will be defined with stone walls.

- 3.62 Stone enclosures or shelters for sheep on the moorland are proposed, to be sited in the course of the works on site, selecting suitable locations.

Landscape character

- 3.63 The restored site falls into four broad areas:

The north-western area, overlooking Merthyr Tydfil

- 3.64 This area provides an important part of the setting of Merthyr Tydfil. After restoration, it will provide a backdrop of a rounded hill of upland grassland, with landform variations reflecting valley features of varying scale, and restoration of the lines of the former railway and trunk road. Water courses will have a natural stream character, with stony bottoms and cascades on steeper sections. On the lower slopes, it will be integrated with the A4060 and vegetation to its west by the introduction of woodland areas, with further variety provided in the wetlands developed from the former water treatment areas. The footpath network proposed offers routes over the high ground, along the retraced lines of former road and railway, and through open and wooded areas, with potential links to the settlement. From within the area, wide-ranging views will be available over the surrounding area, and except for the lower wooded area, there will be a sense of elevation and exposure.

The north-eastern area, north of the Bogey Road and extending to Trecatti and Tair Carreg Moor in the east

- 3.65 This area is separated from Merthyr Tydfil by the higher landform to the west. It slopes towards the central area of the site and the Bogey Road, with views concentrated within the site and southwards over the rising ground of Merthyr Common. This area will be characterised by the pattern of vegetation proposed, with upland grassland on the upper slopes (continuing from the north-western area), wet heath where it borders the Tair Carreg Moor SINC to the east, and acid grassland on the lower slopes bordering the Bogey Road. In this area, water features will have the character of reservoirs and leats, reflecting the former man-made features of the Dowlais Free Drainage System, and a section of the opencast high wall is proposed to be left exposed. These features will be linked by the footpath network, and in conjunction with the measures to interpret other heritage features (described in Section 7), interpretative signage is proposed.

The central southern area, extending to the enclosed fields and Iron Age settlement

- 3.66 This area includes the central ecological area and the major heritage features to be retained. In the southern part of the area, the landform will be restored to a gentle ridge of upland grassland in the east, and a wooded valley to the south, with a general sense of enclosure by the higher ground surrounding the area. The heritage and ecological features of interest will be linked by existing tracks or new footpaths, with interpretive signage. The footpaths here have been aligned to avoid the lapwing nesting area which would be created in the east of this area to avoid disturbance.

The southern enclosed fields

- 3.67 The areas between Garth Fawr and Cwm Golau and bordering Bryn Caerau will be laid out in a traditional pattern of irregular fields with hedgerow boundaries, and will be used for grazing. Located on the shallow valley sides above the steep slopes of Nant Gyrawd, it will have a sense of enclosure and intimacy. Heritage interest could be enhanced, if suitable material is recovered, by stone walls to mark the boundary between the enclosed fields and the open land of Garth Fawr. A footpath through the fields will link the area with the surrounding rights of way network.

Land Management

- 3.68 The division of the site into compartments for management during the aftercare period is shown on Figure 5. Grazing is an important component of management and stocking rates are likely to vary according to the use of the various management compartments. Stocking rates are normally stated as Livestock Units (LU) per ha. This is a method of describing different stock types and age groups based on their energy requirements. Standard ratios are used, commonly based on one livestock unit equalling one Friesian dairy cow. English Nature's Upland Management Handbook (English Nature 2001) includes a table of Livestock Units, based on the MAFF Farm Business Survey as follows:

Stock type	Livestock Units	Stock type	Livestock Units
Cattle		Sheep	
Dairy cow	1.00	Ewes:	
Dairy bull	0.65	Light	0.06
Beef cow	0.75	Medium	0.08
Beef bull	0.65	Heavy	0.11
Heifers in calf	0.80	Breeding ewe hoggs	0.06
Other cattle (not intensive beef):		(¹ / ₂ -1 year)	
0-12 months	0.34	Other sheep over 1 year	0.08
12-24 months	0.65		
Over 24 months	0.80	Rams	0.08
Horses	0.80	Lambs	0.04-0.08
		Store lambs under 1 year	0.04

- 3.69 Not all schemes use the same values for Livestock Units. For example, Tir Gofal uses 0.15 LU for a sheep, 1.0 LU for a horse, 1.0 LU for a cow over 24 months and 0.6 LU for a cow under 24 months. Appropriate LU values for the stock to be grazed at the site would be agreed for the Aftercare Schemes with advice from the Technical Working Group. The following LU values have been assumed for the purposes of this strategy:

1 sheep = 0.15 LU
1 horse = 0.80 LU
1 cow = 0.65 LU

- 3.70 Preferred stocking rates on the enclosed fields at Bryn Caerau (Compartment 7b) once established, could be up to 2.25 LU/ha (equivalent to 15 sheep/ha, or 2.8 horses/ha, or 3.5 cows/ha), whilst on the wet grass heath adjacent to Tair Carreg Moor, the preferred stocking rate would be not more than 0.15 LU/ha (1 sheep/ha, or 0.19 horses/ha, or 0.23 cows/ha). 0.45-0.75 LU/ha (3-5 sheep/ha, or 0.6-0.9 horses/ha, or 0.7-1.2 cows/ha) would be likely to be appropriate across much of the site to allow for development of good wildlife habitat. Stocking rates during the aftercare period would be agreed with the WAG Agriculture Department and the LPA, with advice from the Technical Working Group, as part of the detailed aftercare schemes.

- 3.71 The number of registered rights for Gelligaer and Merthyr Commons (some 3091ha) is 54750 sheep. Some of the commoners can graze horses and cows as an alternative to sheep. These alternative rights total 329 horses or 10925 cattle.
- 3.72 Considering the sheep rights alone, this equates to 2.66 LU/ha if all the rights were exercised. It can be seen that this would be some 3 - 6 times the rates likely to be appropriate across much of the site.
- 3.73 It is recognised that the grazing patterns of cattle and ponies may be better suited to the development of diversity of both flora and fauna, particularly invertebrate fauna, and that the intensity of grazing should vary through the year. Spring, summer & autumn grazing is generally preferable, and winter grazing and supplementary feeding should be avoided. However, the practicalities of agricultural management, and the requirements of graziers, may not always allow ideal conditions to be achieved.
- 3.74 The future management of the common land beyond the aftercare period is discussed further below. It is recognised that through the Single Farm Payment, agri-environment schemes and future legislative changes, there is likely to be a new approach to the management of commons which will have a direct bearing on the numbers and type of livestock grazed by the commoners.
- 3.75 The proposed management of land within the compartments identified on the plan are as follows.
- Compartment 1 - Wet Grass Heath, Compartment 2 - Acid Grassland, and Compartment 3 - Upland Grassland*
- 3.76 Aftercare management will be through appropriate cutting and/or grazing at suitable stocking levels. These areas will revert to Common Land on completion of the restoration scheme and will be managed with the rest of the Common Land.
- Compartment 4 Grassland with Woodland Blocks*
- 3.77 Aftercare management will be through appropriate cutting and/or grazing at suitable stocking levels. Woodland blocks will be established using species mixtures, planting stock and techniques appropriate to the site. Appropriate beating up and other woodland management will be implemented during the aftercare period
- 3.78 This area will remain fenced from the Common Land at the end of the aftercare period. Thinning and other woodland management will be undertaken as required. The grassland will be grazed at appropriate stocking levels.
- Compartment 5 Central Ecological Area*
- 3.79 This area of nature conservation interest, between the Bogey Road and the railway line, contains ponds where great crested newts and other amphibians have been recorded. Most of this area has been excluded from the site and will be retained, enhanced and managed as an ecological area. A detailed management plan will be prepared and implemented for this area following commencement of the scheme.
- 3.80 Suitable areas for reptiles will be retained in this area including the line of the former railway itself. Given the small numbers of reptiles likely to be affected by the works, this will be suitable as a receptor area for translocation of reptiles from other parts of the site.

Compartment 6 Upland Grassland and Woodland (in 6b)

- 3.81 Aftercare management will be through appropriate cutting and/or grazing at suitable stocking levels. Compartment 6a will revert to Common Land on completion of the restoration scheme or will be managed with the adjoining Common Land. The applicants will seek to achieve appropriate stocking levels over the Common Land. Compartment 6b will remain under Miller Argent's control and they will control stocking levels over this land. The higher part of this parcel will be managed to provide suitable nesting habitat for lapwings.

Compartment 7 Cwm Golau and Bryn Caerau

- 3.82 The sheltered valley of Cwm Golau, with its woodland, (Compartment 7a) is excluded from the site. This land will be retained and managed in order to enhance its existing ecological interest and through appropriate habitat creation and improvement. A detailed management plan will be prepared and implemented to enhance the overall nature conservation value of this area following commencement of the scheme. This will include areas of tree and shrub planting, reinforcement of hedgerows, fencing, and control of stocking levels. Ponds to provide habitat for great crested newts have already been constructed in this area by Miller Argent largely through clearing out old infilled ponds and former settling lagoons..
- 3.83 Aftercare management of Compartment 7b will be through appropriate cutting and/or grazing at suitable stocking levels. Hedges will be established using suitable native species as explained in section 4 and managed so as to form stock-proof boundaries and to provide habitat features. This area will include two wetland areas based around restored water treatment areas comprising ponds with surrounding wet habitats.
- 3.84 Compartment 7b will remain under the applicants' control and will be managed together with the retained farmland in Cwm Golau (Compartment 7a). Miller Argent will control stocking levels over this land.

Future Management of the Common Land

- 3.85 The Gelligaer and Merthyr Commoners Association is responsible for the management of the common land. A Management Plan for the common has been prepared and a project plan developed to introduce a broad management and improvement programme. The association has been advised that an application for Objective 1 funding to improve management of the common has been approved.
- 3.86 The management plan refers to the existing flora and fauna of the common and sets out a number of overall objectives for management. These include:
- “(iv) To prevent the illegal grazing of the common by owners of stock who are not registered commoners and by registered commoners who do not comply with legally authorised stocking levels.*
 - “(vi) The maintenance and enhancement of all historical ecological and archaeological features on the common and to liaise with the other authorities and organisations with particular interest in these features and to help and assist such bodies in any of those initiatives.”*
- 3.87 In relation to the management of grassland, heath and wetlands, the objectives are:
- “(i) To keep an up to date register of all “Registered Commoners”.*
 - “(ii) To monitor stock numbers and the regulation thereof and the use of supplementary feeding.*

- (iii) *To consider the conservation of the natural indigenous grassland, heath and wetland, together with the natural fauna and flora, and to draw up detailed proposals for the use of lime and fertilizer with these considerations in mind.*
- (iii) *To control the spread of bracken, gorse, rush, thistle, ragwort and other such weeds and to do so in a manner which does not cause damage to the natural nature of the common or interfere to any practical extent with the enjoyment of the common by others. To liaise with and take the advice of other interested bodies and to cooperate with such bodies in the implementation of control action.*
- (v) *To return to the natural nature of the common, its landscape and herbage, all those areas despoiled by development, past and present, and not satisfactorily reinstated so as to provide acceptable visual amenities, grazing and habitat.*
- (vi) *To draw up proposals in conjunction with the landowner and other interested bodies, to increase the bio-diversity of the common and to seek aid to fully implement these proposals on areas approved.*
- (vii) *To investigate the possibility of the provision of shelterbelts by the planting of trees, and to provide for the maintenance of existing woodland."*

3.88 With respect to general nature conservation requirements, the objectives of the plan are:

- "(i) To cooperate with those who are responsible for all ponds, feeders, reservoirs and the like, together with their ancillary water catchment and drainage facilities, to properly maintain these features so as to enhance the habitat of wild species that depend on them.*
- (ii) To ensure that wildlife habitat in general is properly preserved and that no actions are taken which would endanger any rare species."*

3.89 The management proposals include measures for enhancement of biodiversity as well as a number of other key areas; historic landscape, agricultural impact, public recreation, and anti-social behaviour.

3.90 The Gelligaer and Merthyr Commoners Association would be invited to be represented on the Technical Working Group to ensure that, together with other interested parties, they were involved in discussions regarding the future management of the land.

Visitor Centre

3.91 Planning consent has been granted for a Visitor Centre at Cwmbargoed Disposal Point to be operated in association with the scheme. This will provide educational and interpretation facilities, both for the land reclamation process, and for the natural and historical environment in the vicinity of the site.

4.0 Soils, Seeding and Planting

Existing Soil Resource

- 4.1 A detailed assessment of soil resources was commissioned by British Coal Opencast and carried out by ADAS in 1992/3. Further supplementary work was carried out by ADAS in 1993, 1994 and 1995. Additional investigation was carried out by RJ Skinner consulting in 2003.
- 4.2 Four broad soil types have been identified on the agricultural parts of the site and are depicted on Figure 6. Soil forming materials were also identified over the areas depicted on Figure 7. The soils and soil forming materials depicted on the drawings have been described as follows:-

Soil Unit 1 - Mineral Soils

- 4.3 Soils of this type were found predominantly in the enclosed fields in the south-eastern part of the site, but also in small areas on the undisturbed common land. They consist of dark greyish brown, medium clay loam topsoils to 200mm depth, overlying yellowish brown medium clay loam subsoils to 500mm. Below this depth is yellowish brown weathered boulder clay.

Soil Unit 2 - Organic or Peaty Topped Mineral Soils

- 4.4 Almost all of the undisturbed common land consists of soils of this type together with some areas within the enclosed fields in the south-eastern block. This soil type is represented by two typical cross sections:
- (i) topsoil consisting of black or very dark grey peaty loam to approximately 150mm depth over a grey, medium clay loam subsoil down to 400mm.
 - (ii) dark grey brown organic clay loam topsoil to 200mm depth overlying light brownish grey medium clay loam subsoil to 450mm depth.

- 4.5 In the case of both variant soils the material below the subsoils was weathered boulder clay.

Soil Unit 3 - Restored Soils

- 4.6 Restored soils occur on the old Trecatti Opencast Site, part of which covers the north of the Ffos-y-fran area. A 'topsoil' layer of approximately 325mm depth incorporating some organic matter has developed during the period since its restoration. Overall, the material consists of 1000mm plus of dark or dark greyish brown medium clay loam. Intrusions of brown or yellowish brown heavy clay loam were found to be common. Stone content of the soil layers below 300mm is over 35% by volume up to 300mm in size and frequently up to 75% or more. However in the topsoil layers, stone removal at the time of restoration has reduced this content to around 10%.

Soils Units 4 & 5 – Spoil Tips and Disturbed Soils

- 4.7 Soil Unit 4 is found in the naturally vegetated coal and shale tips covering the central western part of the site. Soil Unit 5 lies primarily in the levelled and grassed spoil tips around the western edge of the site.
- 4.8 In both cases, a shallow rooting zone of 150 – 300 mm in depth has developed consisting of a medium clay loam incorporating some organic matter. This overlies shaly spoil material, relatively loose in Soil Unit 4 but compacted in Soil Unit 5, except on slopes. Where it contains enough fine material to determine soil texture, this was

found to be a medium clay loam. Stone content was assessed at over 75% by volume up to 200mm in size in the top 250mm increasing to over 90% with depth. The quantities of large stone vary across this unit, and as mapped in the soil forming materials map, areas within Soil Units 4 and 5 have been identified as sources of suitable soil forming materials for future restoration at the site.

Soil Forming Material

- 4.9 Soils over much of the site have been examined to greater depth using a mechanical excavator to 900mm depth to investigate whether there were any, deeper seated, soil forming materials suitable for use in the subsequent site restoration. Five types of Soil Forming Material have been identified; these are shown on Figure 7.
- 4.10 In areas to be used for overburden and Soil Forming Material storage, trial pits have been dug to approximately 1.5m. In the area of excavation trial pits were dug to 3.5 to 4m where possible. There will inevitably be more Soil Forming Material at greater depths than those examined, but this has not been identified or included in the volumes quoted.
- 4.11 Prospecting borehole logs have been checked to see if there was any likelihood of Soil Forming Material being present at greater depths than the trial pits. The geological descriptions and soil descriptions of a given horizon are not necessarily the same. Therefore, material found at depth cannot be assessed accurately for potential soil forming quality.

Soils Stripping and Storage

- 4.12 All available topsoil will be stripped from all areas to be used for excavation, overburden, subsoil and soil forming material storage, roads, hard standing areas, water treatment facilities and building construction.
- 4.13 All available suitable subsoil will be stripped from any area previously stripped of topsoil, except those areas required for the storage of subsoil.
- 4.14 Suitable soil forming material which has been identified will also be stripped. Wherever possible such material will be directly spread.

Soil Stripping

- 4.15 Before any major excavation is commenced in areas where soil resources are present, topsoil will be stripped to the average depths indicated for the various soil units indicated above and placed in the soil storage mounds shown on the Progressive Restoration plans in Appendix A. Sufficient areas will be stripped to provide for the uninterrupted working of the site until the next suitable season for topsoil stripping, including the excavation area and also areas to be used for buildings, plant yards, stockpiles of any material except topsoil, access roads, temporary haul roads and tracks, pipeline excavations and temporary or permanent diversions of watercourses.
- 4.16 As soon as practicable after topsoil stripping has been completed, subsoil will be stripped to the average depths indicated for the various soil units indicated above and similarly placed in storage mounds shown on the Progressive Restoration plans.
- 4.17 Every effort will be made to avoid compaction of soils. The stripping of soils will be confined to periods between April and September when conditions are dry enough to prevent damage through the passage of heavy plant. This will also help to prevent the intermixing of soil layers by the stripping process. Stocks of topsoil, subsoil and soil forming material will not be traversed by heavy plant except when absolutely necessary. Most potential archaeological resources will be encountered during soil stripping and the mitigation measures are explained in section 7.

4.18 Topsoil and subsoil from Area 2 (see Figure 8) will be stripped and stored separately for use in restoration. An area of wet grass heath in the east of the site is identified as being of conservation interest. The topsoils and subsoils over this area will be stripped and stored separately for subsequent reuse in the formation of similar wet grass heath in the same general area during restoration of the site (see area 2WH on Figure 8).

4.19 In Soil Unit 3 (the restored Trecatti overburden store site), there is an upper 325 mm layer of material which has agricultural value and will be stripped as "topsoil". As the area covered by this Soil Unit will be used for the storage of Soil Forming Material and overburden to an approximate height of 25m, there would be no benefit from stripping the underlying much poorer soil materials.

Soils Storage

4.20 Sufficient area has been allocated to store all soils and Soil Forming Material identified to the maximum heights set out below. Topsoil, subsoil and soil forming material and overburden will be stored separately and prevented from mixing. Two qualities of natural topsoil and subsoil have been identified and it is proposed to store these separately.

4.21 In addition, the maturing restored topsoil covering the former Trecatti site area, Soil Mapping Unit 3, will be stored separately.

4.22 As described above, soils from the wet grass heath area will be stored separately and replaced in approximately the same location from which they were stripped.

4.23 The soils from the remainder of Soil Unit 2 (as shown on Figure 6) are fairly similar in nature across the site and only after replacement will restoration create the two separate restoration types; "2" and "2AG" as shown on Figure 8. These represent semi-intensive agricultural grassland and acid grassland respectively. The differences will be introduced following soil placement by the appropriate differential use of lime, fertilisers, seed mixtures and grazing regimes.

4.24 Maximum storage mound heights will generally be as follows:

- Topsoil and Subsoil 4 m;
- Soil Forming Material 15 m.

4.25 Soil forming material will be segregated and stored within the northern overburden mound.

4.26 All mounds of soil will be seeded to grass, utilising native species where practicable, at the earliest opportunity. This will limit the potential for colonisation by aggressive weed species. Any localised infestation by such species will be dealt with by use of suitable herbicide treatments or other management techniques as appropriate. The vegetation on the soil and soil forming material stores will be managed by cutting and/or grazing.

4.27 A suitable seed mix for stores of mineral soils and soil forming materials to be used in the restoration of Areas 1, 3 and 4 would be:

<i>Agrostis capillaris</i>	Common bent	15%
<i>Festuca rubra rubra</i>	Creeping red fescue	30%
<i>Poa pratensis</i>	Smooth-stalked meadow grass	20%
<i>Lolium perenne</i>	Perennial ryegrass	25%
<i>Trifolium repens</i>	White clover	10%

4.28 The same mix would be suitable for overburden stores. As explained at para 4.33, any overburden from the surface of the stores containing vegetation and used in

restoration of Area 2 will be placed a minimum of 2m below the base of the restored soil profile.

- 4.29 A suitable seed mix for soils to be used in the restoration of Area 2 would be:

<i>Agrostis capillaris</i>	Common bent	15%
<i>Festuca rubra rubra</i>	Creeping red fescue	35%
<i>Festuca ovina</i>	Sheep's fescue	30%
<i>Poa pratensis</i>	Smooth-stalked meadow grass	20%

- 4.30 The following grass seed mixture would be suitable for organic and peaty soils

<i>Agrostis capillaris</i>	Common bent	20%
<i>Agrostis vinealis</i>	Brown bent	15%
<i>Anthoxanthum odoratum</i>	Sweet vernal grass	15%
<i>Festuca ovina</i>	Sheep's fescue	25%
<i>Festuca rubra rubra</i>	Creeping red fescue	25%

- 4.31 The practicability of use of seed of Welsh provenance for stores of soils to be used in restoration of Area 2 will be investigated and used if available on reasonable commercial terms.

- 4.32 All drainage from soil stores will pass through water treatment lagoons to protect downstream watercourses from pollution with fine particulate material.

Soils Utilisation and Restoration Method

- 4.33 In taking overburden from store for use in restoration, any overburden from the surface of the stores containing vegetation and used in restoration of Area 2 will be placed a minimum of 2m below the base of the restored soil profile.

- 4.34 There is a shortage of good quality topsoil and subsoil for use in the restoration on Ffos-y-fran. There is currently an estimated shortfall of some 2 million tonnes. This shortfall will be made up by using soil forming material which has been identified within the superficial deposits and spoil tips of historically worked materials.

- 4.35 The use of low compaction bulldozers, rather than scrapers or mechanical shovels only, would be employed for reinstating soils. This method of reinstatement has previously been employed and found to be successful in South Wales where site topography and high rainfall can cause problems. The main benefits of this method over the use of motorised scrapers and shovels are:-

- Reduced compaction of the reinstated soil profiles.
- Fewer problems with surface water run-off from freshly restored areas.
- The reinstated soil profile, being less compacted, provides a better drainage regime providing a degree of attenuation during periods of high rainfall.
- The less compacted nature of the soil profile, along with better drainage characteristics, result in improved tree and grass establishment due to quicker and deeper root development.

- 4.36 The method is more adaptable to steeper areas, leaving much smaller areas of micro-topography for soiling with mechanical shovels, which require some form of subsequent soil consolidation. Where the shovel technique has not been followed by some consolidation and soils are left very loose, following a wet period, they can become completely untrafficable and rut severely if run across by farm tractors etc.

- 4.37 Compared with mechanical shovel techniques, the low ground pressure bulldozer has been found to be very satisfactory. It imparts a degree of consolidation to the soil

layers which prevents them holding too much moisture (like a wet sponge) after rain. Routes for dump trucks would be defined and trafficking strictly controlled.

- 4.38 However, much of the soil on site will be subject to compaction, and may be impermeable following the long period of storage. The compaction will need to be relieved. All soils on site will be ripped prior to soil replacement with the exception of that to be replaced in area 2WH. Soils will be ripped to 500mm depth. Compaction of localised patches of the replaced soils in area 2AG and 2 will be employed after soil replacement to achieve habitat mosaics including localised patches of marshy grassland and wet flushes. Field drainage may be required in Area 1.
- 4.39 After laying the soil profiles, a range of agricultural activities will occur and these will vary according to the particular after-use. These works may include ripping, soil levelling, stone picking, cultivation, power forking, disking and stone picking prior to cultivation. Laid material would be sown as soon as practicable after placement.
- 4.40 The combination of these agricultural techniques, along with the advantages of the low compaction bulldozer, together with the use of shovel and truck during the reinstatement, would provide the basis for successful site restoration.
- 4.41 The proposed restoration plan for Ffos-y-fran is shown on Figure 4.
- 4.42 Those areas of the common (Soil Unit 2) that had previously been stripped of organic and peaty soils will receive the same topsoil and subsoil, which will have been stored separately during stripping operations.
- 4.43 Particular attention will be given to those soils stripped from the wet grass heath of nature conservation interest (Soil Unit 2WH), where 200mm of the same topsoil will be underlain by 200mm of the corresponding subsoil to reflect the original profile over this area. In order to ensure that water is retained in the soil profile in this area to maintain the high water table needed to support wet grass heath, a series of clay bunds will be constructed approximately along the contours of the restored area forming a series of cells into which the restoration soils will be placed.
- 4.44 The soils stripped from the remainder of Soil Unit 2 will for the most part be placed in two layers; 165mm of the organic-peaty topsoil over 165mm of subsoil within areas 2 and 2AG shown on the Soil Reinstatement Strategy (Figure 8). Whilst the soils are currently similar, the different after-care management will result in different grassland characteristics as described above.
- 4.45 Within area 2T shown on the Soil Reinstatement Strategy (Figure 8), topsoil and subsoil material from Soil Unit 2 would each be replaced at a thickness of 250mm. This is to give a greater total thickness of soil layers in order to help encourage and sustain good tree growth in this area.
- 4.46 The areas currently overlain by shale heaps, disturbed soils, buildings and disused haul roads and railways will be restored using the soil forming materials (SFMs) found on site. These are mainly shales with some inclusions of boulder clay in material "C". The restored soil thickness will in general be 500 mm (area 4M), but in areas where trees are to be planted the greater thickness of 650mm will be used (in areas 4N and 4S) as shown on Figure 8.
- 4.47 Most of the Soil Forming Materials found are somewhat acidic in nature although none appear to be pyritic and therefore they are not extremely acidic or potentially so. Soil Forming Materials "A" and "B" gave laboratory pH values in the range 4.5 to 5.6. For acid grassland end uses, liming may not be needed on soils formed on these materials and would be avoided, other than where light applications may be needed to aid establishment (e.g. 3 t/ha). Where semi-intensive grass double or treble this lime rate may be needed prior to seeding or planting. Material "C" had a pH range of

5.3 to 6.8 and material "E" pH values from 5.3 to 5.9 (only 2 samples tested). pH values in material D have only been carried out for pit 27 when a range of pH values from 5.1 to 5.9 was obtained. Materials C, D and E could be used for semi-intensive grassland with nil or only small lime additions. The actual rates will be confirmed by further soil testing after final placement on site. All specifications for soil amelioration, if required, will be agreed in advance with the LPA and WAG Agriculture Department.

- 4.48 Use of bulk organic materials will also be considered to improve soil forming materials if necessary. These may include farmyard manure, spent mushroom compost, digested sewage sludge, composted civic amenity 'green' waste, and other materials which may be locally available. The suitability of such materials will be assessed prior to any such use.

Seed Mixtures

- 4.49 Appropriate seed mixtures will be specified according to the soil types to be used in restoration and to the proposed afteruse of the various areas of the site. These will be discussed and agreed with the WAG Agriculture Dept and the Local Planning Authority. Indicative seed mixtures which may be used with reference to the reinstatement areas shown on Figure 8 are provided below. All seed mixes and provenances specified will be subject to availability on reasonable commercial rates and terms. In particular it is the intention to use seed of local or Welsh provenance in restoration of Areas 2AG and 2WH on Figure 8.

Areas 1, and 3 Upland grazing on mineral soils

Seed mixed for mineral soils and restored soils recovered from restored Trecatti site.

<i>Agrostis capillaris</i>	Common bent	5%
<i>Festuca rubra rubra</i>	Creeping red fescue	20%
<i>Festuca rubra commutata</i>	Chewings fescue	10%
<i>Festuca ovina</i>	Sheep's fescue	10%
<i>Festuca tenuifolia</i>	Fine-leaved sheep's fescue	10%
<i>Poa pratensis</i>	Smooth-stalked meadow grass	10%
<i>Lolium perenne</i>	Perennial ryegrass	25%
<i>Trifolium repens</i>	White clover	10%

Area 2 and 2AG Acid grassland on organic and peaty soils

Grass seed mixture for organic and peaty soils

<i>Agrostis capillaris</i>	Common bent	20%
<i>Agrostis vinealis</i>	Brown bent	10%
<i>Anthoxanthum odoratum</i>	Sweet vernal grass	10%
<i>Deschampsia flexuosa</i>	Wavy hair-grass	5%
<i>Festuca ovina</i>	Sheep's fescue	20%
<i>Festuca rubra rubra</i>	Creeping red fescue	20%
<i>Molinia caerulea</i>	Purple moor grass	10%
<i>Nardus stricta</i>	Mat grass	5%

Herb mixture for 2AG to form 20% of the overall mix (indicative - subject to availability - % of total grass + herb mix))

<i>Betonica officinalis</i>	Betony	1.5%
<i>Calluna vulgaris</i>	Heather	1.5%
<i>Carex spp</i>	Sedge (appropriate species)	4.5%
<i>Centaurea nigra</i>	Black knapweed	1.0%
<i>Conopodium majus</i>	Pignut	1.0%

<i>Galium saxatile</i>	Heath bedstraw	0.5%
<i>Hypochoeris radicata</i>	Common cat's ear	1.0%
<i>Leontodon autumnalis</i>	Autumnal hawkbit	1.0%
<i>Potentilla erecta</i>	Tormentil	1.0%
<i>Prunella vulgaris</i>	Self-heal	2.0%
<i>Ranunculus acris</i>	Meadow buttercup	2.0%
<i>Succisa pratensis</i>	Devil's-bit scabious	1.5%
<i>Vaccinium myrtillus</i>	Bilberry	1.5%

Area 2WH Wet heath adjacent to Tair Carreg Moor SINC

Seed for organic and peaty soils to be reinstated in the area adjacent to Tair Carreg Moor SINC.

Grass seed mix as 2AG with additional spreading of litter or seed harvested from Tair Carreg Moor SINC.

Herb mixture for 2WH to form 20% of the overall mix (indicative - subject to availability - % of total grass + herb mix))

<i>Achillea ptarmica</i>	Sneezewort	0.5%
<i>Angelica sylvestris</i>	Wild angelica	1.0%
<i>Calluna vulgaris</i>	Heather	2.0%
<i>Cardamine pratensis</i>	Cuckoo flower	2.0%
<i>Carex spp</i>	Sedge (appropriate species)	4.0%
<i>Erica tetralix</i>	Cross-leaved heath	2.0%
<i>Eriophorum angustifolium</i>	Common cottongrass	1.0%
<i>Galium palustre</i>	Marsh bedstraw	0.5%
<i>Lotus uliginosus</i>	Greater bird's-foot trefoil	1.0%
<i>Lychnis flos-cuculi</i>	Ragged robin	0.5%
<i>Potentilla erecta</i>	Tormentil	1.0%
<i>Succisa pratensis</i>	Devil's-bit scabious	1.0%
<i>Tricophorum cespitosum</i>	Deer grass	1.0%
<i>Vaccinium myrtillus</i>	Bilberry	2.0%

Area 4 Acid grassland on soil forming materials

Mix for recovered soil forming materials amended as necessary.

<i>Agrostis capillaris</i>	Common bent	10%
<i>Festuca rubra rubra</i>	Creeping red fescue	20%
<i>Festuca rubra commutata</i>	Chewings fescue	15%
<i>Festuca ovina</i>	Sheep's fescue	10%
<i>Poa pratensis</i>	Smooth-stalked meadow grass	10%
<i>Lolium perenne</i>	Perennial ryegrass	20%
<i>Trifolium repens</i>	White clover	5%
<i>Trifolium hybridum</i>	Alsike clover	5%
<i>Lotus corniculatus</i>	Bird's-foot trefoil	5%

- 4.50 Sources of seed will vary depending on the afteruse of the various areas of the site. Seed used in Area 1 on Figure 8 is likely to be normal agricultural cultivars. In Areas 3 and 4 seed will again be of commercial stock but less competitive cultivars will be used. The practicability of use of seed of Welsh provenance in these areas will be investigated. In Area 2 grass seed used will be of Welsh provenance if available on reasonable commercial terms.

Seed Harvesting

- 4.51 As an alternative to commercial seed, the potential for harvesting seed from the site, or adjoining land, for use in restoration will be investigated. In the first instance, seed has been harvested from land in the east of the site, between the electricity transmission line and the site boundary, in summer 2005 and put in store for use in restoration. This will enable the quantity and content of the seed harvested to be assessed and consideration given to further harvesting from similar habitats elsewhere in future years for storage.
- 4.52 Seed harvested from the site or adjoining land (or other suitable seed of Welsh provenance) will be used for seeding of soil stores to be used in restoration of acid grassland and wet heath areas, unless found to be not practicable and with the approval of the Planning Authority.
- 4.53 The views of Caerphilly County Borough Council will be sought regarding future harvesting of seed from the Tair Carreg Moor SINC either to put in store for future restoration, or for direct sowing
- 4.54 Harvested seed (or other suitable seed of Welsh provenance) will be used for the wet heath restoration, unless found to be not practicable and with the approval of the Planning Authority..
- 4.55 Harvested seed (or other suitable seed of Welsh provenance) will be used for the acid grassland restoration, unless found to be not practicable and with the approval of the Planning Authority.
- 4.56 The potential for use of harvested seed in progressive restoration of the western area of the site, and of using the early restoration phases, where such locally harvested seed had been used, as a seed source for use on the later phases, will be investigated and implemented if practicable.

Tree and shrub species

- 4.57 The principal areas of tree and shrub planting will be on the restored land in the west of the site adjacent to the A4060 road. There will also be an area of woodland planting in Area 6b in the southern part of the site. There will be planting of new hedgerows associated with the restored land north of Bryn Caerau Farm in the south of the site. Suitable species and specifications, including replacement requirements for failed stock, for these plantings will be discussed and agreed with the Local Planning Authority. The operator will collect seed of suitable species from the woodlands in Cwm Golau to the south of the site, and raise plants for use in the restoration scheme.
- 4.58 Indicative species which may be used are as follows:

Woodland Planting

Tree Species		Mix%
<i>Alnus glutinosa</i>	Common alder	15
<i>Betula pendula</i>	Silver birch	10
<i>Betula pubescens</i>	Downy birch	10
<i>Quercus petraea</i>	Sessile oak	15
<i>Sorbus aucuparia</i>	Rowan	10
<i>Malus sylvestris</i>	Crab apple	5
Shrub species		
<i>Corylus avellana</i>	Hazel	10
<i>Crataegus monogyna</i>	Hawthorn	5
<i>Prunus spinosa</i>	Blackthorn	..5

<i>Ilex aquifolium</i>	Holly	5
<i>Salix caprea</i>	Goat willow	5
<i>Ulex europaeus</i>	Gorse	..5

- 4.59 The potential benefits of phased planting, utilising pioneer/nurse species in the first instance to be followed after a few years by canopy species, will be considered. The aftercare schemes will include full details of planting and management proposals.

Hedge Planting

Tree species

<i>Fraxinus excelsior</i>	Ash	no.
<i>Quercus petraea</i>	Sessile oak	no.
<i>Sorbus aucuparia</i>	Rowan	no.
<i>Betula pubescens</i>	Downy birch	no.

Shrub species

<i>Corylus avellana</i>	Hazel	25
<i>Crataegus monogyna</i>	Hawthorn	55
<i>Prunus spinosa</i>	Blackthorn	5
<i>Ilex aquifolium</i>	Holly	5
<i>Rosa canina</i>	Dog rose	5
<i>Malus sylvestris</i>	Crab apple	5

- 4.60 All tree and hedge plantings will be protected against grazing animals by fencing until the end of the aftercare period.

5.0 Waste Management of former Landfills

Proposed Works

- 5.1 Three existing landfill sites, Landfill 13, Hoover and Merthyr Landfills, lie within the boundary of the proposed land reclamation scheme and most need to be relocated to allow the associated opencast mining operations to proceed. The locations of the landfills are shown on Figure 9. Subsequent to the mining process, it is proposed to carry out further restoration and return the area to beneficial use.
- 5.2 Residual materials from the reclamation operation which cannot be used on the site will be disposed of at the nearby licensed landfill site (or other suitable licensed landfill). An alternative option for disposal of residual material in a containment cell in the east of the site will not be implemented. Any hazardous waste encountered will be removed to a suitably licenced waste facility off site.
- 5.3 The reclamation operation and containment will be subject to appropriate licences and permits. It is anticipated that the removal of the landfills will be substantially completed in 9 months.
- 5.4 The waste strategy adopted is sufficiently robust for potential variation in the waste handling solutions to be accommodated.
- 5.5 Landfill Tip 13 and the Hoover Landfill will be removed entirely, together with part of the Merthyr Landfill. The area to be extracted will be set out with pegs to define the area prior to mining each landfill site. Any area including "hot spots" of elevated levels of contaminants will also be pegged out for further investigation. Additional sampling will be carried out to locate and further define any areas with excessively elevated levels of contamination.
- 5.6 Each landfill will be worked in blocks to the full depth of the landfill. The excavation will be benched to ensure that no faces occur which are higher than the machine working beneath them. Each bench will be worked down in horizontal layers ranging from 0.5 m to 3 m. This will reduce cross-contamination and enable the deposit to be worked down to any "hot spots" which require selective removal. Landfill Tip 13 will be worked from east to west. The Hoover and Merthyr Landfills will be worked from the north-west to the south-east.
- 5.7 Wherever possible, the face will be worked from the lowest to highest floor level to avoid flooding the extraction face. Temporary bunding would be constructed to collect leachate if this becomes a problem during excavation. A vacuum tanker would be used to suck up leachate from collection points if required.
- 5.8 Generation of significant volumes of leachate during excavation will be avoided through limiting the extent of the open excavation, and capping and control of surface water.

Removal of Extracted Material

- 5.9 The nature and potential contamination risk of the extracted material will determine the post extraction treatment.
- 5.10 Detailed protocols will be agreed with the regulators and will in place before the extraction operation is carried out.
- 5.11 It is anticipated that the excavation works and classification of materials arising will result in four product materials:

- (1) Uncontaminated, granular stone and ash soils capable of being utilised for on-site construction. This material will be stockpiled separately in clearly defined and labelled stockpiles. Testing to ensure the uncontaminated nature of this material will be carried out to agreed examination and testing protocols.
- (2) Material generally conforming to the above description but containing wood, metal, plastics, textiles and paper which can be separated out from the mass and disposed of to Trecatti landfill. The resulting inert materials will then be used as in 1 above.
- (3) Non-inert material (based on testing or visual or olfactory evidence) will be disposed to landfill at Trecatti landfill via the Cwmbargoed Disposal Point in accordance with the Duty of Care waste management legislation.
- (4) Any hazardous material excavated will be removed to a suitable licensed facility off site.

5.12 These works will be carried out under a Waste Management Licence.

Engineering Fills and Cover

5.13 There are abundant engineering fill materials on site for cover materials and structural fill. Drainage layers can be produced by crushing on-site materials or importing crushed/screening materials.

Landfill Gas Management

- 5.14 Part of the Merthyr Landfill would be left in-situ. This will leave an exposed face cutting the full depth of the landfill. It is proposed to seal the face with conditioned clay to a specification agreed with the Environment Agency.
- 5.15 The remaining parts of the landfill would be covered with an engineered cap. There are two options available. The whole area could be sealed with clay and topsoiled. Vents would be added to release any accumulation of landfill gas.
- 5.16 An alternative would be to cover the landfill with 1m of appropriate soil. This would provide a semi-permeable layer. Methane would slowly permeate through the soil where the large surface area of the soil would enable microbial activity to reduce the methane to water and carbon dioxide. This is likely to be the preferred option.

6.0 Ecology

Introduction

- 6.1 The ecological principles of the restoration strategy are:
- i to conserve features of ecological interest in situ where practicable.
 - ii to enhance such features through appropriate habitat creation and improvement.
 - iii to create areas of ecological interest as part of the restoration of the site.
 - iv to enhance both retained and newly created areas thorough appropriate management so far as this in the control of the operator.
- 6.2 Subsequent to publication of the Ffos-y-fran Land Reclamation Scheme Environmental Statement in May 2003, the Merthyr Tydfil Biodiversity Action Plan was launched in June 2003. Whilst the Environmental Statement made reference to the then proposed action plan, the now published plan is considered further in this document.
- 6.3 The surveys and studies carried out to assist in the assessment of the ecological impacts of the Scheme are described in detail in the Environmental Statement. A number of further ecological surveys have been carried out, subsequent to completion of the Environmental Statement, as part of the continuing work in relation to the Scheme. These comprise:
- Breeding Birds Survey 2003
 - Bat survey 2003
 - Amphibian Surveys 2003 & 2004
- 6.4 The findings of these additional surveys are taken into account in this section of the Restoration Strategy.

Conservation and enhancement of existing features

- 6.5 The Ffos-y-fran Land Reclamation Scheme has been designed, so far as practicable, to avoid damage to nature conservation interests.
- 6.6 The conservation of features of ecological interest in situ has resulted in the abandonment of previous proposals which required a more extensive southern overburden store, which would have infilled the upper part of Cwm Golau with culverting of the Nant Gyrawd. This strategy has also enabled potential archaeological remains and elements of the prehistoric landscape to be preserved *in situ*. Reduction in the extent of the southern overburden store has been achieved through a proposed northern overburden store on land of little nature conservation interest on the restored area of the former Trecatti opencast site. Cwm Golau, with its ancient woodland, is now excluded from the site. This land (other than that part which is common land) will be retained, enhanced and managed in accordance with the second component of the strategy. A detailed management plan will be prepared and implemented to enhance the overall nature conservation value of this area following commencement of the scheme. This will include areas of tree and shrub planting, reinforcement of hedgerows, fencing and control of sheep stocking levels. New ponds to provide habitat for amphibians, particularly great crested newt, have already been constructed in this area.
- 6.7 The sheltered valley of Cwm Golau, with its woodland provides good habitat for bats. Improvements to hedgerows in the valley will be of benefit to bats since they typically forage along hedgerows and use them as movement corridors. Bat boxes will be

placed in woodland and other suitable locations to provide additional opportunities for bat roosting.

- 6.8 The only indication of a potential roosting site for bats within the Ffos-y-fran Land Reclamation Scheme site in 2001 was at the Bogey Road bridge/cutting, where it was considered possible that two *Myotis* bats (probably whiskered bats) were roosting. These structures offer potential hibernation sites (in cracks/crevices within masonry) for both pipistrelles and *Myotis* bats.
- 6.9 A further bat survey was undertaken in 2003, the main aim of which was to investigate bat use of the Bogey Road bridge and cutting. No roosting bats were found at the bridge or cutting on any of six visits over the period June to September. Regular feeding activity of common pipistrelle and noctule bats was recorded, and whiskered bats were recorded on one occasion. It was considered likely that individual bats will occasionally use the roost potential of the masonry, although this was not confirmed.
- 6.10 These structures will not be affected by the Ffos-y-fran scheme. However, the Bogey Road bridge is in poor structural condition and it is possible that works may be needed to the bridge for reasons of public safety irrespective of the Ffos-y-fran operations. Insofar as any such works may affect a bat roost site, they would be carried out under licence granted by the Welsh Assembly Government under the Habitat Regulations. Once any necessary safety works were complete, incorporating any provision for bats required by the licence, including suitable bat roost features, the bridge would be maintained but would not be used as a public highway. It would therefore remain as a potential bat roost, as well as being of historical interest.
- 6.11 An area of nature conservation interest between the Bogey Road and the railway line, containing ponds where great crested newts and other amphibians have been recorded, will be retained. Suitable areas for reptiles will be retained in this area including the line of the former railway itself. Given the small numbers of reptiles likely to be affected by the works, this will be suitable as a receptor area for translocation of reptiles from other parts of the site. Most of this area has been excluded from the site and will be retained, enhanced and managed as an ecological area. An area to the west of the excluded area will be affected by the construction of a haul road between the extraction void and the southern overburden store, and settlement lagoons. As for Cwm Golau, a detailed management plan will be prepared and implemented for this area following commencement of the scheme.
- 6.12 A number of other ponds which would have been lost if previous proposals had been implemented, will be retained as part of the scheme as described later in this section.
- 6.13 The previous proposals would have involved the loss of much of a Site of Importance for Nature Conservation (SINC) known as Tair Carreg Moor. The Ffos-y-fran Land Reclamation Scheme does not include any of the land within the SINC.

Ecological considerations in the working and restoration of the site

- 6.14 There are opportunities for mitigation of adverse ecological effects through control of working methods and on restoration of the site, through sensitive landscape design and habitat creation. Whilst the overall project length is up to 17 years to final reinstatement (followed by 5 years of aftercare), the site will be progressively restored as the opencast operations work through the site. This will therefore release areas of restored land as the scheme progresses on which flora and fauna can begin to re-establish. There will also be opportunities for creation of wildlife habitat on the overburden mounds which will be in place for a period of some 10 years. These would be particularly suitable for ground-nesting birds such as lapwing and skylark.
- 6.15 Measures will be taken to ensure that no significant pollution of watercourses occurs as a result of site operations. Such measures will be designed and implemented to

the satisfaction of the Environment Agency and will be regulated by the Agency. Appropriate monitoring will be carried out to ensure effectiveness. Discharge consents are already agreed with the Environment Agency and are in place.

- 6.16 Measures will be taken to suppress dust which could be generated as a result of the operations. These measures, which were set out in the Environmental Statement, are standard in the industry, will be expected to be generally effective in controlling dust emissions. In so far as there will be deposition of dust on vegetation, this will only be likely to occur to any significant degree in the immediate vicinity of areas where heavy equipment is in use over long periods, such as along the haul roads between the excavation area and the overburden stores, and the Cwmbargoed Disposal Point. Whilst deposit of dust on leaf surfaces can reduce rates of photosynthesis, and can affect rates of gaseous exchange by blocking of stomata, any such effects will be localised and there is no likelihood of significant effects on vegetation as a result of the proposed operations.
- 6.17 There will be sources of noise during the operation of the site and measures will be taken to minimise such noise. Wildlife generally readily habituates to noise associated with such operations when it is not associated with any particular threat. Sudden loud noises, such as blasting, do cause disturbance of wildlife. However, although disturbance does occur, this is typically short-lived and does not necessarily result in any particular harm to wildlife populations.
- 6.18 Whilst there will be considerable levels of human activity and machine operation within the active extraction area of the opencast void throughout the period of opencast operations, much of the site will only be subject to disturbance for part of the operational period. For example, areas used for soil and overburden stores, and the haul roads serving them, will only be subject to significant disturbance during the construction of the stores in the early stages of working, and during removal of material from the stores at the end of operations. For the remainder of the operational period, these areas will be subject to little disturbance. As for noise, wildlife is able to habituate to heavy machinery, although humans on foot typically always result in disturbance of sensitive species. Given the nature of the proposed opencast operation, there is little potential for disturbance of wildlife beyond the active areas of the Ffos-y-fran site.
- 6.19 In order to avoid destruction of birds' nests, which are protected by law, it is normal industry practice to clear vegetation which may hold birds' nests outside the period March to August inclusive. In the case of the proposed operations, many of the bird species present are ground-nesting, and clearance of vegetation would largely be through stripping of soils. Given the nature of the soils at the site and the climatic conditions, it would generally not be practicable to begin soil stripping until April. In order to avoid destruction of nests, birds would be actively deterred from nesting in areas where soils are to be stripped, or which are otherwise to be affected by operations, by appropriate measures during March and April.
- 6.20 As explained in section 1, an Environmental Management Plan will be prepared and implemented for the Ffos-y-fran Land Reclamation Scheme operations. This will include the requirements for mitigation of ecological impacts described above, and additional measures described later in this section, such as the mitigation for protected species which is summarised at para 6.154.
- 6.21 Planning and supervision of operations will seek to ensure that disturbance to existing undisturbed habitats and species, whether protected, of conservation concern, or undesignated, is kept to a minimum. Where necessary and appropriate, protective fencing and warning signs will be erected around areas to be retained during site operations, to protect features of natural conservation importance. Such fencing and signage will be maintained for as long as required to protect the features. The importance and sensitivity of habitats and species (both those which will be undisturbed, as well as those which will be reinstated) would be explained to site

personnel before the start of works, and at appropriate times during the progress of the works.

Habitats present and their restoration

- 6.22 A vegetation and habitat survey of the site, and some areas of adjoining land, was undertaken during the summer and autumn of 2001. Habitats and vegetation units were mapped at 1:2500 scale using a combination of existing habitat maps, vertical aerial photographs and ground-truthing site visits. The habitats identified are shown on Figure 10.
- 6.23 Much of the site comprises land affected by past mining and other anthropogenic activities, large areas of which are of little nature conservation interest, but locally, secondary habitats of interest have developed on this land. The site area also includes a range of semi-natural habitat types. Much of the land is common land subject to common rights of grazing. The common land is grazed by sheep, cattle and horses. As is typical of such land in upland areas, past overgrazing has resulted in degrading of the vegetation with the development of extensive acid grasslands at the expense of dwarf shrub heath communities.
- 6.24 The main habitat types represented are as follows:
- A limited area of broad-leaved ravine-woodland to the south east of the site with some associated marginal scrub.
 - A small conifer plantation.
 - Various types of grassland including dry acid grassland and “marshy grassland” (i.e. types dominated mainly by rushes or, more locally, purple moor-grass. Sheep grazing has modified past upland heathland vegetation to varying degrees to create grassland types ranging from semi-natural acid-grasslands to semi-improved, more neutral grassland. Some areas have in turn been further agriculturally improved by reseeding and by the use of artificial treatments.
 - Large areas of acid grassland – wet dwarf-shrub heath mosaic, generally rather degraded and with only a limited dwarf-shrub component, occur over some parts of the site. Locally this vegetation is less degraded and includes a higher cover of the dwarf-shrub component. These areas are considered to be of greater nature conservation interest than the degraded areas. The largest area of this vegetation is included within the Tair Carreg Moor SINC to the north-east of the site. Although included in previous planning applications, this area is now excluded from the Ffos-y-fran land reclamation scheme as can be seen from Figure 2.
 - Small areas of dry dwarf-shrub heath dominated by heather or bilberry are generally confined to steep railway cuttings or embankments or to a few natural cliffs or steep valley sides. In this latter situation, however, heavy grazing suppresses the dwarf-shrub component to the detriment of the vegetation diversity.
 - Limited areas of continuous bracken are present on dry slopes, mainly in the south of the site.
 - Flushed areas and soakways are associated with springs and seepages, particularly in the small valleys of the upper Bargod Taf catchment, and often grade into ‘marshy grassland’.
 - Large areas within the site have suffered the effects of prolonged industrial activity and are either unvegetated, only sparsely vegetated, or have been regraded and seeded to a rye-grass based ley (with varying degrees of success).

- Upland streams flow generally southwards through or adjacent to the site, the most notable being the Nant Gyrawd and the headwaters of the Nant Bargod Taf.
 - Man-made ponds and reservoirs together, with their associated marginal habitats, are of varying wildlife interest. The water-levels of some have been permanently lowered in the recent past exposing wide areas of often-unvegetated, gravelly, former lake-bed.
 - Boundary habitats, including remnant hedgerows, banks, ditches and remnants of stone walls, are present dividing fields within the agricultural land in the south of the site. Stone abutments are also associated with old railway structures and around some of the curtilages of the demolished dwellings south of the Bogey Road.
- 6.25 The majority of the restored land will be used for upland grazing as urban common land. Bryn Caerau Farm (where disturbed) will be returned to agricultural use, and nature conservation measures will be incorporated throughout the restoration scheme. The site will be predominantly restored to grassland and moorland vegetation associated with the open areas of the common, with particular attention being given to re-instating the acid grassland presently adjacent to the Tair Carreg Moor SINC that is located outside the eastern boundary north of the Bogey Road.
- 6.26 As shown on the Restoration Plan (Figure 4), areas of woodland are proposed in the west of the site overlooking Merthyr Tydfil. A network of hedgerows would be established in the area north of Bryn Caerau Farm in the south of the site providing green links for foraging, access and shelter opportunities for birds, bats and other mammals.
- 6.27 The final distribution of land uses across the site will depend upon the soil and soil-forming resources available.

Wildlife Habitats

- 6.28 UK Biodiversity Action Plan Priority Habitats and Welsh Assembly Government Habitats of Principal Importance (including EC Habitats Directive Annex I Habitats) which occur within or in the vicinity of the site:
- Upland heathland
 - Purple moor grass and rush pastures
 - Ancient and/or species-rich hedgerows
 - Upland oakwood

Upland heathland, purple moor grass and rush pastures

- 6.29 The site includes areas of upland heathland, purple moor-grass and rush pastures (largely comprising mosaics of these vegetation types) which will be affected by the scheme. There are some areas of lichen and bryophyte rich heath on old colliery spoil tips. The areas which will be affected by the operations are largely in the central and eastern part of the site north of the Bogey Road, and in the western part of the site south of the former railway. Acid grassland and wet grass/heath vegetation will be restored in this area on completion of the works, using soils which will be separately stripped and stored, and suitable seed mixtures as described in section 4. The most significant area of wet dwarf shrub heath/acid grassland mosaic within the area surveyed, much of which is within the Tair Carreg Moor SINC, is largely outside the site, although the western part of this area (outside the SINC) will be affected.
- 6.30 There are areas of these habitats within the central and Cwm Golau ecological areas, outside the site which will not be disturbed by the scheme. These areas will be

managed in order to maintain or enhance their ecological value. Management plans are to be prepared and implemented for these areas.

6.31 Dry heaths and wet heaths with cross-leaved heath are EC Habitats Directive Annex I habitats.

6.32 The Merthyr Tydfil BAP objectives for heathland are to:

- Halt the loss of areas of areas of heathland.
- Achieve favourable management of heathland.
- Create areas of new habitat where appropriate.

6.33 The Merthyr Tydfil BAP objectives for purple moor-grass and rhos pasture are to:

- Halt the loss of areas of purple moor-grass and rhos pasture.
- Achieve favourable management of purple moor-grass and rhos pasture.
- Create areas of new habitat where appropriate.

6.34 There will be loss of existing wet grass heath as a result of the scheme. The major part will be restored using appropriate soils placed within cells formed by clay bunds, as described in section 4.0, utilising suitable cultivation, seeding and management techniques. Where practicable seed will be supplemented with locally sourced seed from semi-natural vegetation. The potential benefits of spreading vegetative material from suitable habitats to provide a seed source will be considered. Full specifications will be provided in the detailed restoration plans to be prepared for the phases of the scheme.

6.35 Whilst the scheme conflicts with the BAP objective with respect to the loss of existing habitat, improved management of Cwm Golau and the central ecological area will enhance existing habitats, and similar habitats will be created through restoration.

Ancient and /or species-rich hedgerows

6.36 Almost all of the existing hedgerows within the Phase 1 Habitat Survey area (Figure 10) are on the lower ground north of Bryn Caerau Farm in Cwm Golau. Most of these hedgerows are excluded from the site and will not be affected by the scheme. Others are within the Cwm Golau ecological area and will be retained and new hedgerows planted as part of the enhancement of this area. Gaps in these existing hedgerows will be planted up. Locally native species of local provenance will be used in such plantings. If insufficient local stock is available this may be supplemented with commercial stock. Typical species which will be planted in these hedgerows are referred to in section 4. Aftercare plans will include requirements for hedgerow management.

6.37 The Merthyr Tydfil BAP objectives for ancient/species-rich hedgerows are to:

- Halt the loss of ancient/species-rich hedgerows.
- Achieve favourable management of all hedgerows.
- Create new species-rich hedgerows in appropriate areas.

6.38 The Ffos-y-fran proposals are fully in accord with the BAP objectives.

Upland Oakwood

6.39 There is no upland oakwood within the site. There is an area of such woodland to the south east of the site in the Cwm Golau ecological area. This woodland will not be affected by the scheme having been excluded because of its ecological interest. It will be retained and managed in a manner sympathetic to nature conservation.

- 6.40 As shown on the Restoration Plan (Figure 4), areas of woodland are proposed in the west of the site overlooking Merthyr Tydfil. Typical species which would be used in these plantings are referred to in section 4. The intention would be to establish woodland which, with management, would develop the characteristics of upland oak-birch woodland.
- 6.41 The Merthyr Tydfil BAP objectives for upland oakwood are to:
- Halt the loss of areas of upland oakwood
 - Achieve favourable management of upland oakwood
 - Create areas of new habitat where appropriate.
- 6.42 The Ffos-y-fran scheme fully accords with these objectives.

Local Biodiversity Action Plan Habitats

- 6.43 Local BAP habitats additional to the UK BAP habitats listed above, which are included in the Merthyr Tydfil BAP are:
- Coniferous Plantation
 - Standing Open Water / Ponds
 - Rivers & Streams
 - Ffridd / Bracken Slopes
 - Mineral Spoil Areas
 - Acid Grassland

Coniferous Plantation

- 6.44 There is only one small coniferous plantation within the site situated south of the Bogey Road, immediately east of the former Ryan's offices. Although within the site, this plantation will not be affected by the proposed operations and will be retained as shown on the restoration plan (Figure 4).
- 6.45 The Merthyr Tydfil BAP objective for coniferous plantations is to:
- Increase the biodiversity value of all conifer plantations.
- 6.46 The conifer plantation within the site is very small and little could be done to enhance its biodiversity other than felling and replanting with native species. This is not proposed at present since it does provide shelter for birds and other wildlife in an exposed area where this is generally lacking.

Standing Open Water

- 6.47 Ponds would be retained as far as practicable. The following ponds, the locations of which are shown on Figure 10, will be retained. Where possible, these ponds have been correlated with the Merthyr Tydfil Pond Survey 1999-2000 (MTPS). The conservation value given to the ponds, in the local context, in the report of the survey is indicated where applicable:

Pond 5 (MTPS No.64 - High)

Isaac Morgan Pond. This former reservoir is outside the site and within the central ecological area. The open-water area supports a large and abundant population of floating bur-reed which is of at least county importance. The pond supports amphibians. Care will be taken in construction of the haul road linking the opencast excavation area to the southern overburden storage area, to avoid dewatering of this pond.

Pond 6 (MTPS No.56 - High)

This is a large, shallow pond with diverse aquatic and marginal vegetation which is also within the central ecological area outside the site boundary. A series of flushes feed into the pond on its northern side and merge into the adjacent semi-natural acid grassland and wet heath. They are rich in sedges and include small populations of lesser scullop and marsh speedwell. The pond supports amphibians, including great crested newt, and is notable for its invertebrates.

Pond 11 (MTPS No. 62 - Moderate)

A largely overgrown small pond with fluctuating water-levels located at the edge of a regraded and re-seeded spoil tip, but with a more permanent area of water at the southern end dominated by water horsetail. The pond is immediately outside the eastern edge of the site within the Cwm Golau ecological area. It has been cleared of dense vegetation and made suitable for great crested newt.

- 6.48 Further ponds form part of, or are associated with, a Scheduled Ancient Monument and will be retained as part of the scheme. These are:

Pond 9 (MTPS No. 68 - Low)

A reservoir with rocky shores to a rock dam on its south-eastern side and more grassy banks to the west. This site supports a number of discreet rafts of floating bur-reed, large ones in deep water near the southern dam and also smaller rafts elsewhere. It supports amphibians.

Pond 28

A small former reservoir in an exposed position largely devoid of vegetation.

- 6.49 There are also a number of ponds within and to the south of the Tair Carreg Moor SINC which would also not be affected by the operations. These are:

Pond 7

A moderate sized, mainly open-water pond in an exposed position located to the north of the site of the former Tunnel Tavern. It supports a narrow marginal zone on its northern shore dominated by bog-moss (*Sphagnum* spp.), common cotton-grass and soft rush. The pond supports amphibians.

Pond 8

A large, shallow, former reservoir with little open water and largely vegetated-over with dominant floating sweet-grass. Round-leaved crowfoot is abundant in the marshy ground to the north of the pond and at its outlet on the eastern side. The pond is notable for its invertebrates

Pond 27

A vegetated-over former reservoir, having now become a bog moss dominated swamp with locally abundant common cottongrass, soft rush, and brown bent impounded behind a breached embankment, which supports a dry acid grassland community.

Pond 29

A small area of ponded water dominated by floating sweet-grass, at the junction of the Bogey Road and the Fochriw Road, with a swampy, rush dominated area flanking its northern margin. It is notable as it supports a large population of ivy-leaved crowfoot and rare round-leaved crowfoot.

Pond 30

A series of small, connected lagoons located at the site of the former wheel-wash at the eastern end of the East Merthyr Phase 2 site haul-road. They are largely unvegetated although small populations of round-leaved crowfoot are present in the connecting channels. Some amphibians have been recorded.

- 6.50 The following ponds would be lost through implementation of the scheme:

Pond 1 (MTPS No. 47 - High)

A medium sized, mature pond with good diversity although the edges are trampled and eroded, with poor bankside vegetation and litter. Dumped rubbish and domestic waterfowl detract from its ecological value. Although outside the site area, the indirect effects of excavation are likely to result in loss of water supply to this pond.

Pond 2 (MTPS No.105 - Low)

A lagoon with a generally unvegetated shale bed and shores but with sparse acid grassland colonising towards its south-western end. The pond supports amphibians.

Pond 3

A large exposed reservoir having little floral interest with little emergent or bankside vegetation except for stands of the aquatic form of bulbous rush along its northern shore. Its banks are dominated along the northern side by soft rush. The pond is often used by large numbers of lesser black-backed and herring gulls from the nearby Trecatti Landfill. The pond supports amphibians and one great crested newt was recorded in 2004.

Pond 4 (MTPS No. 53 - High)

The steeply sloping banks of this small pond allow some shelter which has favoured the growth of good stands of marginal and aquatic vegetation. Amphibians have been recorded (including one great crested newt in 2004), as well as some notable invertebrates.

Pond 4A (MTPS No. 55 - High)

This pond was recorded during the 1992-93 surveys as small and shallow, occupying a depression dammed up against the Bogey Road. The construction of the East Merthyr Phase 2 haul road on its northern side has resulted in its infilling with outwash from the unvegetated road embankment.

Pond 10 (MTPS No. 66 - High)

This pond supports broad-leaved pondweed with soft-rush on the banks and common spike-rush on the western margin and towards the shallower deltaic area in the north. This deltaic spoil deposit supported a large number of plant species characteristic of a diverse range of habitats.

Pond 10A (MTPS No.65 - Moderate)

A well vegetated, steep-sided, small reservoir close to, but upstream of pond 10, with locally abundant broad-leaved pondweed and a small colony of floating bur reed at the northern end. Round-leaved crowfoot was noted near the water inlet.

Pond 10B

A small pool at a c5m higher level than pond 10A dominated by bulbous rush, broad-leaved pondweed and locally dominant water-purslane, with marginal soft rush.

Pond 10C

A series of small pools about 4m above the level of pond 10. They are small and probably of little floral significance with soft-rush dominant around the margins. A single great crested newt was found here during the 2001 survey. Great crested newts were recorded here on three of the four survey visits in 2004, with a maximum of 6 individuals (1 male and 5 female) on a single visit.

Pond 13

This pond had become completely filled with spoil tip outwash and supported a quite diverse flora characteristic of somewhat base-enriched, wet or marshy soils.

Pond 14 (MTPS No. 60 - High)

A relatively large, linear, disused reservoir, impounded by a stone-faced bank on its south side. The eastern end and southern margin is dominated by soft rush and the

aquatic form of bulbous rush with some floating sweet-grass. Floating bur-reed is locally abundant at the western end, and a bed-forming sedge was recorded at the eastern end.

Pond 15

A small pond occupying a hollow in an old, well-vegetated, colliery spoil tip with marginal soft rush and emergent floating sweet-grass.

Pond 16

This is a small linear pond with a moderate water flow, being essentially a section of widened ditch on the north side of an access road. Marginal vegetation is dominated by rushes but also includes, for example, cuckoo flower, marsh thistle and common yellow-sedge. Emergent species include floating sweet-grass, bulbous rush, water horsetail, amphibious bistort, bog pondweed and round-leaved crowfoot whilst the moss *Fontinalis antipyretica* occurs below the water surface. Abundant frog-spawn was observed in March 2002. Amphibians, including great crested newts, were recorded in 2004.

Pond 17

An area of flooded rush-dominated marshy-grassland with small areas of open water with bog pondweed and floating sweet-grass. Frog tadpoles were noted in 1992.

Ponds 18, 19 & 20

A series of silted, former ponds supporting an unusual flushed vegetation community.

Pond 21

A large disused settling lagoon devoid of emergent or floating vegetation except a small patch of common spike-rush on the eastern side. The banks mostly consist of spoil with some spoil flats but are otherwise steep. The pond is used by large numbers of gulls from the nearby landfill.

Pond 26 (MTPS No. 59 - High)

A eutrophic pond located in a spoil tip depression at the western end of Pond 14. The banks are fringed with Soft Rush and the water surface dominated by Floating Sweet-grass.

Pond 31

A small, former lagoon now dry as its dam is now breached.

Ponds 32, 32A & 32B

A group of small, ephemeral ponds on the top of the sparsely vegetated Ryan's Tip. A single great crested newt was recorded in Pond 32b on one occasion in 2004.

Ponds at Cwmbargoed Disposal Point

- 6.51 There are four ponds in an area immediately south of the Cwmbargoed Disposal Point, outside the site area. These ponds were constructed in 1992 specifically to provide habitat for great crested newts which were displaced by the East Merthyr Reclamation Scheme, although no newts were introduced to the ponds. Three of these ponds were surveyed in 2003 and all four in 2004. A single great crested newt was recorded from one of the ponds in 2003. The species was recorded from all four ponds in 2004. Palmate newt, frog and toad were also recorded.

New Ponds in Cwm Golau

- 6.52 A number of new ponds were constructed in 2003 at suitable locations in Cwm Golau to provide habitat for great crested newts which will be translocated from the Ffos-y-fran Land Reclamation Scheme, under licence issued by the Welsh Assembly Government.
- 6.53 These ponds were surveyed in 2004. Palmate newts and frogs were recorded from some of the ponds.

6.54 Further ponds were constructed in Cwm Golau in 2004.

Future Pond Creation

6.55 A number of ponds will be created as part of the operation and restoration of the site. These will include ponds based on silt lagoons which will be restored to provide wetland habitats, and also ponds provided specifically for the conservation of great crested newts which will be constructed (or in some cases have already been constructed). Proposed locations of these ponds are shown on the restoration plan (Figure 4). The margins of new ponds will generally be constructed with gradients in the range 1:10 to 1:15 to encourage the development of marginal vegetation and aquatic fauna.

6.56 The Merthyr Tydfil BAP objectives for standing open water are to:

- Halt the loss of standing open water.
- Achieve favourable management of standing open water.
- Create areas of new habitat where appropriate.

6.57 The scheme will result in losses of existing standing open water, including ponds which are of local importance. New ponds have already been constructed in Cwm Golau and there would be further construction of new ponds and enhancement of existing ponds during the operation of the site. Further ponds will be created as part of the restoration, including some larger ponds based on silt retention lagoons. Where ponds are to be lost as a result of the Ffos-y-fran site operations, notable plant species associated with the ponds will be translocated to other retained ponds, or introduced to new ponds to be constructed, to aid in the establishment of vegetation and to assist in maintaining the quality of the aquatic environment.

6.58 The area of standing water on completion of the scheme will be no less than that which currently exists at the site, excluding those ponds and lagoons associated with the modern Ryan's tip washing operations south of the Bogey Road. The scheme will have regard to the need to maintain the quality of standing open water features on the site, and their associated marginal habitats.

Rivers & Streams

6.59 The majority of the Ffos-y-fran site lies within three main catchment areas drained by four significant watercourses. These are the Nant Morlais and Nant Cwm Blacs which flow westwards and are tributaries of the Afon Taf; and the Bargod Taf and its tributary the Nant Gyrawd which flow southwards and are also tributaries of the Afon Taf. Significant streams within the site are largely confined to the southern section and all flow southwards. Most have an upland character with stony or rocky bottoms and flow in moderately steep-sided valleys. The main watercourses are the Nant Gyrawd and the headwaters of the Bargod Taf. The Nant Gyrawd in Cwm Golau above Bryn Caerau Farm flows through a deep, rocky gorge.

6.60 The Nant Gyrawd would not be affected by the scheme, apart from one consented discharge. Its course is now entirely outside the Ffos-y-fran site. It forms an important feature of the proposed Cwm Golau ecological area.

6.61 Some of the headwater streams of the Bargod Taf are within the southern overburden storage area, and would be diverted in accordance with the existing consents from the Environment Agency.

6.62 These streams are generally within areas affected by previous mine spoil disposal. During site operations measures will be implemented to avoid damage to watercourses not directly affected by site operations, and to protect such watercourses from pollution through appropriate drainage systems and water

treatment facilities. All such measures will be discussed with the Environment Agency.

6.63 On restoration of the southern overburden storage area, headwater streams of the Bargod Taf will be reinstated as part of the drainage system of the restored site. The detailed proposals will be discussed with the Environment Agency.

6.64 The Merthyr Tydfil BAP objectives for rivers streams and floodplains are to:

- Maintain and enhance the existing habitat and species diversity of rivers, streams and floodplains.
- Where feasible, re-instatement of existing watercourses will be encouraged.

6.65 There will be some loss of watercourses during operation of the site, and thus some conflict with the first objective of the plan, but on restoration the scheme will accord with the second objective insofar as the watercourses will be replaced to replicate habitats provided by the natural streams so far as practicable. Given the upland nature of the watercourses there are no significant floodplains associated with them.

Ffridd / Bracken Slopes

6.66 Ffridd is the term for a complex mosaic of heath, bracken, woodland, acid grassland, old workings and wet flushes, usually grazed by sheep on valley sides between the enclosed land on the lower slopes and the open ridge tops. There are no extensive areas of such habitat within the Ffos-y-fran site although there are scattered patches of bracken in mosaic with other vegetation on better drained valley sides. The largest areas of bracken are on the sides of the Nant Gyrawd valley, north of the woodland. This area is within the Cwm Golau ecological area.

6.67 The Merthyr Tydfil BAP objectives for ffridd are to:

- Halt the loss of areas of ffridd.
- Achieve favourable management of ffridd.
- Create new areas of habitat where appropriate.

6.68 Given the limited extent of such habitat within the site, and that the largest areas of bracken will be retained within an area which will be subject to enhanced management for nature conservation, the scheme does not conflict with the objectives of the plan. The restoration of the lower sections of the western part of the site to a mosaic of small woodlands within grassland will, in the longer term, enable development of habitat resembling ffridd.

Mineral Spoil Areas

6.69 In the west and south of the site are areas of colliery spoil, some of which are well vegetated and have developed vegetation comparable with semi-improved grassland on disturbed soils elsewhere on the site. These are of limited wildlife value. Some of the older spoil tips carry a mosaic of dry acid grassland, dwarf shrub heath and lichen/bryophyte heath, including some good, but small areas of dwarf-shrub heath.

6.70 Less stable, steeply sloping areas of spoil are less well vegetated but support a characteristic assemblage of early colonising plant species. These areas of spoil will largely be within the area of the opencast excavation, and additional areas south of the Bogey Road will be affected by the Ffos-y-fran operations.

6.71 The Merthyr Tydfil BAP objectives for mineral spoil areas are to:

- Halt the loss of areas of mineral spoil of high biodiversity value.
- Achieve favourable management of mineral spoil areas for biodiversity.

- On mineral spoil areas of low biodiversity value encourage restoration to enhance biodiversity.
- 6.72 One of the main principles of the East Merthyr Restoration Scheme (Phase III of which is encompassed within the Ffos-y-fran scheme) is to restore the areas affected by spoil disposal from former mineral working and other industrial activity. It is thus inevitable that the vegetation associated with such spoil will be lost and, to the extent that some of these areas are of value for biodiversity, that the scheme does not accord with this objective of the plan.
- 6.73 It is inevitable that the complex topography, and thus variation in vegetation across these areas will be lost. Some areas of such spoil support habitats which are of local interest and which may be difficult to recreate on restoration, such as lichen-bryophyte heath. However, a suitable receptor site has been identified by Merthyr Tydfil County Borough Council and, subject to timing of the commencement of operations, surface material from selected areas of lichen-bryophyte heath will be separately stripped and spread on the receptor site to attempt to conserve this vegetation. Restoration of the site will restore significant areas to acid upland grassland on soil forming materials which will be managed to encourage the development of nature conservation value, so far as this is in the control of the operator. This is area 4M on Figure 8. As part of the restoration, small scale variation in topography will be introduced in this area to provide a range of soil moisture regimes to encourage variation in vegetation.

Acid Grassland

- 6.74 Areas of wet acid grassland have been considered previously. There are also extensive areas of dry acid grassland, particularly in the western part of the site, largely on areas of colliery spoil. All of this grassland is subject to grazing by sheep, horses and some cattle at varying intensities. The quality of the grassland in those areas which have been most intensively grazed has been degraded by the effects of grazing and by nutrient enrichment. The grassland in parts of the western section of the site has been degraded by former industrial activity and motor cycle scrambling.
- 6.75 Much of the dry acid grassland is in the section of the site from which coal will be extracted and will be lost through excavation of the opencast void. Other areas will be affected by overburden storage. These areas will be restored to grassland on completion of site operations. The Ffos-y-fran operations will also affect relatively small areas of such vegetation south of the railway.
- 6.76 The Merthyr Tydfil BAP objectives for acid grassland are to:
- Halt the loss of areas of acid grassland.
 - Achieve favourable management of acid grassland.
 - Create areas of new habitat here appropriate.
- 6.77 As explained above in relation to mineral spoil areas, one of the main principles of the East Merthyr Restoration Scheme (Phase III of which is encompassed within the Ffos-y-fran scheme) is to restore the areas affected by spoil disposal from former mineral working and other industrial activity. It is thus inevitable that the vegetation associated with such spoil, including acid grassland, will be lost and that the scheme does not accord with these objectives of the plan.
- 6.78 Extensive areas of the site will however be restored to acid grassland on completion.

Dry Stone Walls & Other Boundary Features

- 6.79 Boundary habitats excluding hedgerows, include banks, ditches and remnants of stone walls dividing fields within the agricultural land, largely outside the south of the site. Stone abutments are also associated with old railway structures and around

some of the curtilages of the demolished dwellings south of the Bogey Road. The majority of such features will not be affected by the Ffos-y-fran operations. Such features within the Cwm Golau ecological area will be improved as part of the scheme. Detailed proposals will be set out in the Management Plan for this area. As explained in section 3 (and shown on the Restoration Plan – Figure 4 – if suitable stone is recovered during the excavations, field boundaries in the south of the site will include some in dry stone construction

6.80 The Merthyr Tydfil BAP objectives for dry stone walls, banks and ditches are to:

- Halt the loss of dry stone walls and other boundary features.
- Achieve favourable management of all boundary features.
- Create new dry stone walls and other boundary features where appropriate.

6.81 The scheme does not conflict with the objectives of the action plan.

Restoration and species

6.82 The focus of restoration is inevitably on re-instatement of habitats. However, consideration is given here to those species for which there is a species action plan (or for which such a plan is proposed) in the Merthyr Tydfil BAP.

Birds

6.83 Birds recorded during the breeding bird survey carried out in 2001 are shown on Figure 11. The results of the 2003 breeding bird survey are shown on Figure 12.

Peregrine falcon

6.84 Sightings of peregrine during the ecological surveys in 2001 were of individual birds overflying the north eastern part of the site. No peregrines were recorded during the 2003 breeding bird survey. There is no evidence that the species is particularly associated with the site and there are no suitable nest sites within or in the close vicinity of the site. The Merthyr Tydfil BAP objectives for peregrine are to:

- Encourage the reporting of incidents to the Wildlife Crimes Officer, CCW or the Countryside Officer.
- Ensure all known sites are managed effectively for the benefit of peregrines.
- Ensure land managers etc. are aware of the risks associated with agro-chemicals and of the alternatives available.
- Ensure all known nesting sites are monitored annually, through South Wales Peregrine Watch
- Raise awareness in schools etc. of the value of quarry sites and the plight of peregrines.

6.85 The Restoration Scheme does not conflict with these objectives. In managing the land associated with the Ffos-y-fran scheme the operator will have regard to the action plan objectives.

Barn owl

6.86 In 2001, barn owl was recorded hunting on several occasions in the area between the Bogey Road and the railway, and in the southern part of the site. In 2003, there was evidence of barn owl nesting in the derelict office building in Ryan's yard, outside the site area. There are no buildings suitable for nesting within the operational areas of the Ffos-y-fran site.

- 6.87 There will be some loss of habitat suitable for hunting barn owls, particularly through construction of the Southern Overburden Store. Barn owls are less likely to hunt over the open areas in the north of the site.
- 6.88 The land which will be affected is likely to form only a small portion of the likely territory of the barn owls. Much of the area of the valley will remain undisturbed within the Cwm Golau ecological area. During the operational period, rough grassland areas will be retained around the margins of the operational site. This will support small mammal prey for barn owls. Restoration of the southern part of the site to fields with hedgerows will re-instate suitable habitat for this species in the long term.
- 6.89 The availability of suitable nest sites can be a constraint on barn owl populations, and the potential for provision of owl access and nesting platforms in suitable buildings within the operator's control will be investigated.
- 6.90 The Merthyr Tydfil BAP objectives for barn owl are to:
- Make the public aware of the threats to barn owl.
 - Halt the decline and aim to get former territories recolonised.
 - Increase public understanding of and encourage public participation in survey of Barn Owls.
 - Increase awareness of the link between pesticides and other chemicals and declining populations of natural predators of rodents.
- 6.91 The Restoration Scheme does not conflict with these objectives. Management of the land associated with the Ffos-y-fran scheme will have regard to the action plan objectives.

Song thrush

- 6.92 Song thrush was recorded breeding in three locations in 2003, two in the Nant Gyrwd woodland, and one in the Bargod Taf valley south of the site boundary. None of these territories will be affected by the operations. This area was not included in the 2003 survey and no breeding song thrushes were recorded elsewhere. Planting of hedgerows and sympathetic woodland management will be beneficial to this species.
- 6.93 The Merthyr Tydfil BAP objectives for song thrush are to:
- Safeguard the apparently healthy local population of Song Thrush, by raising the public awareness of the conservation value and biological richness of the County Borough – even the areas traditionally thought of as despoiled waste (an image problem).
 - Try to maintain existing feeding and breeding habitats and bring less suitable or poorly managed ones up to scratch, perhaps by encouraging landowners to take up schemes such as Tir Gofal.
 - Encourage wildlife friendly gardening and make the public aware of just how valuable gardens can be to wildlife.

- 6.94 The Restoration Scheme does not conflict with these objectives. Management of the land associated with the Ffos-y-fran scheme will have regard to the relevant action plan objectives.

Skylark

- 6.95 Skylark was the second commonest breeding bird species recorded during the 2001 breeding bird survey (after meadow pipit) with 46 territories recorded. This was also the case in 2003 when 51 skylark territories were recorded. Breeding territories were distributed across all of the open areas of the site. The excavation of the opencast

void, and storage of soils and overburden, will affect much of the habitat suitable for skylark. Once the overburden mounds are complete they will be seeded to establish a rough and patchy grass sward. With suitable management, these areas will provide habitat for breeding skylarks, as will retained grassland and moorland vegetation around the site margins. In the longer term restoration to grass moor and heath vegetation will provide for the continued presence of this species.

6.96 The Merthyr Tydfil BAP objectives for skylark are to:

- Prevent any decline of the current breeding population within the County Borough.
- Where possible, encourage an increase in the number of breeding pairs by habitat creation and management.

6.97 During the period of working, there will be a reduction in the extent of habitat for skylark and thus some conflict with the plan objectives. During the preparatory works for the site, and for each subsequent phase of working, nesting will be actively discouraged on the areas to be disturbed during the months immediately preceding soil stripping. Some of the skylarks will relocate to other suitable nesting areas, such as the overburden storage mounds and the Cwm Golau ecological area, which will be managed so as to provide suitable nesting areas. In the longer term, suitable nesting habitat will be recreated and managed appropriately in so far as this is in the control of the operator.

Linnet

6.98 Up to five breeding pairs of linnet were recorded in 2001. Three of these were in the Bargod Taf valley along the south western boundary of the site in an area which would not be affected by the operations. The remaining two pairs were in the west of the site north of the Bogey Road along the former railway line. This area will be affected by the excavation of the opencast void.

6.99 Ten pairs were recorded in 2003. Two of these were in the Bargod Taf Valley. Seven were in the west of the site north of the Bogey Road and the remaining one on an area of tip west of the Nant Gyrawd. These latter eight pairs were in areas which will be affected by the operations.

6.100 Linnets are typically associated with relatively open habitats with plentiful sources of seeds. Areas of rough grassland around the margins of the site will provide suitable habitat during site operations. There will continue to be suitable marginal habitats in the longer term following restoration of the site. Enhanced management of Cwm Golau will provide improved habitat for linnet.

6.101 The Merthyr Tydfil BAP objectives for linnet are to:

- Halt the loss of both feeding and breeding habitats.
- Where possible seek to increase the quality and number of suitable habitats.
- Encourage favourable management of suitable habitats.

6.102 Whilst there will be some loss of suitable existing habitat for linnet, this will be off set by improved habitat management elsewhere. In the long term, overall the Restoration Scheme does not conflict with the objectives of the action plan.

Reed bunting

6.103 Up to nine singing male reed buntings were recorded during the 2001 breeding bird survey. These were predominantly associated with ponds and wet flush areas in the northern part of the site.

- 6.104 In 2003, fifteen pairs were recorded. These were again particularly associated with ponds and wet flushed areas in the northern part of the site, but there was also a concentration in the extreme south of the site in the Bargod Taf valley, some in areas which will not be affected by the scheme.
- 6.105 The reed bunting is ecologically restricted to particular types of dense and fairly low vegetation, mainly associated with high soil moisture. Its apparent attachment to marshes, fens, bogs, riversides and inland waters is indirect through dependence on their associated vegetation types rather than being linked with any special need for water.
- 6.106 The areas where reed buntings were recorded will generally be lost as a result of the Ffos-y-fran operations, other than some of the territories in the Bargod Taf valley. During site operations suitable habitat for reed buntings will remain in wetland areas in the central ecological area, and associated with the margins of silt ponds. On restoration of the site, wetland vegetation associated with the restored silt ponds will continue to provide suitable habitat.
- 6.107 The Merthyr Tydfil BAP objectives for reed bunting are to:
- Prevent any decline in the breeding population within the County Borough.
 - Encourage the favourable management of suitable habitat.
- 6.108 During the period of working, it is likely that there will be some reduction in the extent of habitat for reed bunting and thus conflicts to some extent with the plan objectives. However in the longer term, suitable wetland habitat will be recreated and managed appropriately.

Lapwing

- 6.109 Up to nine breeding pairs of lapwing were observed in 2001, although nest failure may have caused some birds to relocate and the number may be over estimated. The majority of these birds were recorded in the area of the spoil tip south of the railway. This area will be affected by the southern overburden storage mound required for the Ffos-y-fran scheme.
- 6.110 In 2003 seven pairs were recorded, all breeding in the restored area of Phase 2 of the East Merthyr Reclamation Scheme in the extreme west of the Ffos-y-fran site adjacent to the A4070 road. Lapwings have continued to breed in this area during 2004 and 2005. This area will also be affected by the scheme.
- 6.111 This lapwing population is important in the local context, and is likely to form part of a metapopulation breeding at a number of sites in the Heads of the Valleys area.
- 6.112 On restoration of the site, an extensive area at Garth Fawr will be managed specifically to provide a breeding area for lapwings. During the operation of the site the existing lapwing breeding area east of the A4070 will be progressively lost and other suitable areas will be made available for the birds. Initially the area of Ryan's Tip where breeding has previously occurred would be made more attractive to the birds through habitat improvements. As the works progresses habitat would be created on the northern and eastern overburden mounds until the permanent breeding area at Garth Fawr can be created. The sequence of habitat creation is shown in the table and figures at Appendix B.
- 6.113 Habitat provision for lapwing would comprise extensive open areas of land with sparse vegetation and shallow scrapes (with clay lining if necessary) to provide small areas of shallow water. Rushes would be planted around the edges of the scrapes to provide cover for young chicks. Consideration would be given to spreading of farmyard manure to encourage the development of soil invertebrate populations.

Around the edges of the nesting areas, growth of grass would be encouraged to provide cover and feeding for growing chicks.

6.114 Lapwings will be encouraged to settle in the nesting areas by the use of decoys in the early spring. Decoys were historically used in trapping of waders. Stuffed decoys were employed in the trapping of Golden Plover and Lapwing in Central Europe, as well as in the Mediterranean region, the Netherlands and France. Their number at a Lapwing trap typically varied between 15 and 20.

6.115 The Merthyr Tydfil BAP objectives for lapwing are to :

- Where possible halt the destruction or degradation of areas of suitable habitat, whether or not Lapwing currently use them.
- Enhance the breeding success on farmland and colliery spoil through appropriate management.

6.116 During the period of working, there will be loss of the current nesting area used for breeding by lapwing and thus a conflict with these plan objectives. However, Lapwings will be encouraged to relocate to other suitable nesting areas initially at Garth Fawr, and later on the overburden storage mounds, which will be managed so as to provide suitable nesting areas. In the longer term, suitable habitat will be recreated at Garth Fawr and managed appropriately. The Merthyr Tydfil BAP recognises that if coal spoil is restored and managed appropriately it can be attractive to lapwings.

Sand martin

6.117 Sand martin was recorded during the 2001 ecological surveys. None were recorded during the 2003 breeding bird survey. This species typically nests in vertical undercutting banks of rivers, or in physically similar habitats such as the edges of gravel pits. It is frequently seen as a passage migrant elsewhere. There is no evidence that it breeds at the site, or that the site is otherwise of particular significance.

6.118 The Merthyr Tydfil BAP objectives for sand martin are to:

- Protect existing breeding colonies and maintain the breeding population in the county borough.
- Provide advice to landowners, farmers, managers, consultants and engineers on mitigation measures for providing alternative nesting sites for this species.

6.119 The Restoration Scheme does not conflict with the objectives of the plan. Ponds and lagoons at the site will continue to provide feeding habitat for sand martin during site operations and following restoration.

Breeding bird assemblages

6.120 Figure 11 identifies areas of importance for woodland birds, breeding waders and ground nesting passerine birds in 2001.

6.121 The only area of importance for woodland birds was in the Nant Gyrawd valley, outside the site area. This area was not included in the 2003 breeding bird survey. This area will not be affected by the Ffos-y-fran operations, and enhancement and management of the Cwm Golau ecological area will benefit woodland birds.

6.122 Two of the six areas of importance for breeding waders (snipe) were in the area north of the Bogey Road which will be affected by the Ffos-y-fran opencast excavation. These areas were also important for snipe in 2003 and common sandpiper was also recorded although breeding was not confirmed.

- 6.123 A third area of importance for waders in 2001 was almost entirely within the area required for the southern overburden store. As explained above, this area was primarily of note for its breeding lapwings. Lapwings were not recorded here in 2003, but the colony had moved to the restored area of Phase 2 of the East Merthyr Reclamation Scheme, as explained above.
- 6.124 A fourth area was between the Bogey Road and the railway where a curlew nest was recorded in 2001. This area is largely outside the site and habitats here will be retained as the central ecological area. However, it will be necessary to construct a haul road across the western end of this area to transport overburden to the southern overburden store during its construction in years 2-7 of working, and to transport material back for restoration of the void during the last four years or so of the operations. Curlew was not recorded here in 2003. There was however, a single curlew territory in the south of the site in an area which will be affected by the construction of soil and overburden stores and lagoons.
- 6.125 The fifth area was to the east of the site in the angle between the Bogey Road and the Fochriw Road. There will be some disturbance at the western end of this area during construction and removal of northern overburden store, and also to a lesser extent through transport of coal between the excavation and the Cwmbargoed Disposal Point during the continued operation of the site. This area was not surveyed in 2003.
- 6.126 The final area of importance for breeding waders in 2001 was around pond 8 within the Tair Carreg Moor SINC to the north east of the site which will not be affected by the operations. This area was not surveyed in 2003.
- 6.127 Additional areas where breeding snipe were recorded in 2003 were in the east of the site, north of the Bogey Road, and in the south west of the site, west of the Bargod Taf. Both of these areas will be affected by the construction of overburden mounds.
- 6.128 A large part of the site north of the Bogey Road is of importance for breeding passerines, particularly skylark (as considered above) and meadow pipit. Meadow pipit was the commonest breeding bird at the site with 58 identified breeding territories in 2001 and 107 in 2003. The additional breeding territories recorded in 2003 were generally in the area south of the Bogey Road. Meadow pipit is generally the commonest breeding bird of upland grass moors and heaths. Given its wide distribution across the site, much of the breeding areas will be affected by the opencast excavation and construction of overburden stores. As explained above, the vegetated overburden and soil mounds, and on restoration, the grassland and heath of the restored site, will provide suitable nesting areas for these species, subject to appropriate control of grazing.

Mammals

Brown Hare

- 6.129 Low numbers of brown hares may use the site, although there were no sightings during any of the ecological surveys. During the operational period the extensive grassed overburden and soil stores will continue to provide suitable habitat for this species. Restoration of the site to upland grassland and heath would similarly provide suitable habitat in the long term.
- 6.130 The Merthyr Tydfil BAP objectives for brown hare are to:
- Survey for and monitor Brown Hare sites
 - Maintain and expand any existing population in the Merthyr Tydfil area.
- 6.131 To the extent that the negative findings of the ecological surveys have contributed to knowledge of the distribution of the brown hare in Merthyr Tydfil, the scheme has

already contributed to the BAP objectives. Given that no significant population is likely to be present at the site, the scheme does not conflict with the objectives.

Amphibians

Great crested newt

- 6.132 The results of an amphibian survey of the site in 2001 are shown on Figure 13.
- 6.133 Great crested newts have been recorded from waterbodies and terrestrial habitat within the site. No great crested newts were recorded from waterbodies or terrestrial habitats in the section of the site north of the Bogey Road in 2001. Terrestrial habitats within the area of the site to the north of the road, which are potentially suitable for the species, extend to within 250m of waterbodies where the species was recorded. There were also waterbodies within the northern section of the site which could potentially be used by great crested newts.
- 6.134 To the south of the Bogey Road, great crested newts were recorded from ponds 6 and 10c, and amongst the rubble of the former Isaac Morgan Cottages. Pond 6 is outside the Ffos-y-fran site, within the central ecological area, and will not be affected by the operations.
- 6.135 The Isaac Morgan Cottages ruins and Pond 10c are within the site boundary. The area of the ruined cottages will not be affected by the works, but Pond 10C is within the area which will be affected by construction of the southern overburden store.
- 6.136 A further amphibian survey was undertaken in spring and summer 2003 to confirm the distribution of the species within the site. Only one great crested newt was recorded. This was found in one of the ponds immediately south of the Cwmbargoed Disposal Point. This is one of four ponds constructed in 1992 to receive great crested newts affected by the East Merthyr Reclamation Scheme Phase II works. However, these ponds were not used and the newts were taken elsewhere.
- 6.137 A further amphibian survey was carried out in spring 2004 to provide additional information on the status of great crested newts in the light of the delay to the project. Great crested newts were recorded in a total of ten ponds. Four of these were the ponds south of the Cwmbargoed Disposal Point which are outside the site area and will not be affected by the works. There were also records from Pond 6 which is within the central ecological area and again will not be affected by the works.
- 6.138 Ponds 10c, 16 and 32b are south of the Bogey Road and will be affected by the scheme. Pond 10c also contained the species in 2001.
- 6.139 In 2004 great crested newts were for the first time recorded north of the Bogey Road with single individuals recorded once from Ponds 3 and 4. From the number of great crested newts recorded in the surveys, it is expected that during the progress of the works to the north of the Bogey Road, only small numbers are likely to be present.
- 6.140 A methodology for the translocation of great crested newts from the working area has been agreed with the Countryside Council for Wales. The principles of the methodology for protection of the species are to contain great crested newts breeding to the south of the Bogey Road within the central ecological area, which includes Ponds 5 and 6 and the Isaac Morgan Cottages ruins; to capture any great crested newts present at ponds and associated habitats which will be affected by the operations, and to transfer them to new ponds which have been constructed; and to prevent great crested newts moving into the working areas.
- 6.141 Additional breeding ponds for great crested newt were constructed in 2003 in areas of suitable terrestrial habitat on land within the Cwm Golau ecological area, to the south of Cwmbargoed Disposal Point, within the operator's control. Terrestrial habitat for

the species in areas close to the ponds has been improved by provision of rubble piles and fencing, and shrub planting.

- 6.142 Additional ponds were constructed in 2004 in Cwm Golau. The creation of several small ponds within 250m of each other is to be preferred over the creation of one large pond.
- 6.143 Whilst the measures are specifically designed for the protection of great crested newts, any other amphibians captured will also be transferred to suitable habitats outside the working area.
- 6.144 As part of the restoration of the site, further ponds will be constructed. Suitable terrestrial habitat for amphibians will be provided in the vicinity of these ponds.
- 6.145 These measures will ensure that suitable habitat for amphibians is provided in the area in the long term.
- 6.146 A licence under Regulation 44 of the Habitats Regulations has been issued by the Welsh Assembly Government to ensure that procedures are in place for appropriate measures to be implemented to protect great crested newts from harm as a result of the operations.
- 6.147 The Merthyr Tydfil BAP targets and objectives for great crested newt are to:
- Halt the decline of great crested newts within the borough.
 - Create 5 new newt ponds by 2004
 - Restore 5 degraded sites by 2004.
- 6.148 The scheme has already contributed to the action plan target by construction of new ponds for great crested newts at six locations in Cwm Golau. Creation of further ponds and improvements to terrestrial habitat, as part of the restoration of the site, will in the longer term provide a conservation benefit in providing additional habitat for great crested newts and other amphibian species in the area.
- 6.149 For the period of aftercare of the restored site, all of the existing and new ponds created for great crested newts will be managed by Miller Argent or their agents. Subsequent to the aftercare period, and whilst ownership remains with Miller Argent, the ponds will continue to be managed by them or their agents. At such time as ownership of the land may be transferred, measures to ensure the future management of the ponds through agreement with a suitable organisation would be agreed with CCW.

Palmate newt

- 6.150 Palmate newts are more widespread at the site than great crested newts and were recorded from ponds 3, 10c, 14 and 26 within the site area in 2001. In the 2003 surveys there were additional records from pond 13. There were additional records in 2004 from ponds 2, 2a, 4, 4a, 4b, 10, 10a, 10b, 16, 16a, 22, 28, 32b, 32c and 33
- 6.151 Records from ponds which will not be affected were from ponds 5 and 7 in 2001, and 5, 6, B and C in 2003. In 2004 there were additional records from ponds 9, 30, A, and D. Survey of the new ponds in Cwm Golau in 2004 recorded the species in ponds N1a, N1b, N1c, N2a, and N2b.
- 6.152 The Merthyr Tydfil BAP objectives for palmate newt are to:
- Halt the decline of this species
 - Increase the quality of suitable habitats, both aquatic and terrestrial
 - Raise awareness of the conservation needs of this species

- 6.153 The habitat creation and management measures described above for great crested newt will also provide for the effective conservation of palmate newt. Whilst the measures proposed for the capture and translocation of great crested newt are specifically targeted at that species, any other amphibians captured will also be transferred to suitable habitats outside the working area. The Restoration Scheme does not conflict with the objectives of the action plan.

Protected Species - Summary of Mitigation

- 6.154 The following table summarises the mitigation measures which will be implemented for protected species.

Species	Protection	Proposed Mitigation
Breeding birds	Wildlife and Countryside Act Part 1 Section 1	<p>In order to avoid destruction of nests, ground-nesting birds will be actively deterred from nesting in areas where soils are to be stripped, or which are otherwise to be affected by operations, by appropriate measures during March and April.</p> <p>Any hedgerows, trees or similar vegetation, which may provide nesting habitat, will be removed during the period September-February inclusive.</p> <p>During operation of the site, the tops of overburden mounds will be managed so as to provide suitable nesting habitat for lapwings. Suitable lapwing nesting habitat will be created on restoration of the site.</p>
Barn owl	Wildlife and Countryside Act Part 1 Section 1 & Schedule 1	The potential for provision of barn owl access and nesting platforms in suitable buildings within the operator's control, and on the edge of Cwm Golau woods, will be investigated.
Bats	Wildlife and Countryside Act Part 1 Section 9 and Schedule 5 Habitats Regulations Schedule 2	<p>Bat boxes will be placed in woodland and other suitable locations to provide additional opportunities for bat roosting at the site.</p> <p>Opportunities for creating underground bat roosts associated with the woodland to be planted south of the Bogey Road will be investigated</p>
Badger	Protection of Badgers Act 1992	A confirmatory survey will be carried out, prior to commencement of work in the area of the Southern Overburden Mound, in order to ensure that no badger setts have been constructed in areas which will be affected by the proposals.
Reptiles	Wildlife and Countryside Act Part 1 Section 9 (1 & 5) and Schedule 5	<p>A trapping programme will be implemented, in tandem with the great crested newt clearance works, in areas of most likely reptile habitat, and reptiles captured transferred to the central ecological area between the Bogey Road and the railway, including the line of the former railway itself.</p> <p>Specific features to provide hibernation and</p>

Species	Protection	Proposed Mitigation
		basking sites for reptiles will be provided within the restored site.
Great crested newt	Wildlife and Countryside Act Part 1 Section 9 and Schedule 5 Habitats Regulations Schedule 2	The great crested newt mitigation programme will be carried out in accordance with the Method Statement approved under the Regulation 44 Licence.
Other amphibians	Wildlife and Countryside Act Part 1 Section 9 (5) and Schedule 5	Any other amphibians captured during the great crested newt mitigation work will be transferred to suitable habitats outside the working area. As part of the restoration of the site, ponds will be constructed. Suitable terrestrial habitat for amphibians will be provided in the vicinity of these ponds. These measures will ensure that suitable habitat for amphibians is provided in the area in the long term.

7.0 Archaeology and the Historic Landscape

Introduction

- 7.1 The Ffos-y-fran Land Reclamation Scheme offers an opportunity to integrate commercial and economic activity of importance to the well-being of the town of Merthyr Tydfil with those of cultural, social, and heritage preservation and promotion objectives. The operators accept that there will be some losses of heritage assets as a result of the proposed scheme. The scheme will however comprehensively mitigate these losses, and innovative archaeological objectives are proposed. The implementation of mitigation objectives, with the preservation of industrial heritage resource in the rest of the designated Merthyr Historic Landscape, will be a major contribution to more broad based heritage research, preservation, and sustainable management objectives.
- 7.2 This section explains the principles and methods by which Miller Argent will mitigate effects on physical heritage resulting from the land reclamation scheme. It addresses mitigation options for effects at ground level and also in underground seams where opencast coal extraction is to occur.

Heritage Aspects considered

- 7.3 The general character of the resources has been defined as:
- Surviving natural landscape of Prehistoric origin and with soil structures, settlement sites and ecological content preserving testament to this.
 - Features of Medieval land use with field systems, enclosures, boundary markers, ditches.
 - Medieval and Post-Medieval Common Land with traditional and continuing pastoral land uses.
 - Surface coal and iron stone patch workings.
 - Spoil and surface structures/infrastructure relating to deep mining.
 - The Dowlais Free Drainage System.
 - Modern features that have affected the heritage assets

Historic Landscape Assessment

- 7.4 A significant component of the cultural heritage assets relates to remnants of the natural and prehistoric landscape on and in which are elements of later periods, particularly the early Industrial period. The landscape of the site is a small but interesting component of the identified historic landscape in and around Merthyr. The importance of the landscape is intimately related to the iron and coal industries of Merthyr and which was central to the industrial revolution and growth of the British Empire and more locally the growth of the major towns of Cardiff, Newport and Swansea. The site is part of an area designated as a 'Landscape of Outstanding Historic Interest in Wales'

The Proposals

- 7.5 Design of the development has involved an archaeological consultant as part of the multidisciplinary team. Some of the key inputs have been or will be:
- Protection designs for Scheduled Ancient Monuments (SAMs) and local surrounding setting, the designated prehistoric landscape, areas of adjacent 'old men's workings', a Listed Building (a wooden aqueduct) and other elements of built heritage value.
 - Integrating an archaeological contractor with the development, for providing desk study inputs, evaluating site resources, and developing mitigation strategies.

- Avoidance of key features by adopting modified/alternative designs and related to the design for top soil and subsoil stripping and new routes. This will encompass leats, boundary stones, enclosures, mining pit head structures.
- Planning for archaeological interventions and approvals.
- Employment and training of a mining surveyor in archaeological documentation, artefact recovery, emergency conservation. The roles are defined as follows and are an extension of those required by law for on-going coal resource mapping:
 - Mapping the extraction pattern in coal seat-earth and iron stone seams.
 - Mapping underground water drainage leats and other 'structural' features such as access and vent shafts and roof support pillars.
 - Documenting working processes, including timber propping, face tooling, tracks, and underground spoil.
 - Logging the location and recovery of artefacts, including for emergency conservation.
- Scientific programme related to the short term behaviour of archaeological structures and artefacts buried below spoil tips (deep backfill).
- Landscape restoration master planning.
- Design of post-scheme heritage promotion.

7.6 Given the scale and duration of the opencast mining, the scheme recognises that the Scheduled Ancient Monuments (SAMs) and other heritage features within the site, and immediately surrounding it, are vulnerable to accidental damage and vandalism. It is also the case that the SAMs and other upstanding structures are in poor condition and are rapidly decaying. Some archaeological features will be left exposed and others preserved under the tips. It is therefore part of the design that protection will be afforded to these assets, following documentation of the 'as found' condition, through:

- Identification markings.
- Secure fencing off.
- Some emergency stabilisation of structurally unsound elements.
- Burial under a sand or other compatible fill buffer formation.
- Regular monitoring.
- The details of these works will be formulated in conjunction with the statutory authorities via detailed specifications, and then approved via Scheduled Monument Consent and Merthyr planning procedures. The Glamorgan and Gwent Archaeological Trust (GGAT) will supervise the consented undertakings.

7.7 Significant mitigation has already been achieved through development of the scheme over the last few years. This has included:

- The discovery and preservation of an Iron Age Settlement within the south-western boundary.
- Withdrawal of the boundary from Tair Cerrig stones in the north-eastern part of the site.
- Exclusion from the site of the Sarn Howell Pond and Watercourses Scheduled Ancient Monument.
- Withdrawal of the south-eastern boundary to exclude and preserve older circular enclosures associated with Bryn Caerau Farm.
- Preservation of a wooden aqueduct (a listed building) over the disused mineral railway cutting in the central section of the site.
- Withdrawal of the eastern boundary to exclude more clearly defined and complex man-made channels associated with the Dowlais Free Drainage System.
- The development of the scheme has also already brought about what is probably the most in-depth study of the Dowlais Free Drainage System.

7.8 Potential impacts on heritage resources have thus been avoided through adjustments to the design of the scheme.

Adjustments to the Quarry Faces

- 7.9 Geotechnical investigations, examining for faults, joints, stratification, and hydrology, have been used to maximise the verticality of the quarry faces. This is essential for safety, the extraction process and for maximising coal recovery within the consented boundary of the quarry. There has been a specific aim to avoid, as far as possible, large scale battering back of the excavation faces into areas where there are heritage features that otherwise would be affected.

Modification to Tip Locations and Lagoon Locations

- 7.10 Responding to increased understanding of the 'workings' of the scheme, and related to results of site investigations and detailed design, the footprint of the storage mounds have evolved. As a result, the position and size of the settlement lagoons have also evolved. The storage mounds and lagoons have been specifically located to avoid known locations of archaeological sites and features. For example, the southern overburden mound was originally intended to cover the land where the Prehistoric settlement has now been located. The approach has been to move the mound rather than excavate this site.

Modification to the Haul Road etc

- 7.11 The route from excavation to storage mound has developed to take account of the public highway from Merthyr to Cwmbargoed, and also to avoid being close to key heritage features, especially reservoirs of the Dowlais Free Drainage system. Here the aim has been to minimise the risk of damage caused by potential vehicle vibrations and impact from accidental falling soils and overburden.

Further Investigations and Mitigation

- 7.12 The site works will further define the physical heritage resources prior to the implementation of the scheme, to more fully define mitigation solutions. Some mitigation will be developed during the scheme as a response to unforeseen discoveries, new and evolving objectives.
- 7.13 The further mitigation relates to three distinct phases:
- Prior to the start of site works - now and through the scheme procurement period.
 - During the site works comprising preparation of the site, excavation and spoil mounding.
 - During the progressive reinstatement of the land surface to its new modelled form and this associated with planning for reinstatement of traditional and new functions.

Early Heritage Site Works

- 7.14 The following works will be undertaken prior to and in the early stages of site operations.
- Further survey and research especially of mining records.
 - On site survey and further investigation of the key parts of the Dowlais Free Drainage System.
 - Archaeological 'Watching Brief' on engineering site investigations for roads and lagoons

- Protection and general survey of SAMs and other key identified heritage features where necessary.

During Operations

7.15 The following measures will be implemented during the subsequent operation of the site:

- Local excavations of identified resources that will be removed or covered by excavations and soil/overburden storage operations.
- Watching Brief on sites and at locations to be protected prior to top soil stripping.
 - General Watching Brief during top soil stripping
 - Watching Brief on excavation of the settlement lagoons and attenuation ponds.
 - Mapping of coal and other material extraction to define locations, extent, age, techniques, and
 - artefact recovery under controlled processes

Restoration - Creation of a Heritage Park

7.16 The Ffos-y-fran surface reclamation aims to be innovative, accepting that it is impossible to copy, nor is it desirable to totally reproduce, the original land forms. The surface will be landscaped in such a way as to allow historic husbandry practices to continue over the landscape to the east of Merthyr, but with features of both heritage and nature conservation interest being retained and serviced by an improved road and footpath network. This will encourage the urban common land to be more frequently used, understood, and appreciated by the people of Merthyr and outside visitors. Provision for heritage features will be integrated with common land and other functions to be re-established.

7.17 Heritage will be an integral part of the innovative landscape creation. The SAMs and other resources will be displayed. Some features of the Ffos-y-fran Land Reclamation Scheme will be incorporated to illustrate continuity of process. There are other possibilities for retaining heritage resources and these are noted further on in this chapter.

7.18 Reference will be made to the mines and discoveries made in the mines and to artefacts.

7.19 The design of such a park will consider long-term heritage management opportunities and procedures.

Conservation of Scheduled Ancient Monuments (SAMs) and Listed Buildings

7.20 The SAMs and associated features survive as derelict industrial features that do not significantly contribute to an understanding of the related industries. More particularly, the Dowlais Free Drainage System reservoirs (and the many related leats) are in a dilapidated state and are slowly decaying. The protection of these during the scheme aims to stop accidental damage and vandalism. The landscape restoration process will seek Scheduled Monument Consent to 'stabilise' the remains from further decay if necessary. In the long term this will make their original function more understandable as more original elements will have survived. This work may involve appropriate conservation and limited restoration.

7.21 Without some cleaning-up works to the leats associated with the SAMs and other reservoirs of the DFDS these will continue to be naturally infilled and so vanish from view. Without heritage-led interventions to keep them functioning, minor features could be at risk from general modern maintenance techniques.

- 7.22 The Listed Wooden Aqueduct is structurally dangerous and the wooden and iron components are highly decayed. Listed Building Consent will be sought for its protection, removal and safe storage. This will aim to ensure that it does not collapse and break up and to stop wood decay. With this achieved, a restoration strategy for the aqueduct will be developed and submitted to the LPA for approval during the early stages of the scheme. The aqueduct is shown in its existing position on the Restoration Plan (Figure 4). However the possibility of relocating the aqueduct to the location of a now destroyed similar aqueduct near the Bogey Road bridge is being discussed with CADW and Merthyr Tydfil County Borough Council.
- 7.23 Linked to the SAMs and associated DFDS leats will be the retention and promotion of heritage remains within the excluded central east west corridor, including:
- Railway cutting of the GWR and Rhymney Branch Railway.
 - Road bridge over the railway cutting.
 - Reservoirs and leats of the DFD System.
 - Elements of tram ways and rail ways.

Also retained within this corridor will be features of the natural historic landscape, providing context within which man-made heritage resources are set.

- 7.24 Within the landscape, where surface restoration will occur following the extraction of coal, archaeological heritage restoration objectives are being promoted, recognising the value and character of the present historic landscape. A range of restoration options are defined below but these can only be confirmed as implementable following further research and site investigation:
- Possible exposure of a not too high section of the quarry face, representing the linear topographic features of the sub surface strata outcrops and also illustrating continuity of industrial process.
 - Contouring of the hill side to illustrate natural drainage with superimposed man made elements, especially features of the Dowlais Free Drainage System descending down to the great iron works.
 - Pit head/adit structural elements, utilising the original materials archaeologically excavated, removed and stored. These would only be found and evaluated in 2007/2008 and if of good quality would be reset in their original positions.
 - Creation of a replacement Longtown Pond with links to retained attenuation ponds of the scheme.
 - The railway route traversing around the western hillside down to Dowlais.
 - Surface irregularity resembling tip and quarry workings and which can result in micro variations in soil and vegetation types. In this context, the potential for restoration of the two 'finger tip' complexes in the east of the site north of the Bogey Road will be explored.

Cultural Benefits to Merthyr Tydfil and South Wales

- 7.25 The Ffos-y-fran scheme will, in the long term, generate the following community benefits:
- Retained, conserved and restored historical structures within a safe accessible landscape, which can be better managed and promoted.
 - New features of industry, illustrating continuity of processes related to the coal extraction industry (for example, lagoons and possible exposure of part of the excavation face).
 - Artefacts for museums and mostly related to the industrial heritage of Merthyr.
 - Data and interpretative information about the behaviour of artefacts and sites preserved in situ below civil engineering works.
 - Innovative archaeological project linking above and below ground technological history.

- New innovative and safely restored landscape containing the preserved and restored heritage elements.
- Academic archaeological reports and more general literature for the public and schools related to the heritage and history of Merthyr.

7.26 In conclusion, the implementation of these heritage objectives will result in Merthyr Tydfil having what could be regarded as a sustainable working 'heritage park' (formed of common land husbandry, moorland ecology and the built heritage) and which could be integrated to other sites of significant cultural value in and around the town.

8.0 Public Access

- 8.1 Existing footpaths, both legal rights of way, and other claimed routes within the site area are shown on Figure 14.
- 8.2 Prior to commencement of operation of the Ffos-y-fran Land Reclamation Scheme, the site area will be fenced and public rights of access to the urban common will be temporarily suspended over the area of the scheme until the site is returned to common on completion of restoration. A temporary alternative route will be made available for the duration of the project as shown on Figure 14.
- 8.3 During reclamation and mining operations the perimeter of the scheme will be fenced, and in order to mitigate the consequential loss of access from the corridor of the A4060 trunk road to the common land to the east of the scheme, a new, temporary route will be created along the northern boundary of the site, as shown on Figure 14. This route will provide access on foot between the reclamation scheme and the Trecatti Landfill to the north, providing a means of walking to the greater area of the urban common whilst operations on site proceed.

Site Restoration

- 8.4 During the aftercare period, a footpath network will be created over the restored site that will reflect the original network, taking into account the changed topography, and will be to a condition not substantially less convenient to the public. Footpaths will avoid areas of ecological sensitivity, in particular the the lapwing breeding area to be established to the south of the Bogey Road.
- 8.5 As the restored landform will differ from that which currently exists, and new landscape and nature conservation features are to be established, heritage features retained and new features established, the alignment of the new routes will reflect the restored landscape rather than merely replicate the original network.
- 8.6 An indicative layout for the new network is shown on the Restoration Plan at Figure 4. The aims of the restoration strategy for public rights of way are to provide both circular routes and links to the surrounding network, and to link features within the site, both as destinations in their own right, and as features of interest along a route.
- 8.7 The overall effect of the network will be the same; to afford the public rights of way over the restored private land and urban common, in addition to their right to walk the common for air and exercise.
- 8.8 Sign posting and interpretation boards will be provided at appropriate locations.

9.0 Conclusions

- 9.1 This document sets out the restoration strategy for the Ffos-y-fran Land Reclamation Scheme. The Ffos-y-fran Land Reclamation scheme will bring about the completion of the East Merthyr Land Reclamation Scheme and achieve the objectives set out in Merthyr's Local Plan. The East Merthyr Land Reclamation Scheme was originally conceived in the 1980's by the County Council (Mid Glamorgan) and the Borough (Merthyr Tydfil), in partnership with the Welsh Development Agency (WDA), to achieve the reclamation of the largest area of acutely derelict land of its type in Western Europe. The Ffos-y-fran scheme is the result of many years of site investigation and consultation. The scheme would complete the local authority's reclamation objectives at East Merthyr.
- 9.2 The scheme accords with the local authority's Local Plan, provides a pragmatic approach to the conclusion of the East Merthyr Reclamation Scheme, and will achieve the restoration of 317ha of derelict land, the majority of which will be returned to common and agricultural land.
- 9.3 Environmental Management Plans will be prepared and implemented for the Ffos-y-fran operations. These will include the requirements for mitigation of environmental impacts. The plans will form an integral part of the contract for the operations and will be prepared in sufficient time for its requirements to be taken into account by those tendering for the work. Environmental specialists will attend pre-works meetings to ensure that the contractor is familiar with site conditions and environmental compliance requirements. All site personnel will be made familiar with the environmental requirements of the works at induction courses and tool-box talks, as necessary.
- 9.4 Site works will be monitored by an Environmental Liaison Officer who will call on the project's environmental and archaeological specialists, where necessary, to ensure that the environmental requirements are fulfilled.
- 9.5 Planning consent has been granted for a Visitor Centre at Cwmbargoed Disposal Point to be operated in association with the scheme. This will provide educational/training and interpretation facilities both for the land reclamation process, and for the natural and historical environment in the vicinity of the site.
- 9.6 The scheme will involve the recovery of coal by opencast methods, which will take between 13.5 and 17 years to extract, depending on the coal delivery rate. During this time the land will be progressively restored as the site is worked, and will be subject to a period of 5 years aftercare as areas are completed. It is expected that land will be restored in the south-western part of the site as early as year 6.
- 9.7 The restoration scheme will work progressively from south to north across the site. Detailed restoration plans for each phase of the scheme will be submitted for the approval of the Planning Authority at least six months prior to the cessation of the replacement of overburden in that phase. The plans will show the final landform, soil profile characteristics and all necessary agricultural facilities and woodland/wetland areas, including written specifications. The phases of working are shown in the Progressive Restoration Plans at Appendix A. The phases are as follows:
- | | |
|---------|--|
| Phase 1 | Preliminary operations (excavation of box cut) |
| Phase 2 | Excavation to maximum void |
| Phase 3 | Excavation to end of coaling |
| Phase 4 | Final void restoration |
- 9.8 The Restoration Plan for the completed site is shown on Figure 4.

- 9.9 The final profile, although based on the Restoration Plan, may have to be amended throughout the working of the site due to any fluctuation between the actual levels of bulkage and coal volumes extracted, and those anticipated. Regular surveys will be carried out to check the balance of the quantities excavated and the material available for restoration, to ensure that the final restoration scheme balances, i.e. to ensure that neither a void nor a dump is left at the end of working.
- 9.10 After the completion of coaling, overburden restoration will take approximately 24 months to complete. The southern overburden dump will be restored first, followed by the north eastern and north western dumps. On completion of overburden restoration, the remaining soil forming material, subsoil, and topsoil in dump, will be restored to complete the restoration stage of the site.
- 9.11 An Aftercare Scheme for each phase of the restoration will be submitted for the approval of the Planning Authority not later than six months prior to the completion of restoration (including soil spreading) of each phase.
- 9.12 A programme of maintenance and aftercare will follow the restoration of the working areas; this will be carried out for a period of 5 years after the restoration works are satisfactorily completed as certified by the LPA. Particular attention will be paid to grazing control, appropriate fertiliser application, soil structure development and drainage necessary to achieve the standards of agricultural land required by the local planning authority and the Agricultural & Rural Affairs Department of the National Assembly for Wales.
- 9.13 On completion of the 5 year aftercare period, and provided that the land has been restored to a standard acceptable to the local planning authority, the site will be returned to Common, Agricultural Tenants, or other Landowners, as required to meet any legal constraints or agreements.
- 9.14 The restoration plan has regard to Merthyr Tydfil County Borough Council's objectives and policies for the landscape. In particular the following objectives have been adopted:
- i. The restoration design aims to develop a range of landscape character appropriate to the different parts of the site, and to integrate it with the surrounding landscape
 - ii. The northern and north-western slopes are part of the landscape setting of Merthyr Tydfil, and their restoration treatment aims to enhance that setting.
 - iii. The project includes restoration of public access routes. Their enjoyment will be enhanced through improved signage and information, and indications of routes linking places or providing circular walks.
- 9.15 A key aim of the proposals is to produce a varied surface giving areas of light and shadow, and texture and grain to the landscape. It includes "macro features", such as valleys and stream courses, and minor variations in terrain, soil depth, drainage and micro-climate. Such "micro" features are frequently absent from older reclamation sites, and will support the aim of developing variety, by providing suitable conditions for different habitats.
- 9.16 All available topsoil will be stripped from all areas used for excavation, overburden, subsoil and soil forming material storage, roads, hard standing areas, water treatment facilities and building construction. All available suitable subsoil will be stripped from any area previously stripped of topsoil except those areas required for the storage of subsoil. Suitable soil forming material which has been identified will also be stripped. Wherever possible such material will be directly spread. Low compaction bulldozers, rather than scrapers or mechanical shovels only, will be employed for reinstating soils.

- 9.17 After laying the soil profiles, a range of agricultural activities will occur which will vary according to the particular after-use. These works may include ripping, soil levelling, stone picking, cultivation, power forking, disking and stone picking prior to cultivation. Appropriate seed mixtures will be specified according to the proposed afteruse of the various areas of the site.
- 9.18 As an alternative to commercial seed, the potential for harvesting seed from the site, or adjoining land, for use in restoration will be investigated. In the first instance, a seed crop has been harvested from land in the east of the site in summer 2005 and put in store for use in restoration. This will enable the quantity and content of the seed harvested to be assessed and consideration given to further harvesting from similar habitats elsewhere in future years for storage or direct use in restoration.
- 9.19 Three existing landfill sites, Landfill 13, Hoover and Merthyr Landfills, lie within the boundary of the proposed land reclamation scheme and most need to be relocated to allow the associated opencast mining operations to proceed. It is anticipated that the excavation works and classification of the soils arising will result in four product materials:
- i Uncontaminated, granular stone and ash soils capable of being utilised for on-site construction.
 - ii Material generally conforming to the above description but containing wood, metal, plastics, textiles and paper which can be separated out from the mass and disposed of to Trecatti Landfill. The resulting inert materials will then be used on site.
 - iii Any non-inert but non hazardous material will be disposed to Trecatti landfill.
 - iv Any hazardous material excavated will be removed to a suitable licensed facility off site.
- 9.20 These works will be carried out under a Waste Management Licence issued by the Environment Agency.
- 9.21 The ecological principles of the restoration strategy are:
- i to conserve features of ecological interest in situ where practicable.
 - ii to enhance such features through appropriate habitat creation and improvement.
 - iii to create areas of ecological interest as part of the restoration of the site.
 - iv to enhance both retained and newly created areas thorough appropriate management so far as this is in the control of the operator.
- 9.22 The conservation of features of ecological interest in situ has resulted in the abandonment of previous proposals which would have infilled the upper part of Cwm Golau with culverting of the Nant Gyrawd. Cwm Golau is now excluded from the site. A detailed management plan will be prepared and implemented to enhance the overall nature conservation value of this area. This will include areas of tree and shrub planting, reinforcement of hedgerows, fencing and control of sheep stocking levels. New ponds to provide habitat for amphibians, particularly great crested newt, have already been constructed in this area.
- 9.23 There is an area of nature conservation interest between the Bogey Road and the railway line, containing ponds where great crested newts and other amphibians have been recorded. Most of this area has been excluded from the site and will be

- retained, enhanced and managed as an ecological area. As for Cwm Golau, a detailed management plan will be prepared and implemented for this area.
- 9.24 The previous proposals would have involved the loss of much of the Tair Carreg Moor SINC. The Ffos-y-fran Land Reclamation Scheme does not include any of the land within the SINC.
- 9.25 It is proposed that the majority of the restored land will be used for upland grazing as urban common land. Bryn Caerau Farm (where disturbed) will be returned to agricultural use, and nature conservation measures will be incorporated throughout the restoration scheme. The predominantly moorland vegetation associated with the open areas of the common will be restored, with particular attention being given to re-instating the acid grassland presently adjacent to the Tair Carreg Moor SINC. The final distribution of land uses across the site will be dependent upon the soil and soil-forming resources available.
- 9.26 A methodology for the translocation of great crested newts from the working area is has been agreed with the Countryside Council for Wales and the necessary licence granted by the Welsh Assembly Government. Specific measures will be implemented to provide habitat for lapwings during the works.
- 9.27 The Ffos-y-fran Land Reclamation Scheme offers an opportunity to integrate commercial and economic activity of importance to the well-being of the town of Merthyr with those of cultural, social, and heritage preservation objectives. The implementation of mitigation objectives, with the preservation of industrial heritage resource in the rest of the designated Merthyr Historic Landscape, will be a major contribution to more broader based heritage research, preservation, and sustainable management objectives.
- 9.28 Significant mitigation has already been achieved through development of the scheme over the last few years. This has included:
- The discovery and preservation of an Iron Age Settlement within the south-western boundary.
 - Withdrawal of the boundary from Tair Cerrig stones in the north-eastern part of the site.
 - Exclusion from the site of the Sarn Howell Pond and Watercourses Scheduled Ancient Monument.
 - Withdrawal of the south-eastern boundary to exclude and preserve older circular enclosures associated with Bryn Caerau Farm.
 - Preservation of a wooden aqueduct (a listed building) over the disused mineral railway cutting in the central section of the site.
 - Withdrawal of the eastern boundary excluding more clearly defined and complex man-made channels associated with the Dowlais Free Drainage System.
 - The development of the scheme has also already brought about what is probably the most in-depth study of the Dowlais Free Drainage System.
- 9.29 The implementation of these heritage objectives will result in Merthyr having what could be regarded as a sustainable working 'heritage park' (formed of common land husbandry, moorland ecology and the built heritage) and which could be integrated to other sites of significant cultural value in and around the town.
- 9.30 The Ffos-y-fran surface reclamation aims to be innovative, accepting that it is impossible to copy, nor is it desirable to reproduce the original land forms. The surface will be landscaped in such a way as to allow traditional husbandry practices to continue over the landscape to the east of Merthyr, but with features of both heritage and nature conservation interest being retained and serviced by an improved road and footpath network. This will encourage the urban common land to be more frequently used, understood, and appreciated by the people of Merthyr and outside

visitors. Provision for heritage features will be integrated with common land and other functions to be re-established.

- 9.31 Heritage will be an integral part of the innovative landscape creation. The SAMs and other resources will be displayed. Some features of the Ffos-y-fran Land Reclamation Scheme will be incorporated to illustrate continuity of process. Reference will be made to the discoveries made in the mines and to artefacts. The design of such a park will consider long-term heritage management opportunities and procedures.
- 9.32 This Restoration Strategy provides a broad scheme within which, through detailed design, features will be introduced for visual and ecological variety. Small-scale variation in landform and degree of compaction of soils will lead to variation in the vegetation that will develop, thus providing patterns of light and shade, colour and texture, typical of surrounding hillsides.
- 9.33 A footpath network will be created over the restored site that will reflect the original network of legal and claimed footpaths. As the restored landform will differ from that which currently exists, and new landscape and nature conservation features are to be established, the alignment of the new routes will reflect the restored landscape rather than merely replicate the original network. The overall effect of the network will be the same; to afford the public rights of way over the restored private land and urban common, in addition to their right to walk the common for air and exercise.
- 9.34 The Ffos-y-fran Land Reclamation Scheme thus represents an integrated working and restoration scheme for the site incorporating the extraction of coal by opencast methods, which will finance the scheme. The restoration will seek to achieve a balance between sometimes conflicting interests, in particular agriculture, Rights of Common (including commoners' rights and the public right to walk the urban common for air and exercise), landscape, nature conservation, cultural heritage and recreation.

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Figure 1

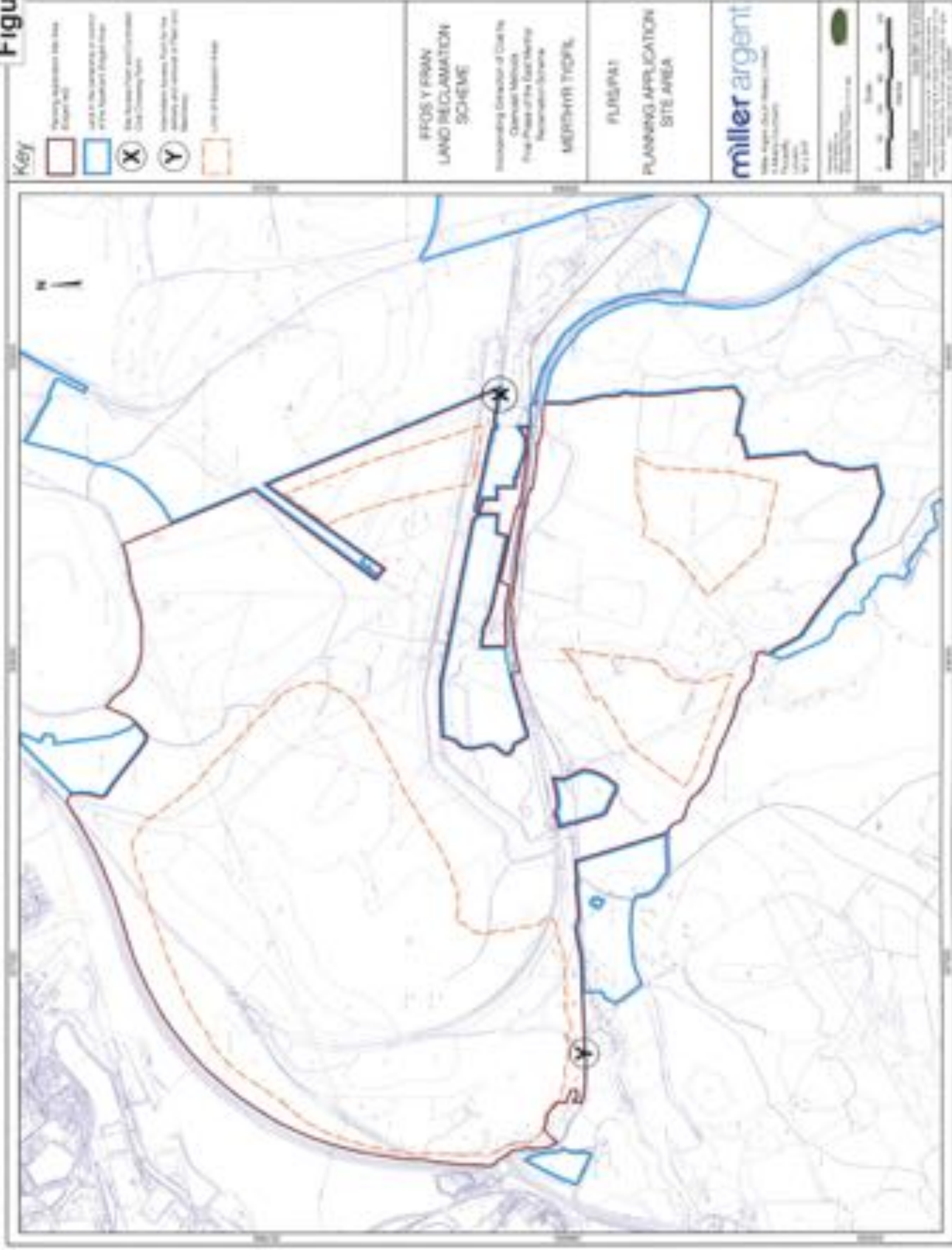


Figure 2

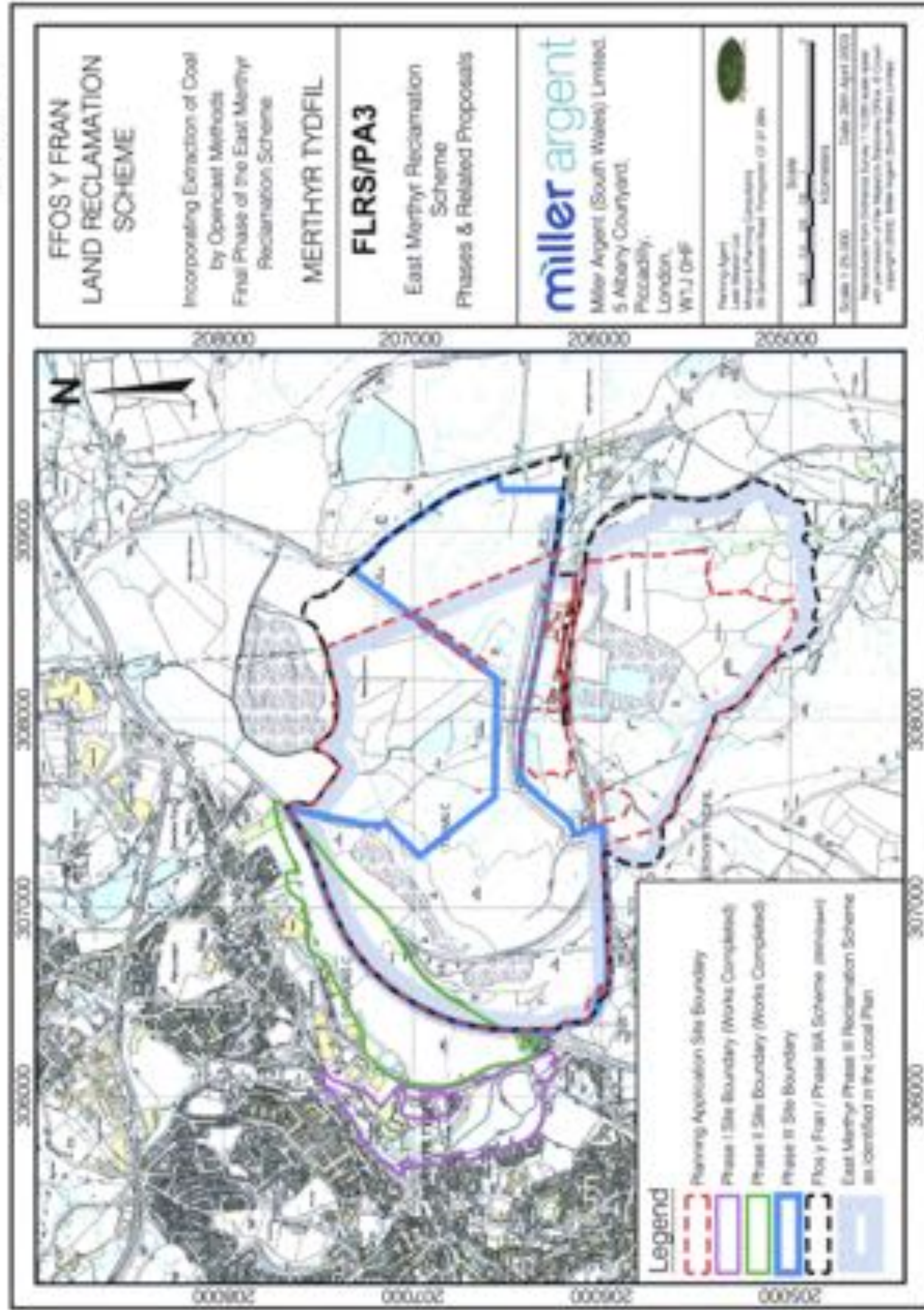
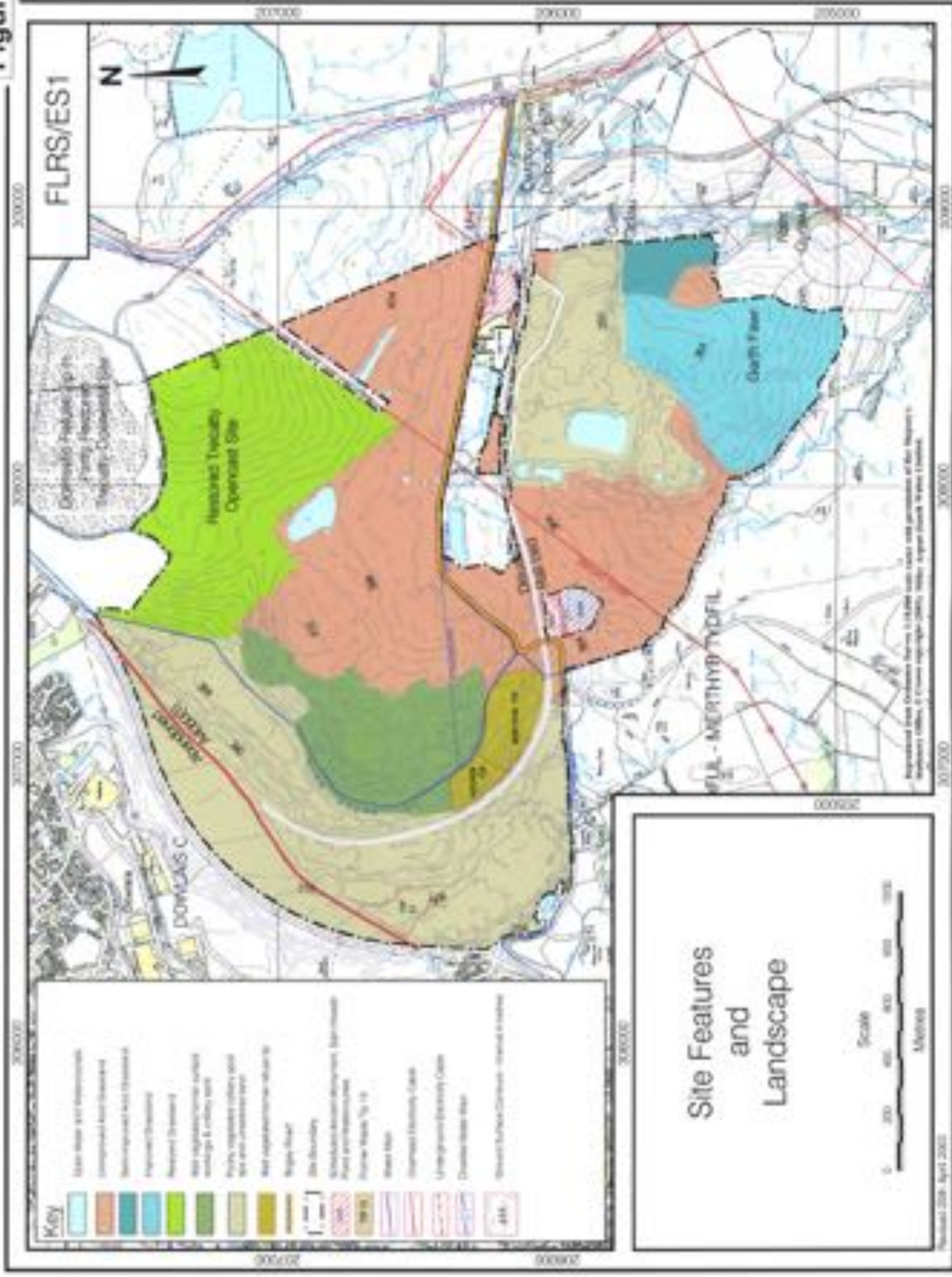


Figure 3



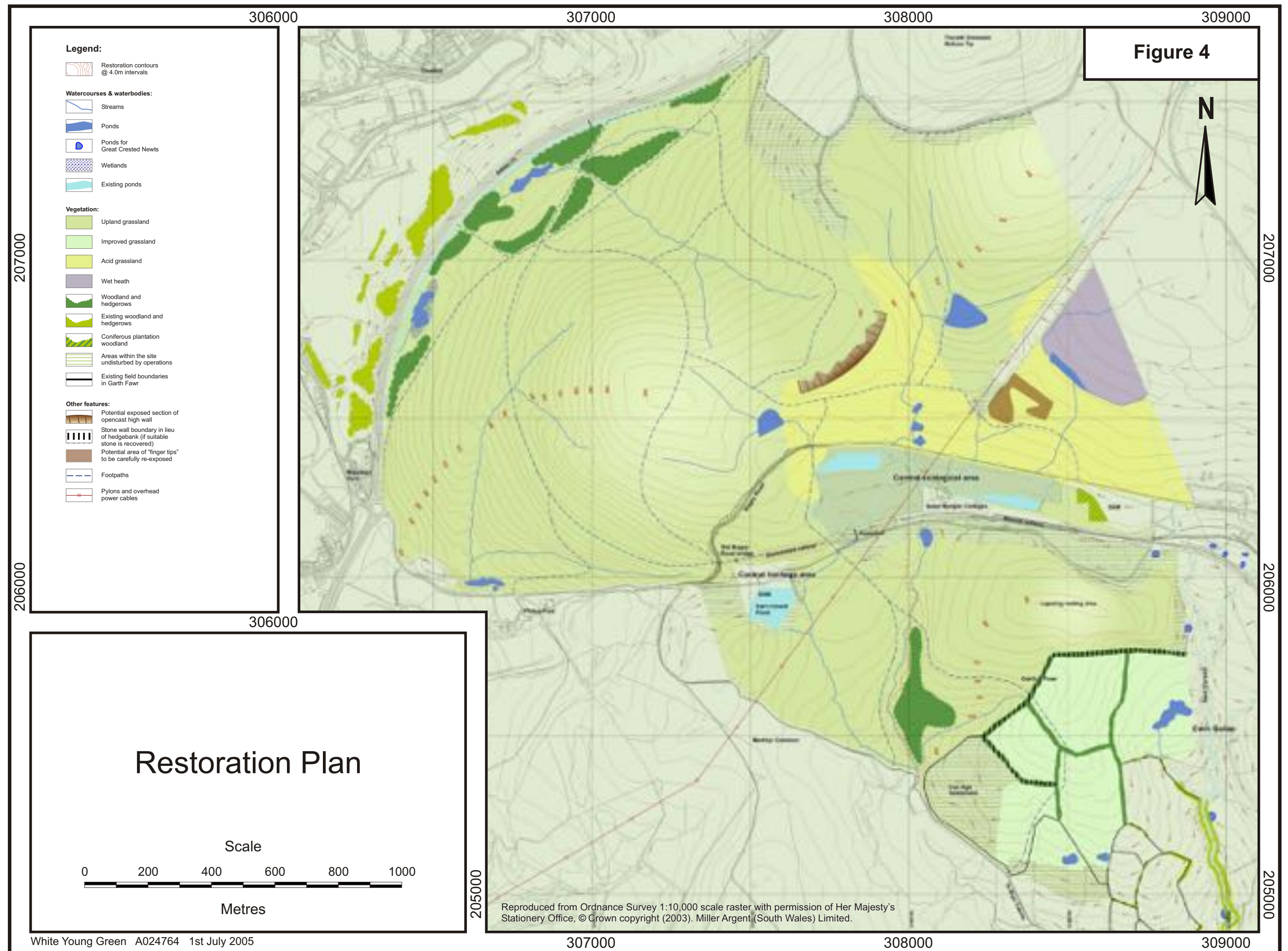


Figure 5

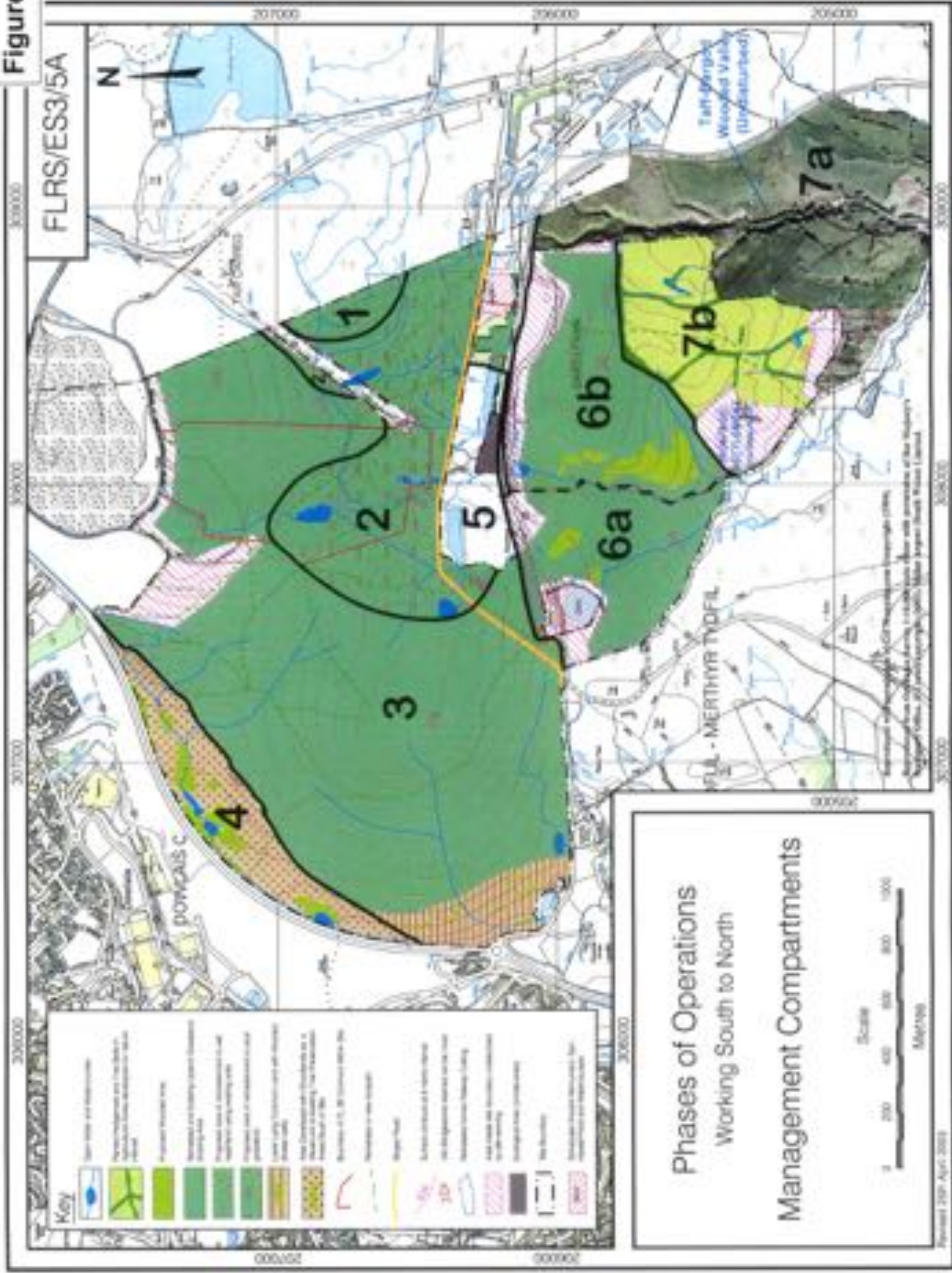


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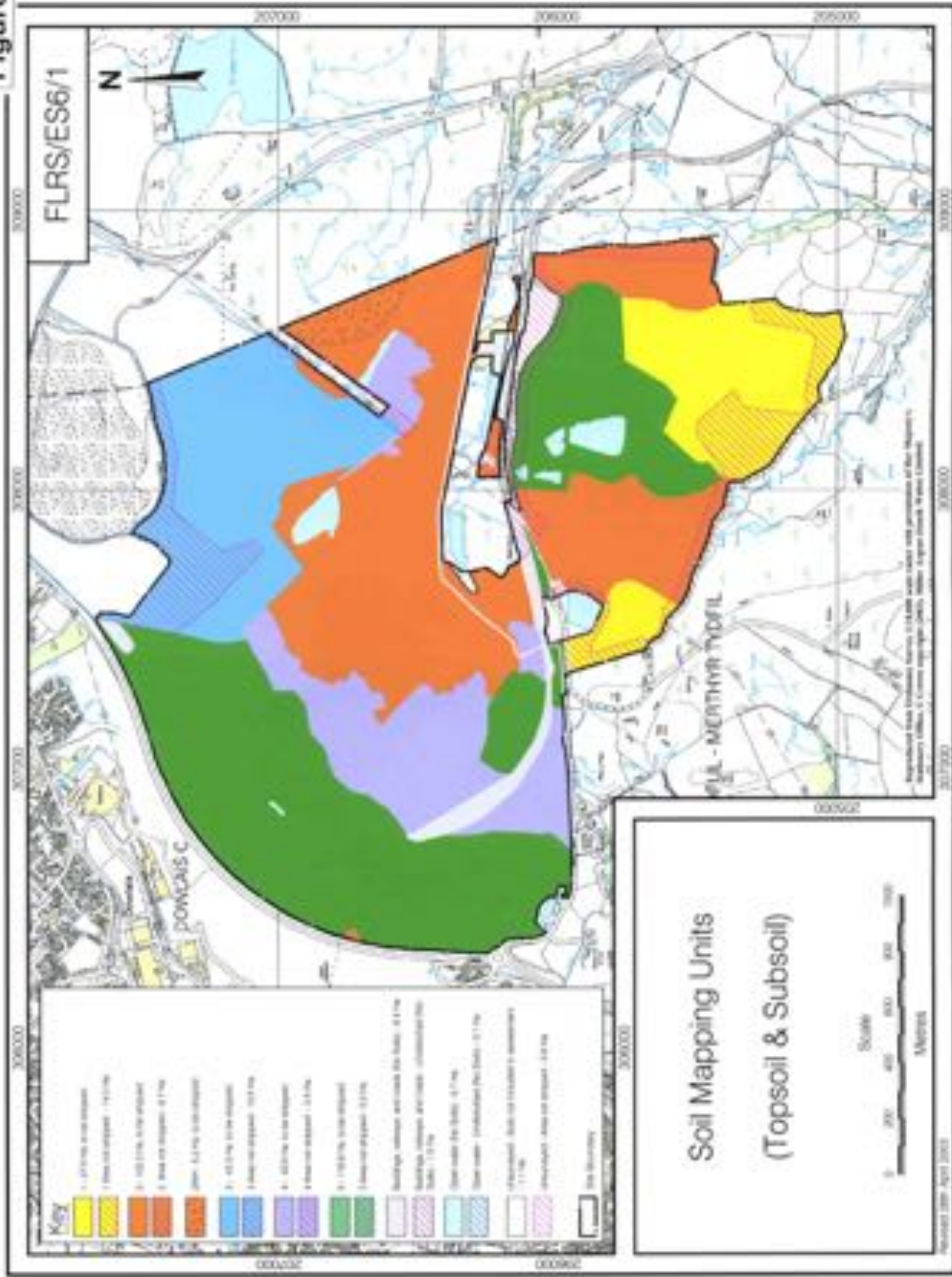


Figure 7

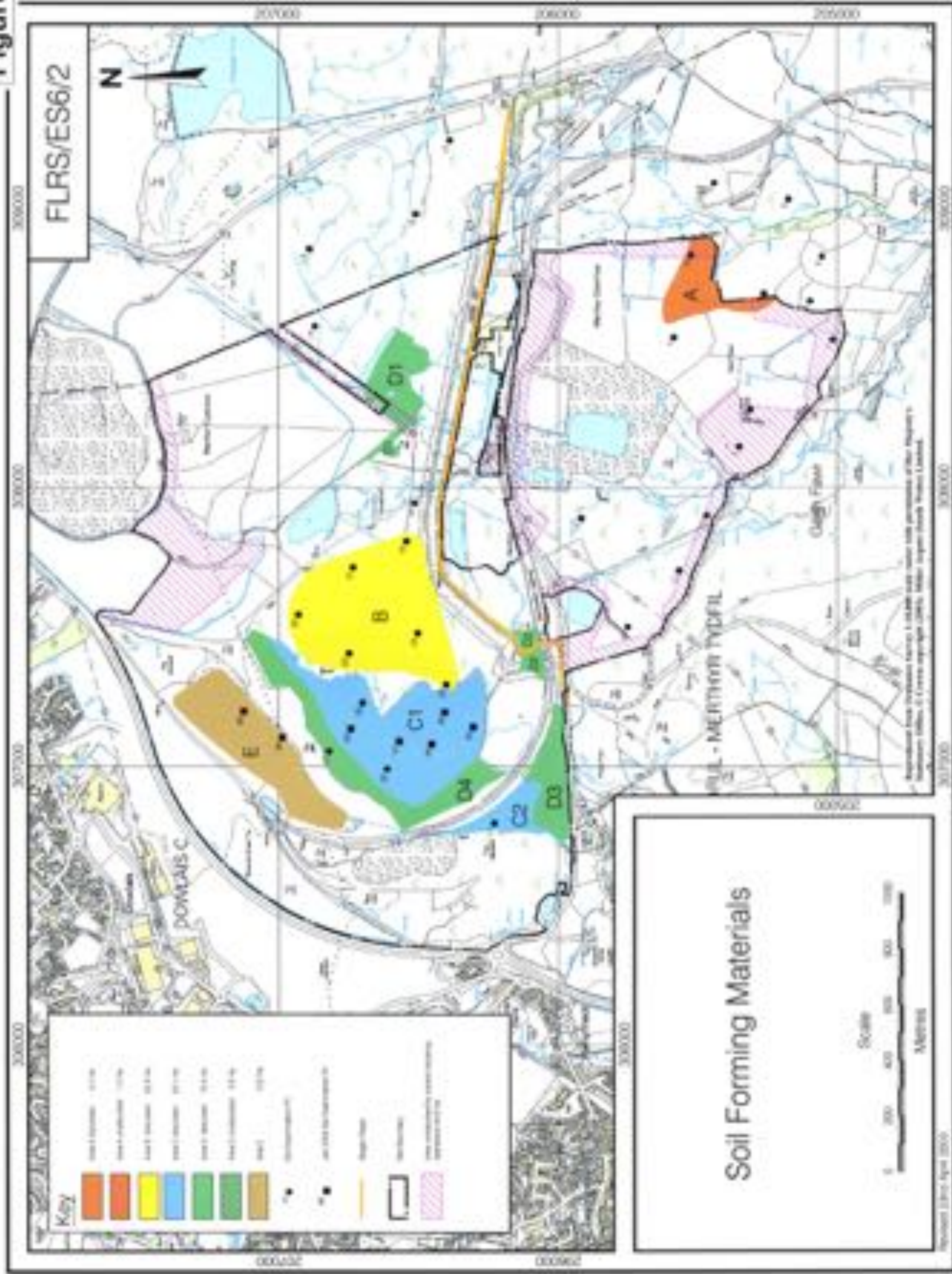


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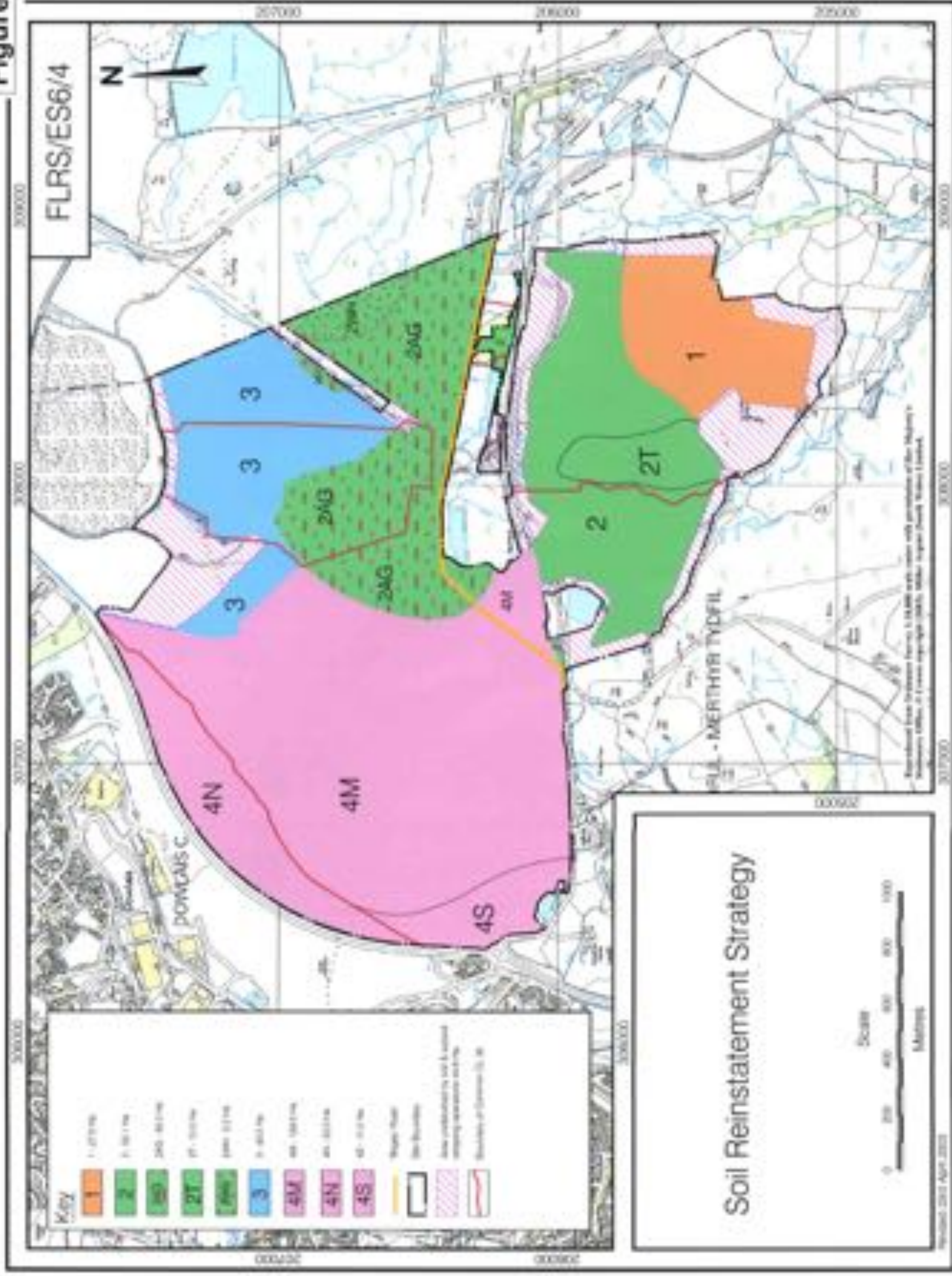


Figure 9

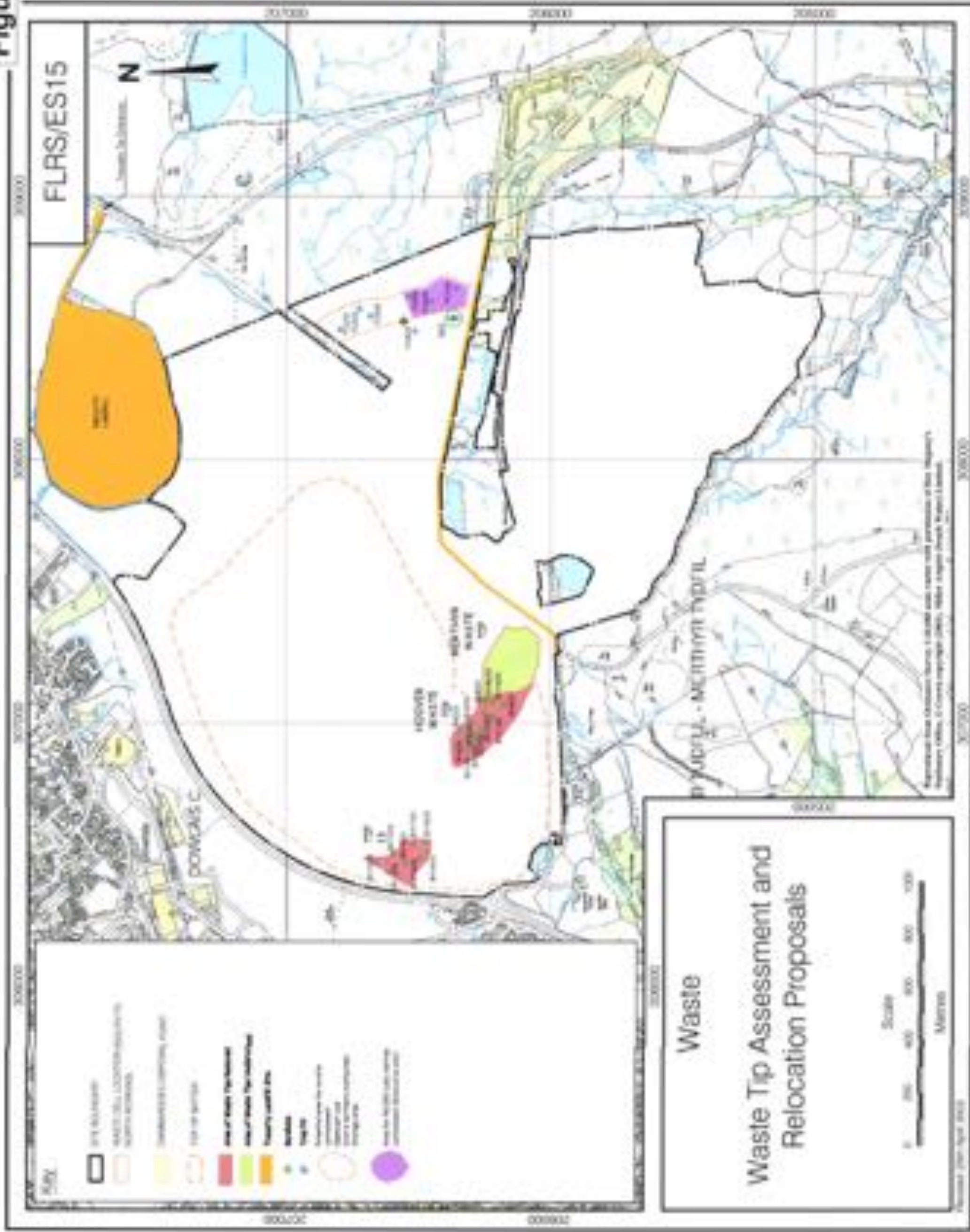


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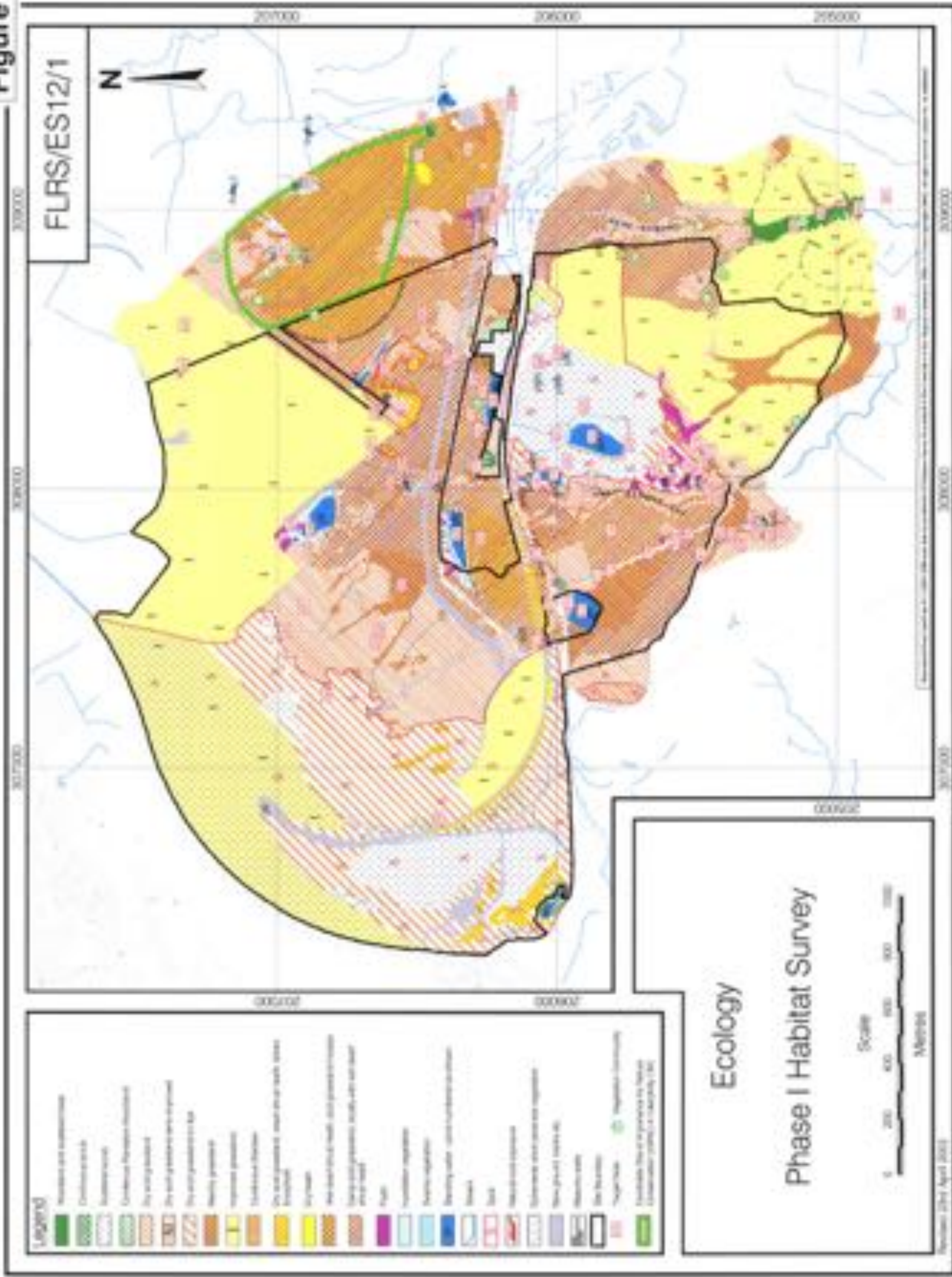


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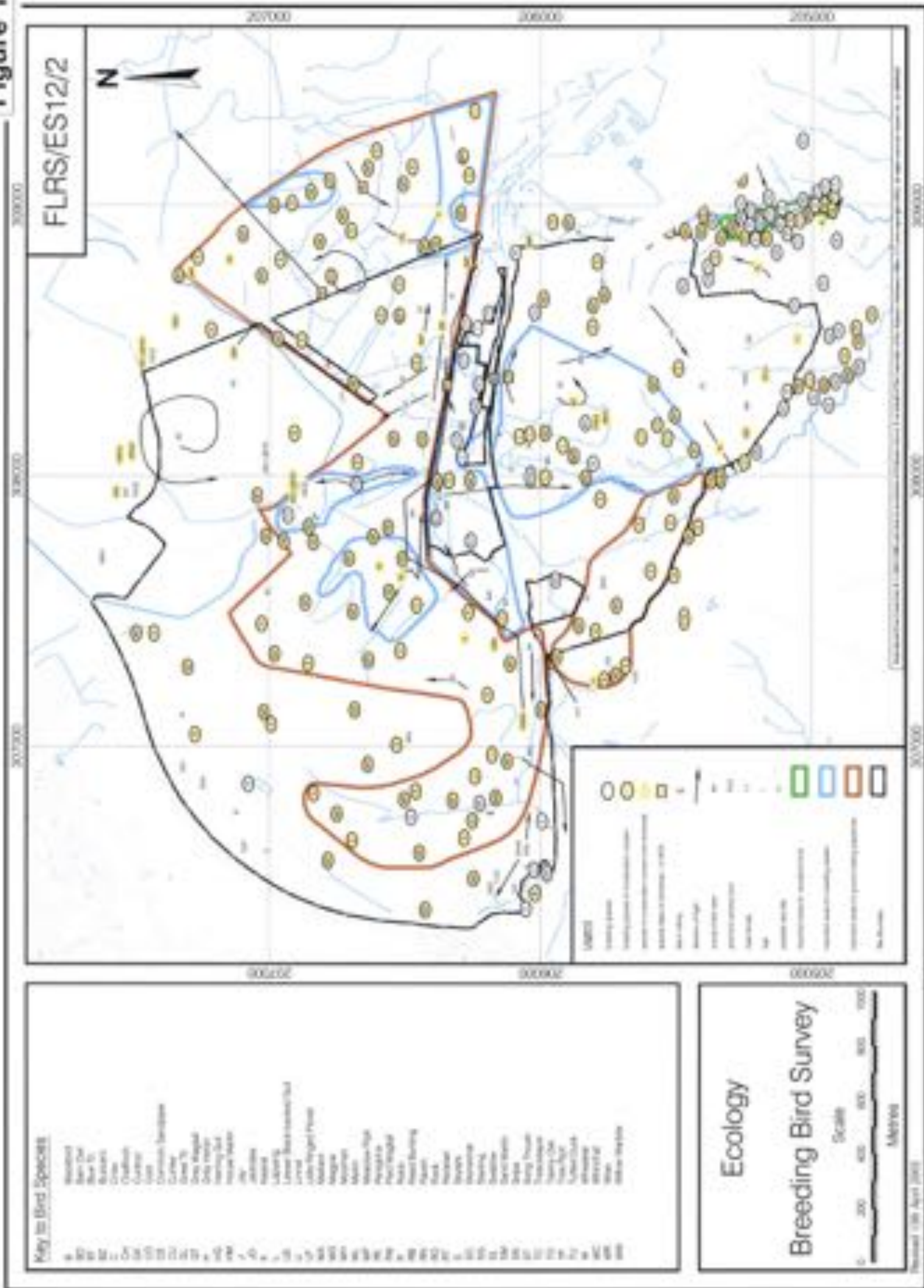


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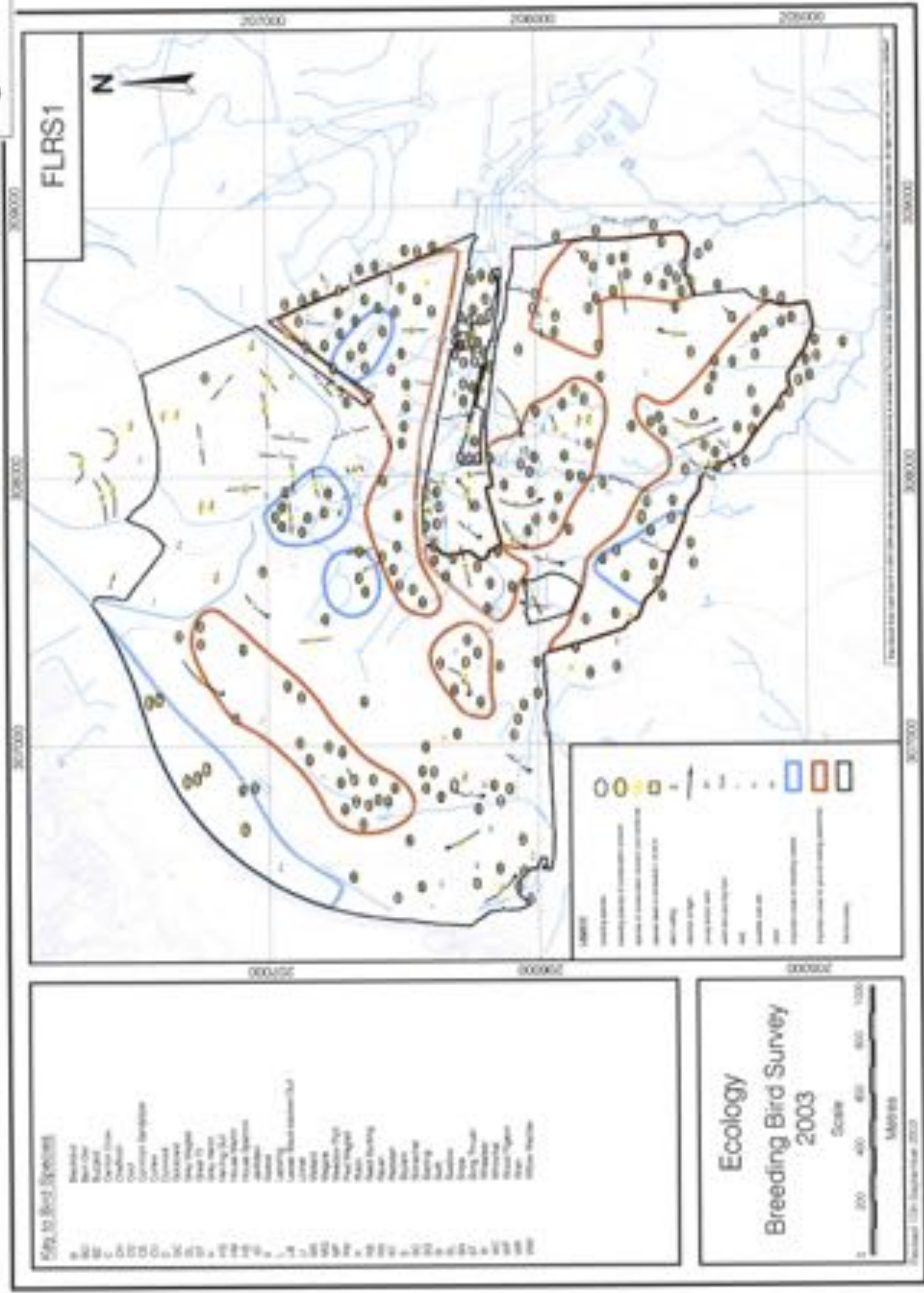


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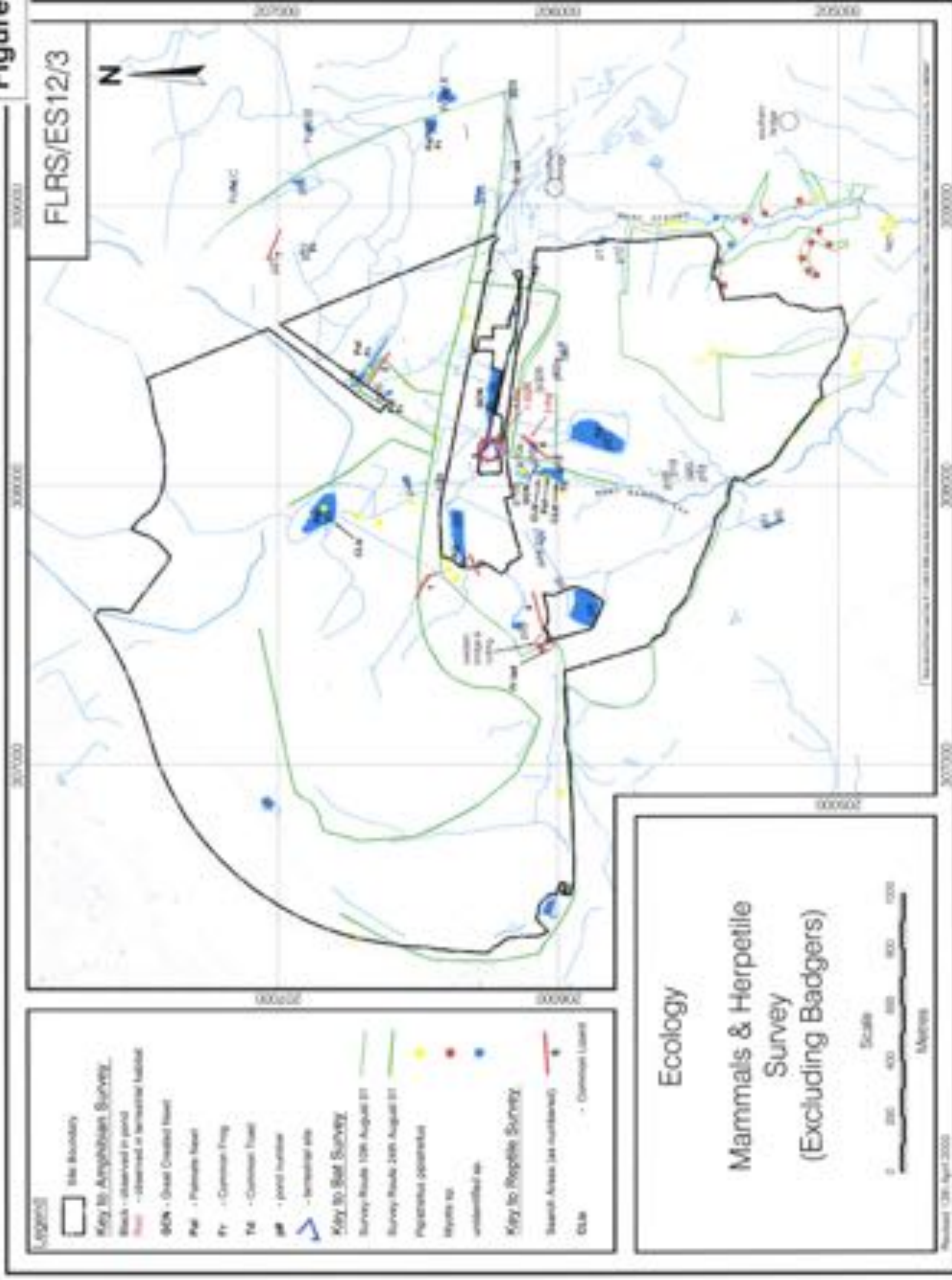
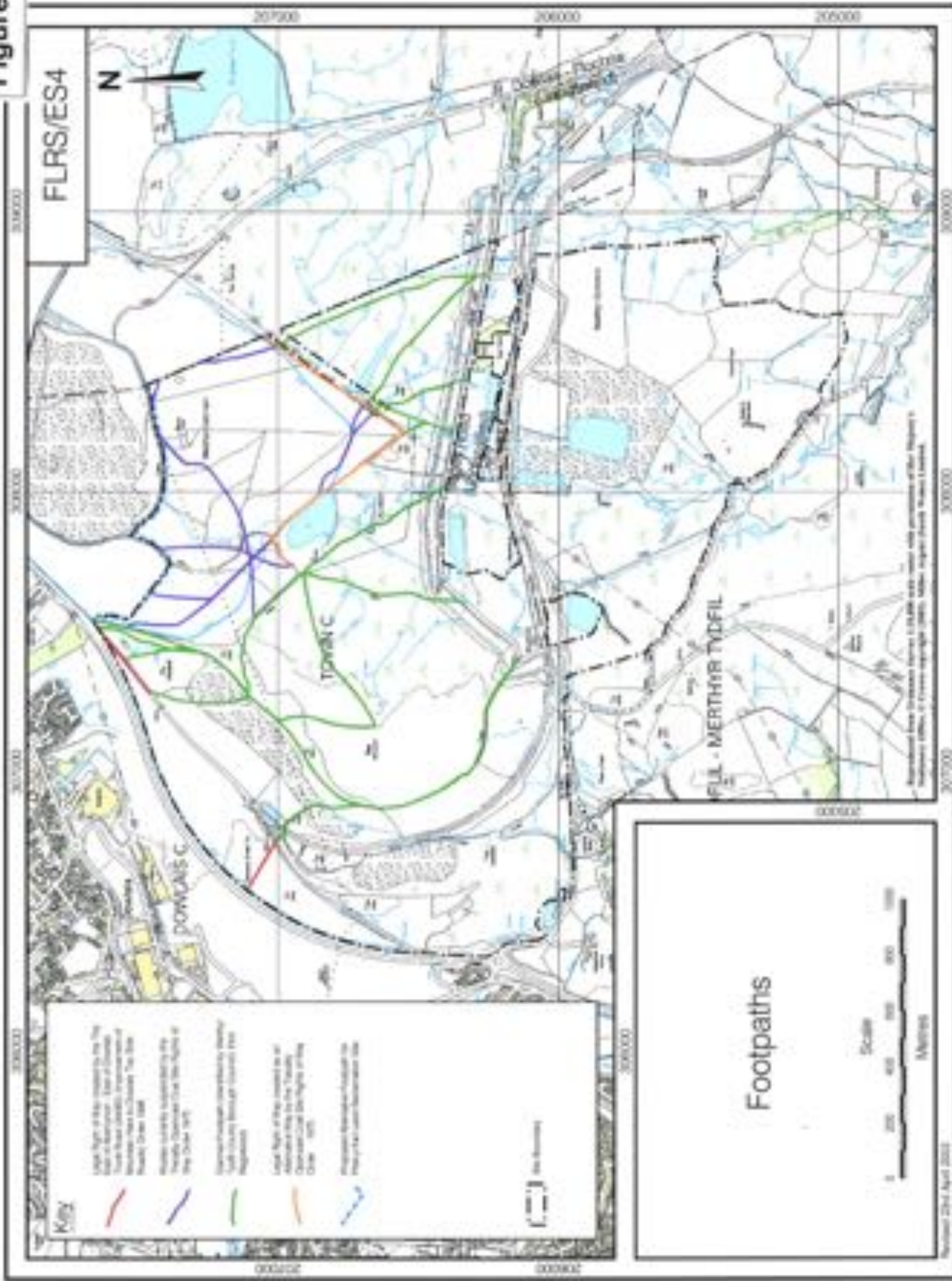


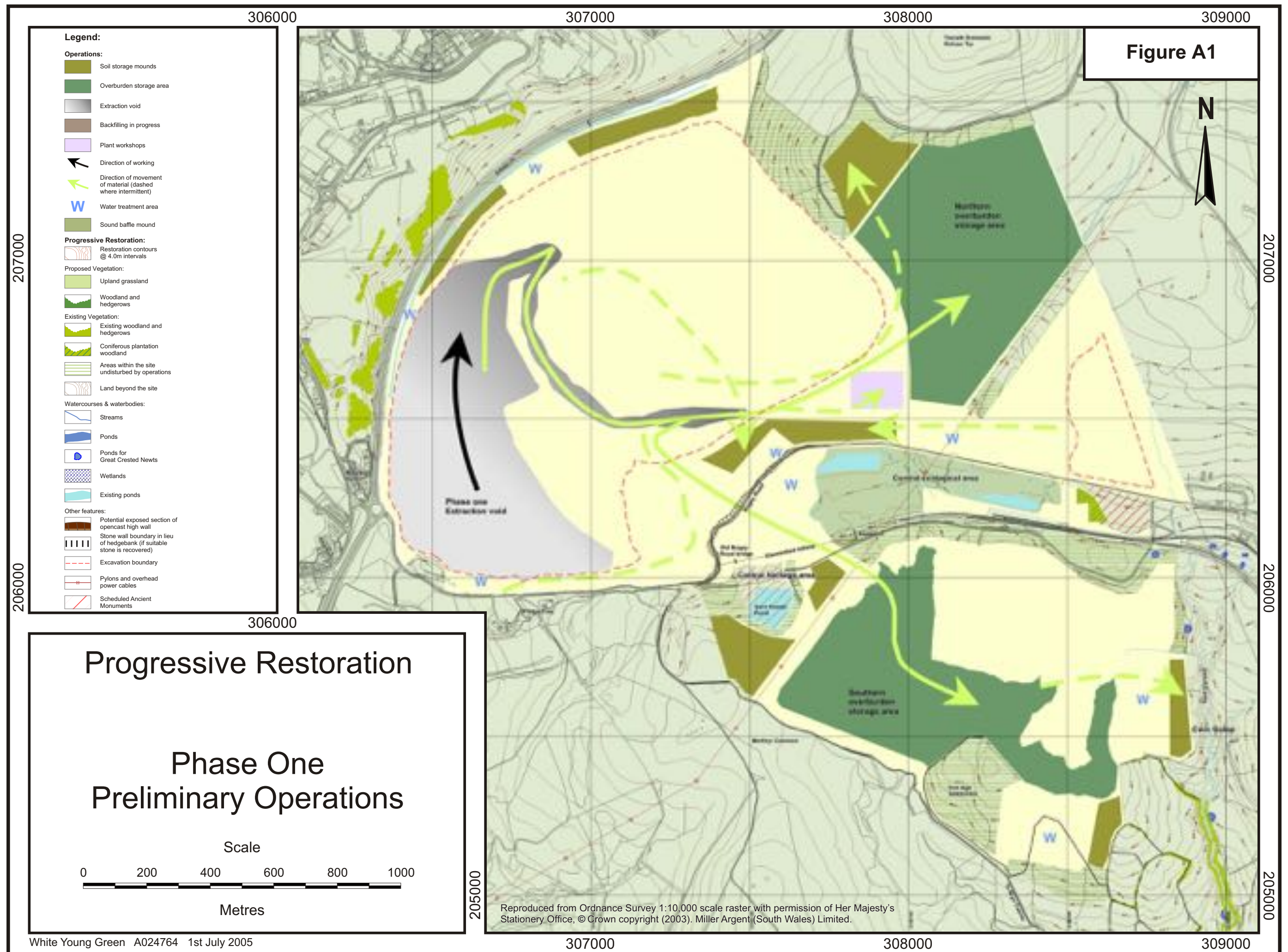
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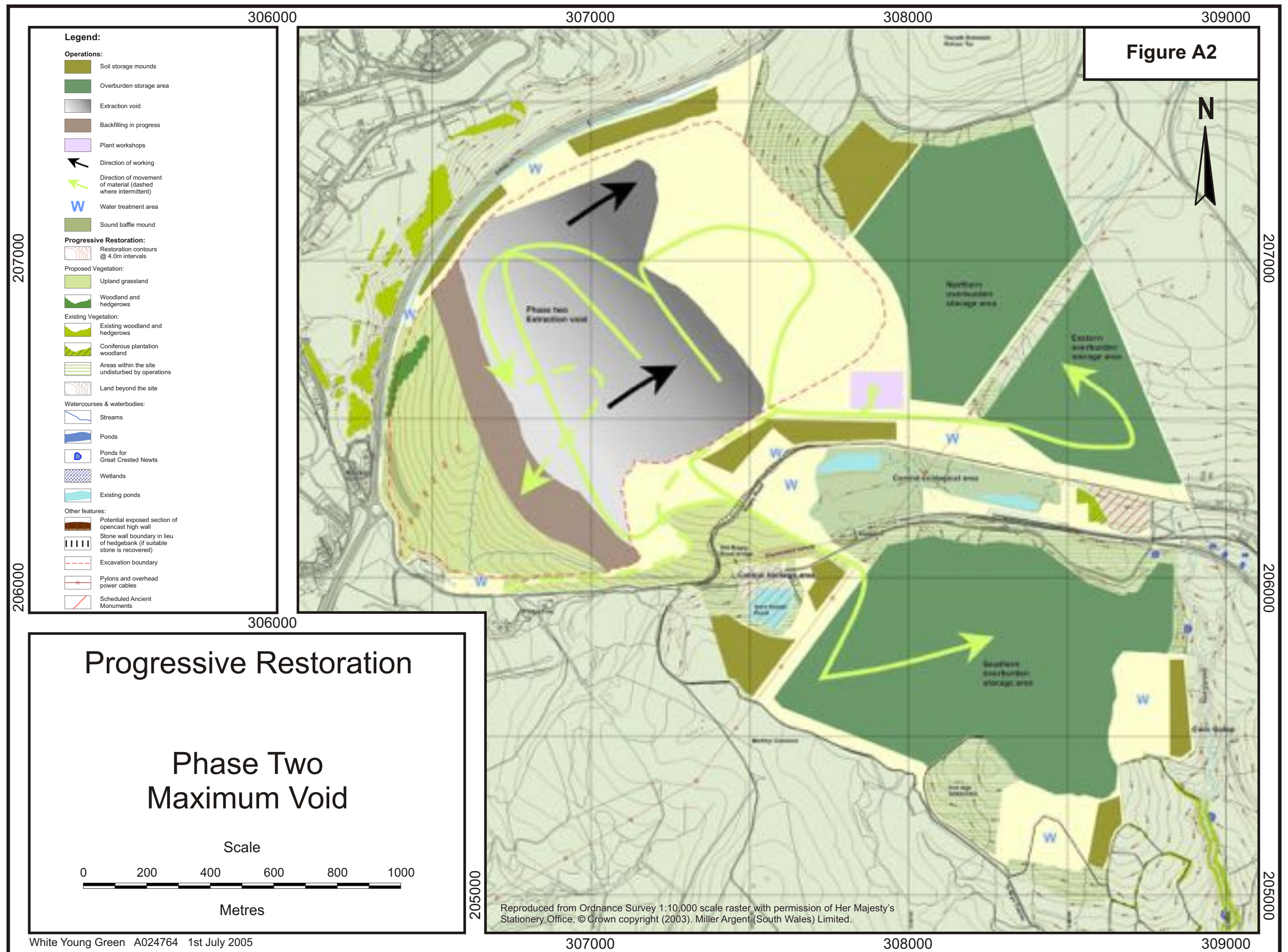


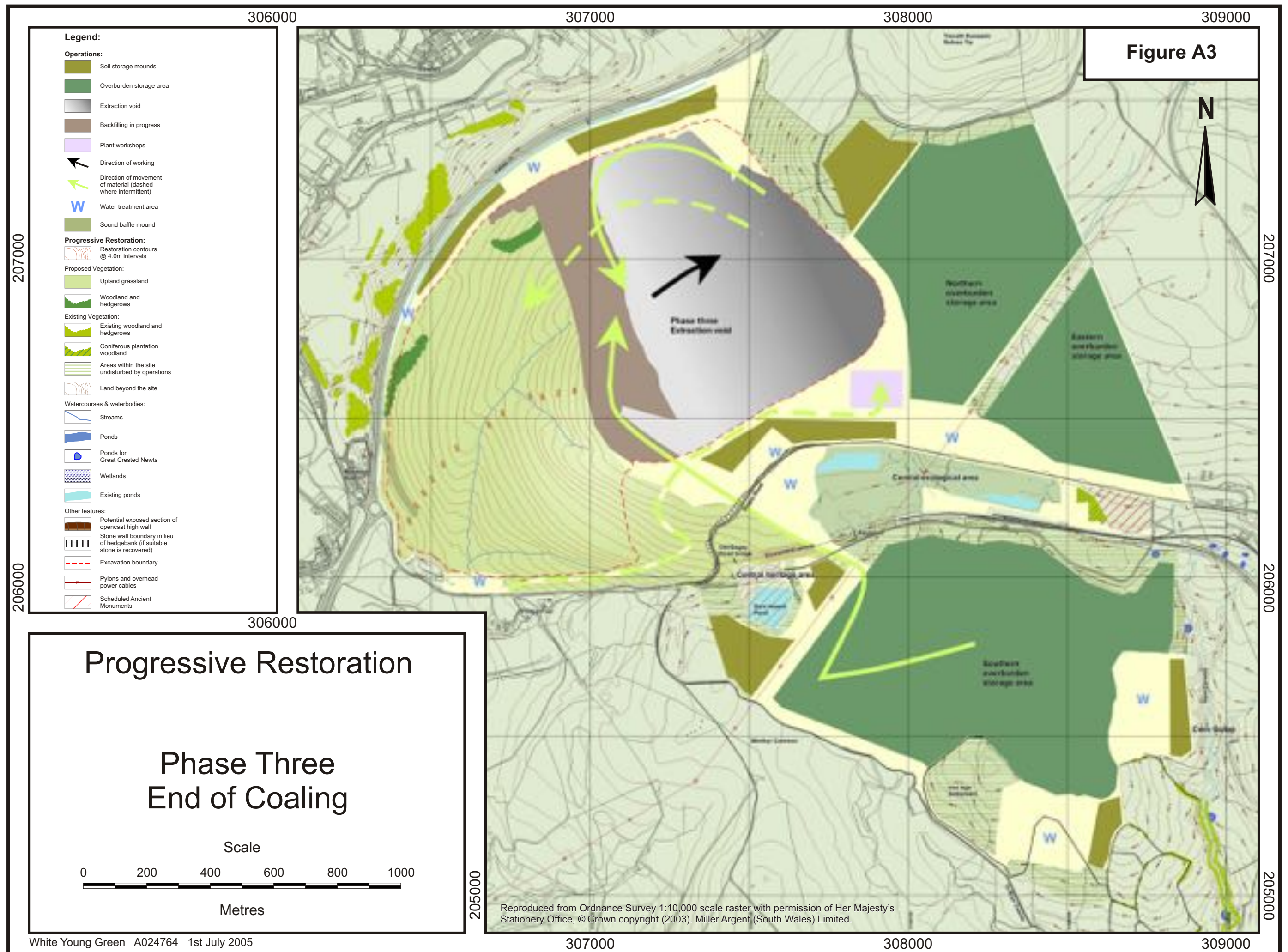
Appendices

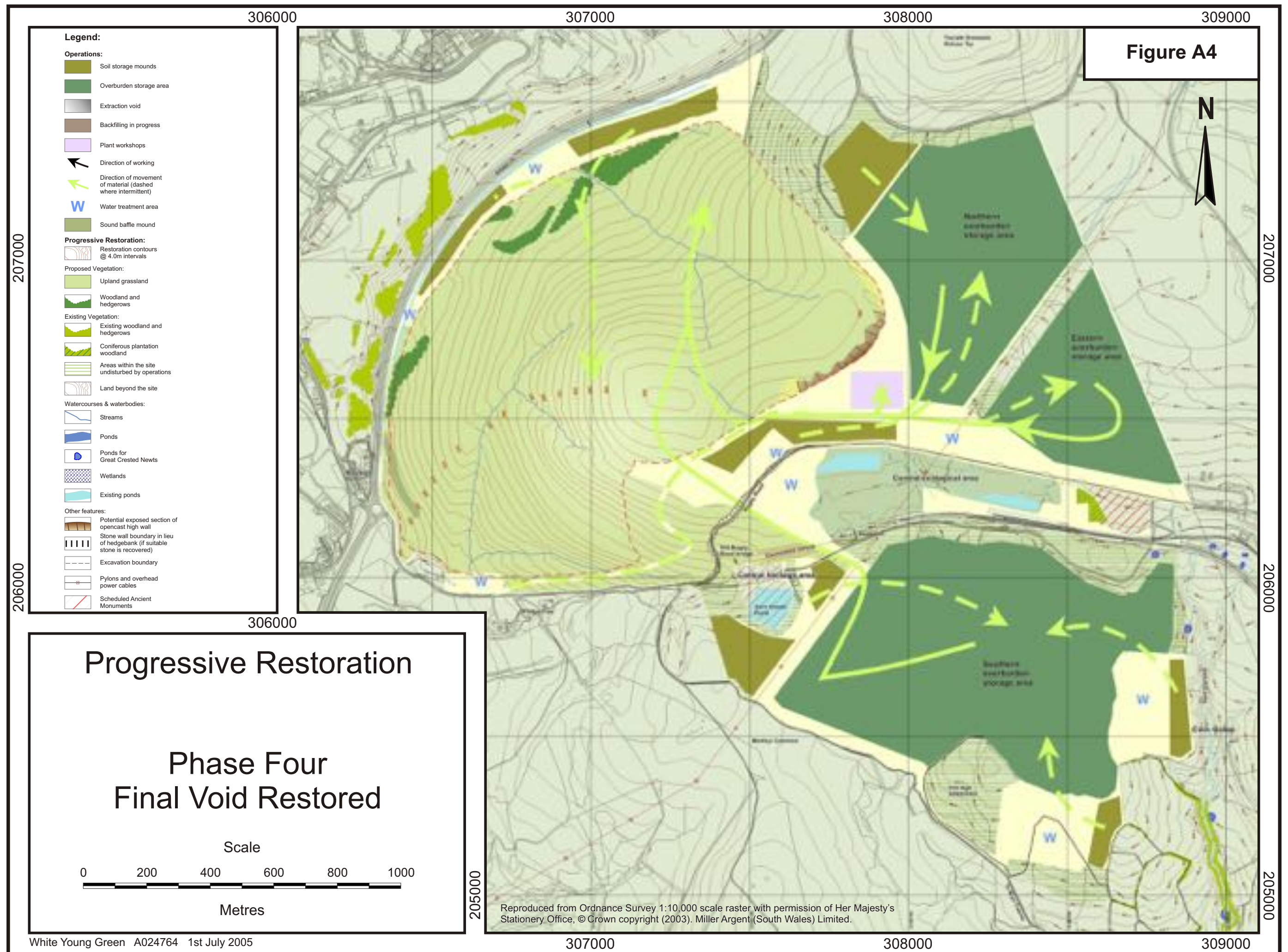
Appendix A

Progressive restoration









Appendix B

Restoration of opencast coal sites: photographic record

Restoration of opencast coal sites
photographic record

PARK SLIP

Operational Opencast Site with Progressive Restoration



1996

Photograph 1 : View of the restored pond and wetland

SITE INFORMATION

Location : West of Aberkenfig
Approximately 2.0km from Bridgend

Ownership : British Coal

Size : 176 Ha

Tonnage : 2,330,215 (301/701 coking)

Coaling operations commenced : 1971

Coaling operations completed : 1979

Aftercare commenced : Progressive

Aftercare completed : 1992

Proposed/Restored landuse : Agriculture/Forestry/Nature conservation

Comments : The site has been progressively restored since 1984, initially for agriculture and more recently for nature conservation, with the creation of lakes, ponds, wetlands, rush meadows and wildflower meadows.

PARK SLIP

Operational Opencast Site with Progressive Restoration

Photograph 2 :
Example of a typical
restored watercourse

(1996)



Photograph 3 :
View of the restored lake

(1996)



PARK SLIP

Operational Opencast Site with Progressive Restoration



Photograph 4

Hedgerow and verge on
access road in August 1997



Photograph 5

PARK SLIP

Operational Opencast Site with Progressive Restoration



Photograph 6

Woodland planting and
grassland in August 1997



Photograph 7

PARK SLIP

Operational Opencast Site with Progressive Restoration



Hedgerow on bank in
August 1997

Photograph 8

PARK SLIP

Operational Opencast Site with Progressive Restoration



Photograph 9 : General view of restored pond and wetland with woodland in foreground and background.

2005



Photograph 10 : Restored Wetland

2005

PARK SLIP

Operational Opencast Site with Progressive Restoration



Photograph 11 : Watercourse - detail of cascade.

2005



Photograph 12 : Reed bed detail.

2005

PARK SLIP

Operational Opencast Site with Progressive Restoration



Photograph 13 : Restored marshy grassland.

2005



Photograph 14 : Restored footpath in wooded area.

2005

LLANILID WEST

Operational Opencast Site with Progressive Restoration



1996

Photograph 15: View of part of the restored site

SITE INFORMATION

Location	:	East of Pencoed Approximately 5.0km east of Bridgend, Mid Glamorgan.
Ownership	:	Celtic Energy Ltd
Size	:	271 Ha
Tonnage	:	c 700,000 (301/701 coking/Bit)
Coaling operations commenced	:	1970/1993
Coaling operations completed	:	1997
Aftercare commenced	:	Progressive
Aftercare completed	:	On-going
Proposed/Restored landuse	:	Agriculture/Amenity
Comments	:	Generally the restored hedgebanks across the site are poor. Sections of these are now being re-worked using a lower, wider bank profile, denser planting and more diverse species mix. Trials are also being undertaken with the use of rabbit guards.

LLANILID WEST

Operational Opencast Site with Progressive Resoration

Photograph 16:

Translocated hedgebank, majority of plants out back with some standards retained and guyed. Trees beginning to re-establish.

1996



Photograph 17:

Existing hedgebank from alongside the Parish Road translocated in 2m sections, undertaken in 1990.





1996

Photograph 18: Re-worked restored hedgebanks with low, wide profile and rabbit guards (Previously restored hedgebank visible beyond)



1996

Photograph 19: Reworked restored hedgebank, again with wide, low profile and denser planting, but without rabbit guards.

LLANILID WEST

Operational Opencast Site with Progressive Resoration



1996

Photograph 20: Example of the temporary seeding of the drift head batter to limit visual intrusion.



1996

Photograph 21: Example of the successful seeding and natural establishment of vegetation on the drift head batter, significantly reducing its visual impact.

LLANILID WEST

Operational Opencast Site with Progressive Restoration



Photograph : View towards Pencoed showing restored grassland and woodland.

2005



Photograph Restored grassland with gorse in the middle ground.

2005

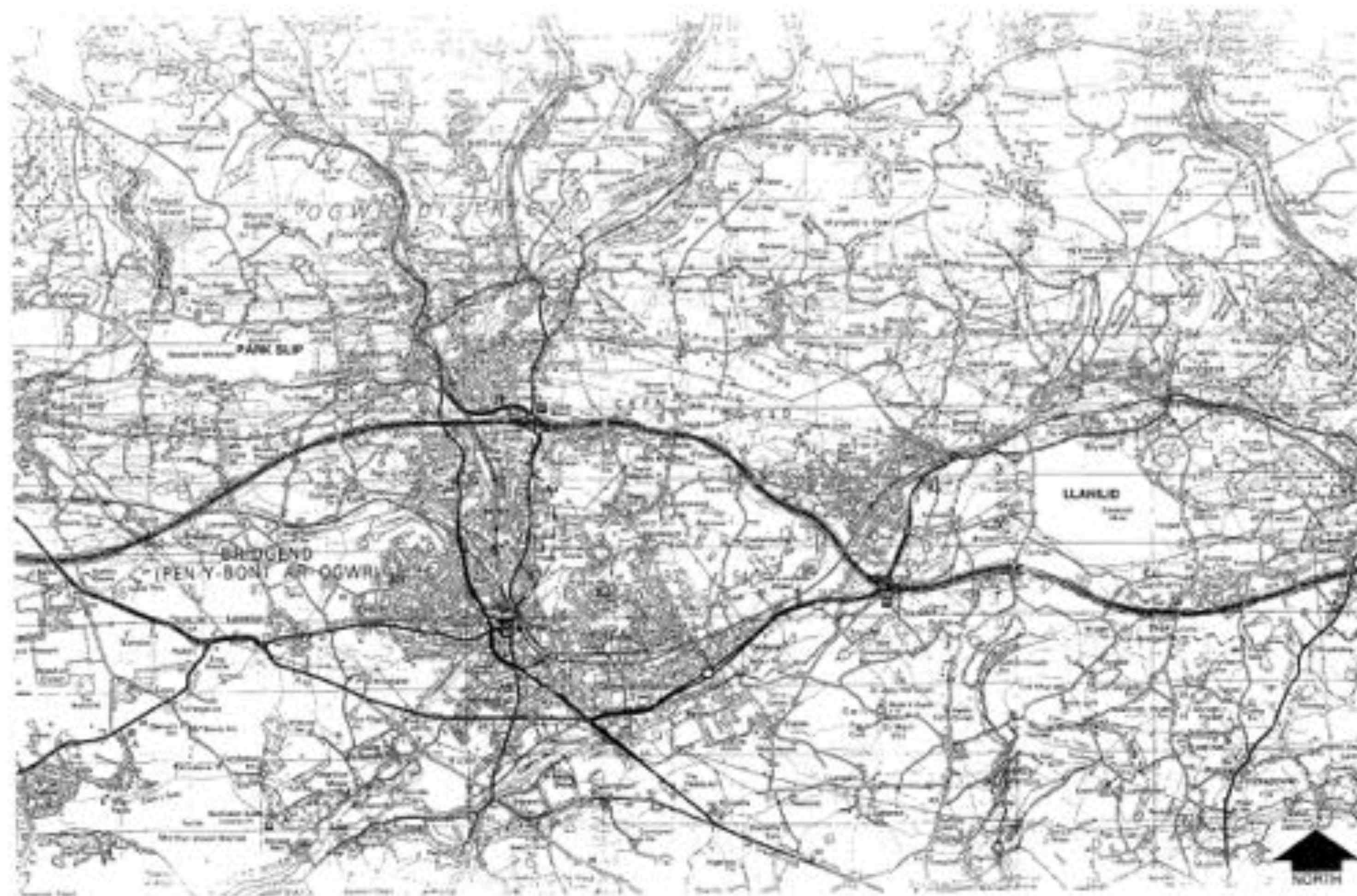
LLANILID WEST

Operational Opencast Site with Progressive Restoration



Photograph 24 : Restored grassland with shrubs and trees.

2005



LOCATION PLAN
Scale 1 : 50,000

BANWEN
Restored Opencast Site



1996

Photograph 25 : View of the restored site.

SITE INFORMATION

Location : East of the village of Banwen, adjacent to the A4109 to Abercraf.
Approximately 3km north-west of Glyn-neath, West Glamorgan.

Ownership : British Coal

Size : 31 Ha

Tonnage : c 75,000 (102)

Coaling operations commenced : 1993

Coaling operations completed : 1994

Aftercare commenced : 1994

Aftercare completed : 1998

Proposed/Restored landuse : Agriculture

Comments :



1996

Photograph 26 : Restored grassland with heather transplants, recently implemented reflecting landform and habitat of adjacent land.



1996

Photograph 27 : Land adjacent to the restored area illustrated above.

BANWEN

Operational Opencast Site with Progressive Restoration



Photograph 28 : Pond and marginal vegetation well established.

2005



Photograph 29 :
Restored grassland and watercourse
blending with surrounding landscape.
2005



Photograph 30 :
Watercourse detail at farm
access crossing
2005

NANT HELEN

Operational Opencast Site with Progressive Restoration



2005

Photograph 31 : View of restored site showing upland grassland, bogland, woodland and watercourse.

SITE INFORMATION

Location : South of the village of Abercraf, to the north-east of Ystradgynlais on the southern slopes of the Upper Tawe Vale

Ownership : Celtic Energy Ltd

Size : 306 Ha

Tonnage : 3.4 Mt

Coaling operations commenced : 1986

Coaling operations completed : 1998

Aftercare commenced : 1996

Aftercare completed : On-going

Proposed/Restored landuse : Agriculture, forestry, woodland

Comments :

NANT HELEN

Operational Opencast Site with Progressive Restoration



Photograph 32 : View towards bogland with upland grassland in the foreground crossed by a watercourse with ponds.

2005



Photograph 33 : Pond in bogland area

2005

NANT HELEN

Operational Opencast Site with Progressive Restoration



2005

Photograph 34 : Bogland and heather area



2005

Photograph 35 : Bogland and heather area detail fenced from commonland grazing.

NANT HELEN

Operational Opencast Site with Progressive Restoration



Photograph 36 :
Detail of marshy grassland
2005

BRYNHENLLYS

Operational Opencast Site with Progressive Restoration



2005

Photograph 37: View from bridleway across restored site

SITE INFORMATION

Location : Cwmtwrch

Ownership : Celtic Energy Ltd

Size : 226 Ha

Tonnage : 1.1 Mt

Coaling operations commenced : 1996

Coaling operations completed : 2003

Aftercare commenced : 1999 (In part)

Aftercare completed : On-going

Proposed/Restored landuse : Enclosed agricultural land and woodland

Comments :

BRYNHENLLYS

Operational Opencast Site with Progressive Restoration



Photograph Restored Grassland

2005



Photograph View over site with marshy grassland in the foreground

2005

BRYNHENLLYS

Operational Opencast Site with Progressive Restoration



Photograph Restored Grassland

2005



Photograph Detail of marshy grassland

2005

BRYNHENLLYS

Operational Opencast Site with Progressive Restoration

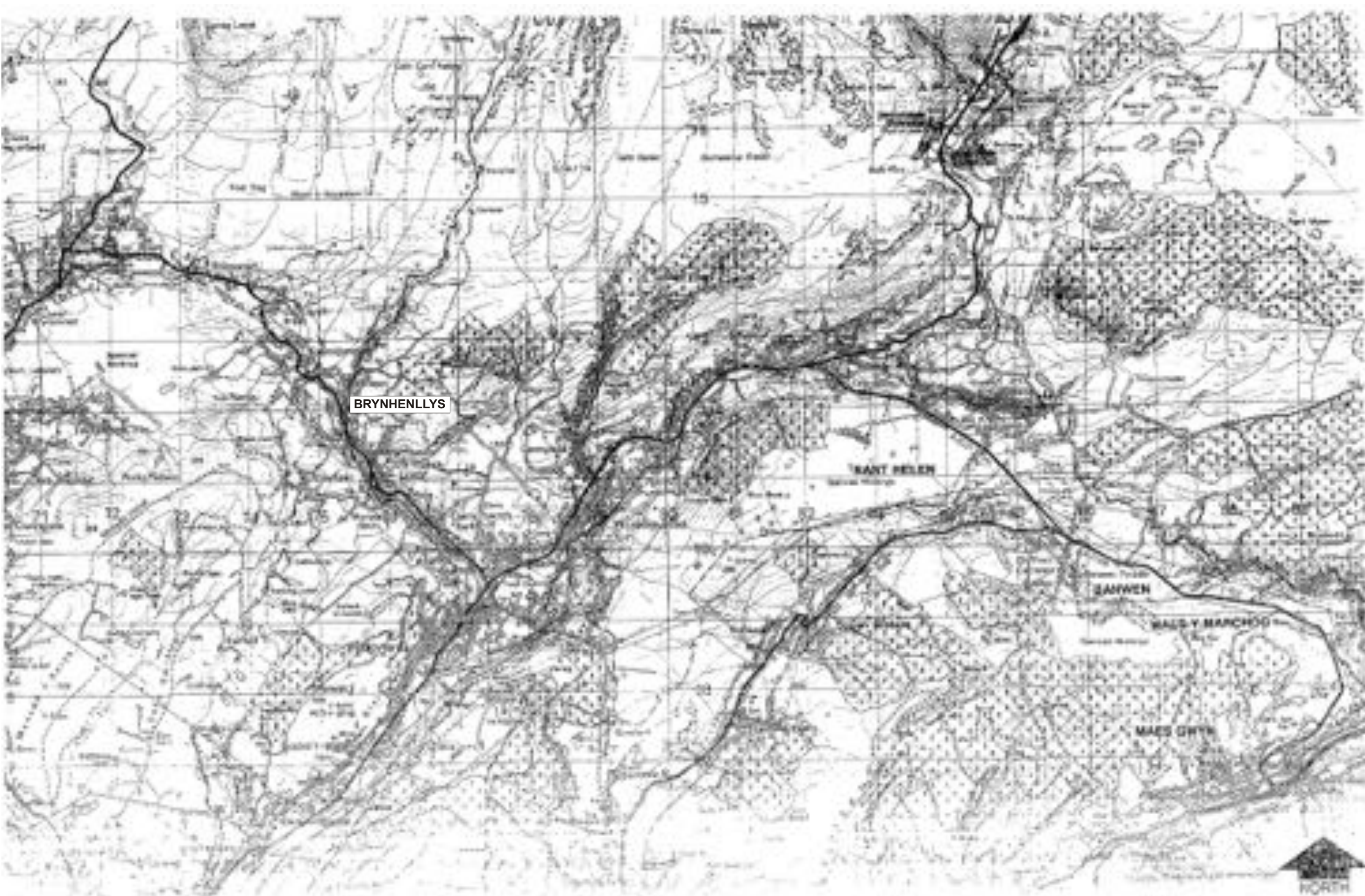


Photograph 42 :
Detail of wetland area
2005



Photograph 43 : Restored Grassland

2005



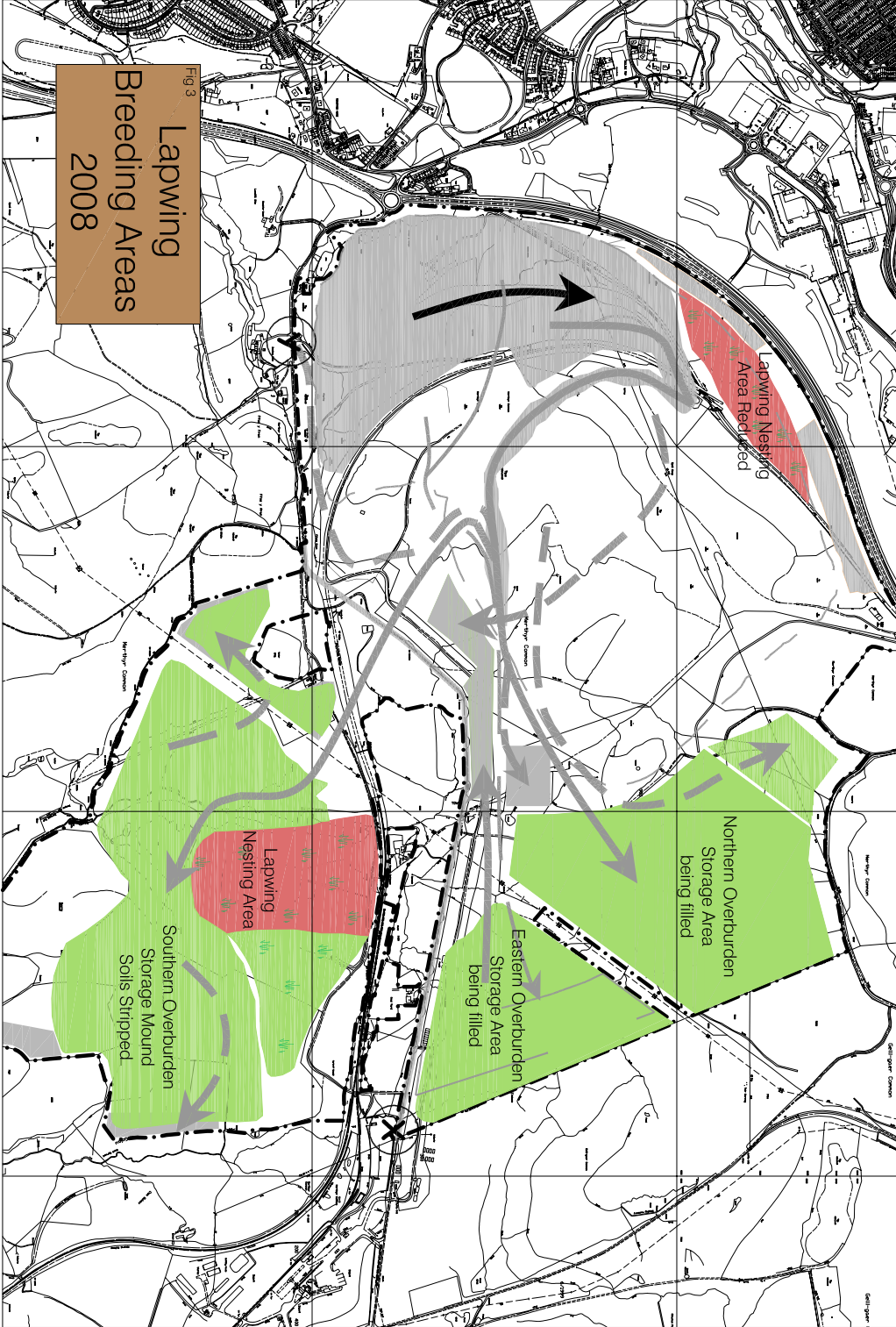
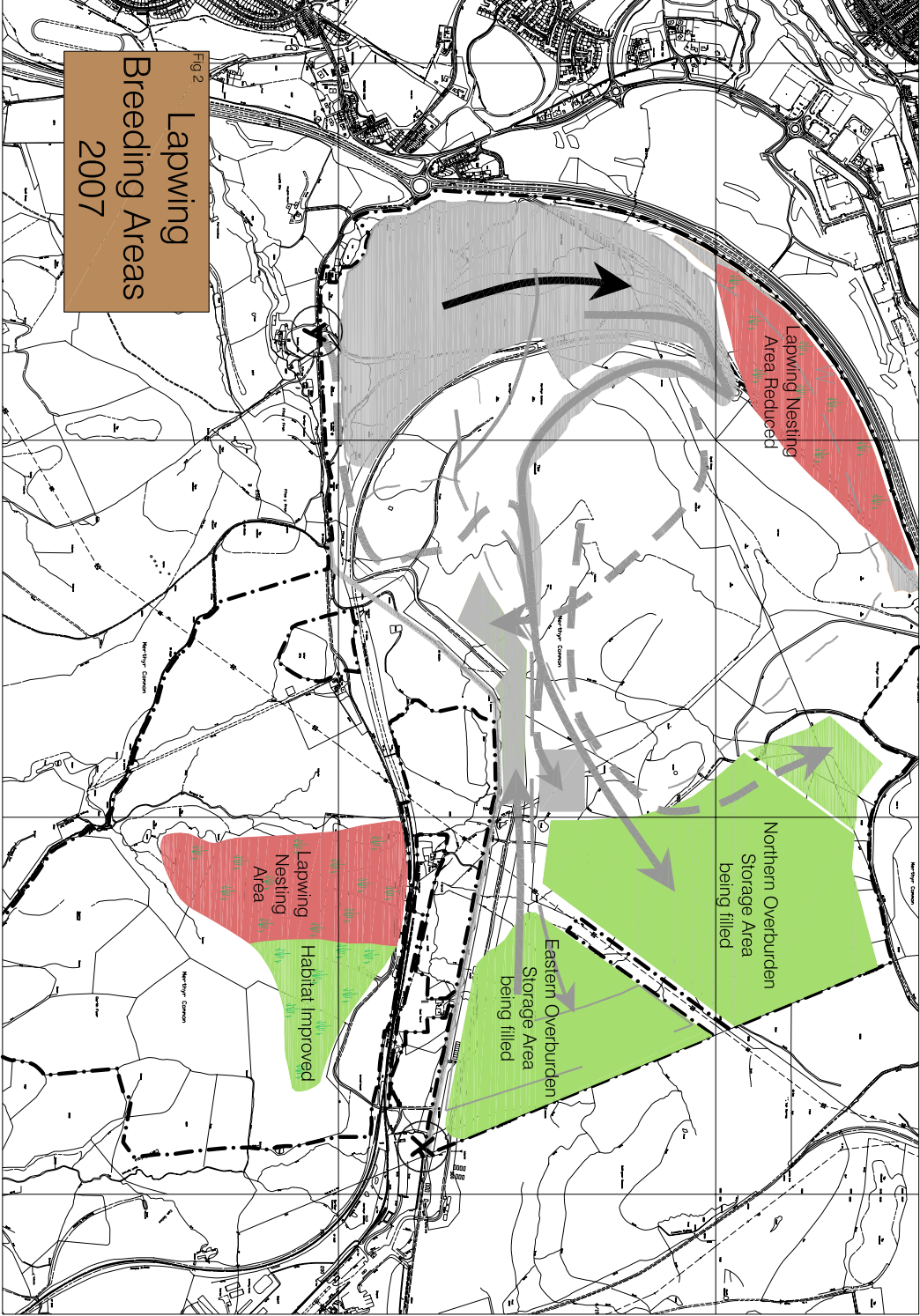
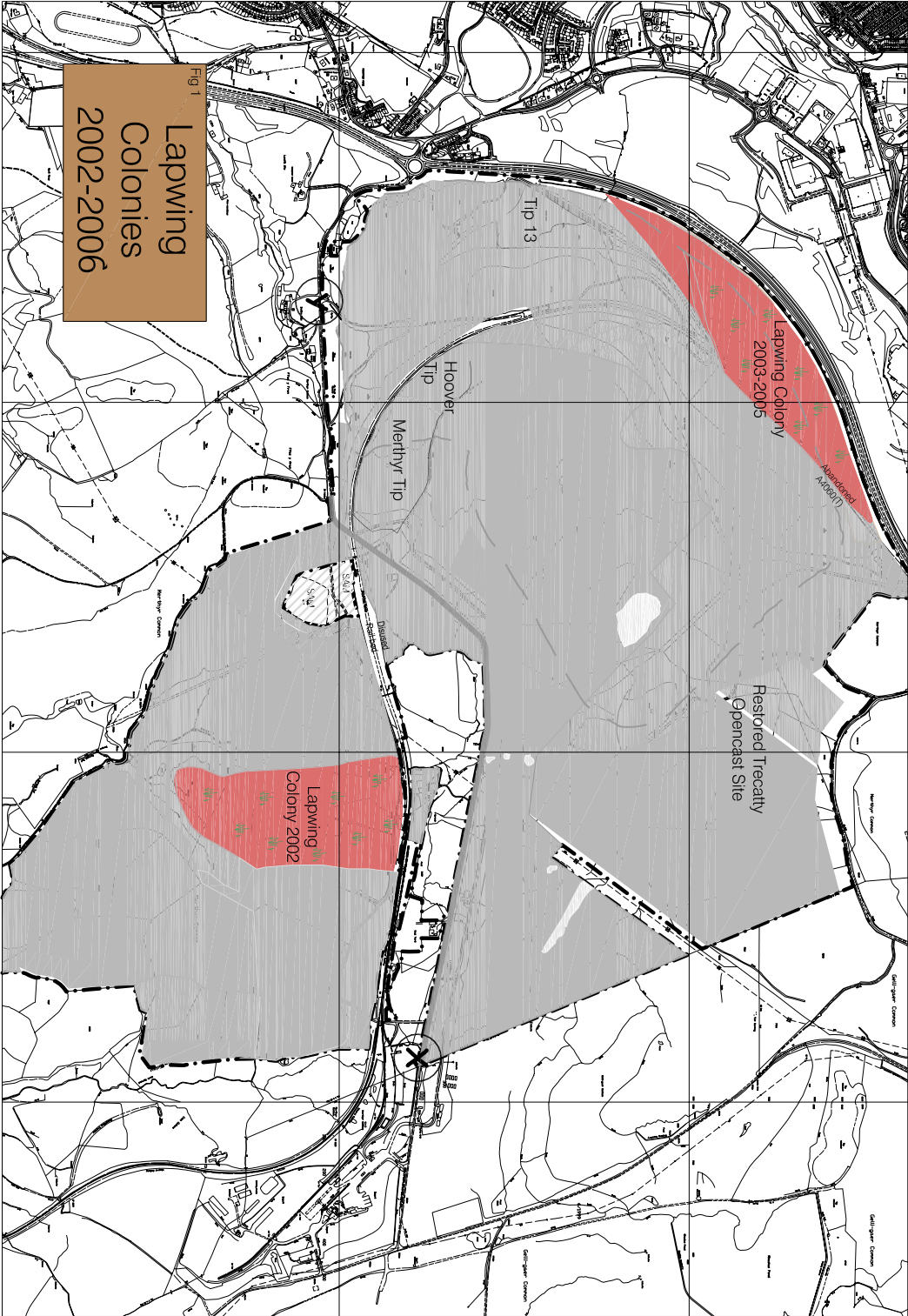
LOCATION PLAN
Scale 1 : 50,000

Appendix C

Provision of lapwing habitat during the works

Lapwing Breeding Areas and Phasing of the Works

Year	Area				
	EMLRS Phase 2 Restoration	Ryan's Tip	Northern Overburden Storage Mound	Eastern Overburden Storage Mound	Southern Overburden Storage Mound
2006	The current breeding area to the east of the A4060 would not be affected	Previous breeding site and the adjoining grassland area to the east, would be made more attractive as lapwing breeding habitat by levelling of existing mounds of spoil, and creation of shallow scrapes during late summer			
2007	Lapwings (and other ground nesting birds) would be deterred from breeding in the southern section which would be excavated as part of the initial box cut. The northern part would remain undisturbed during the breeding season. From August onwards soil storage mounds and a water treatment lagoon would be constructed along the western margin alongside the A4060.	Lapwings would be encouraged to breed by use of decoys. This area would remain undisturbed during the breeding season.	Construction of the overburden mound would commence.	Construction of the overburden mound would commence.	
2008	Lapwings (and other ground nesting birds) would be deterred from breeding in a further strip of land which would then be excavated.	The area would remain undisturbed during the breeding season. Lapwings would be encouraged to breed by use of decoys.	Construction of the overburden mound would continue.	Construction of the overburden mound would continue.	Soils would be stripped over the western and southern parts of the overburden storage area.
2009	Lapwings (and other ground nesting birds) would be deterred from breeding in a further strip of land which would then be excavated.	The lapwing breeding area would be reduced in size through construction of the southern overburden storage mound. Lapwings (and other ground nesting birds) would be deterred from breeding in the area which would be affected. Lapwings would be encouraged to breed in the remainder of the area by use of decoys.	Construction of the overburden mound would be completed and the mound seeded. The top of the mound would be prepared to provide lapwing breeding areas by provision of clay lined depressions (which would hold surface water) and scrapes. Application of organic matter, such as farmyard manure would be considered to encourage development of soil invertebrate populations.	Construction of the overburden mound would be completed.	Construction of the overburden mound would commence.
2010	Lapwings (and other ground nesting birds) would be deterred from breeding in the remainder of this area which would then be excavated.	The lapwing breeding area would be further reduced in size through construction of the southern overburden storage mound. Lapwings (and other ground nesting birds) would be deterred from breeding in the area which would be affected.	Lapwings would be encouraged to breed in this area by use of decoys. Habitat management would be carried out as necessary	The top of the mound would be seeded and prepared to provide lapwing breeding areas by provision of clay lined depressions (which would hold surface water) and scrapes. Application of organic matter, such as farmyard manure would be considered to encourage development of soil invertebrate populations.	Construction of the southern overburden mound would continue.
2011 - 2019		The lapwing breeding area would be lost through completion of the southern overburden store. Lapwings (and other ground nesting birds) would be deterred from breeding in the area which would be affected.	Lapwings would be encouraged to breed by use of decoys. Habitat management would be carried out as necessary	Lapwings would be encouraged to breed by use of decoys. Habitat management would be carried out as necessary	The southern overburden mound would be completed.
2020			Lapwings would be encouraged to breed by use of decoys. Habitat management would be carried out as necessary	Lapwings would be encouraged to breed by use of decoys. Habitat management would be carried out as necessary	The northern part of the southern overburden mound would be removed and the area restored to provide a lapwing breeding area.
2021			Overburden would be removed and the area restored. Lapwings would be deterred from breeding in this area if necessary.	Overburden would be removed and the area restored. Lapwings would be deterred from breeding in this area if necessary.	Lapwings would be encouraged to breed by use of decoys. Habitat management would be carried out as necessary
2022					Habitat management would be carried out as required.



Key

- Lapwing Nesting Habitat
- Site Boundary
- Limit of Excavation
- Direction of Working
- General material or plant movement direction dashed where intermittent

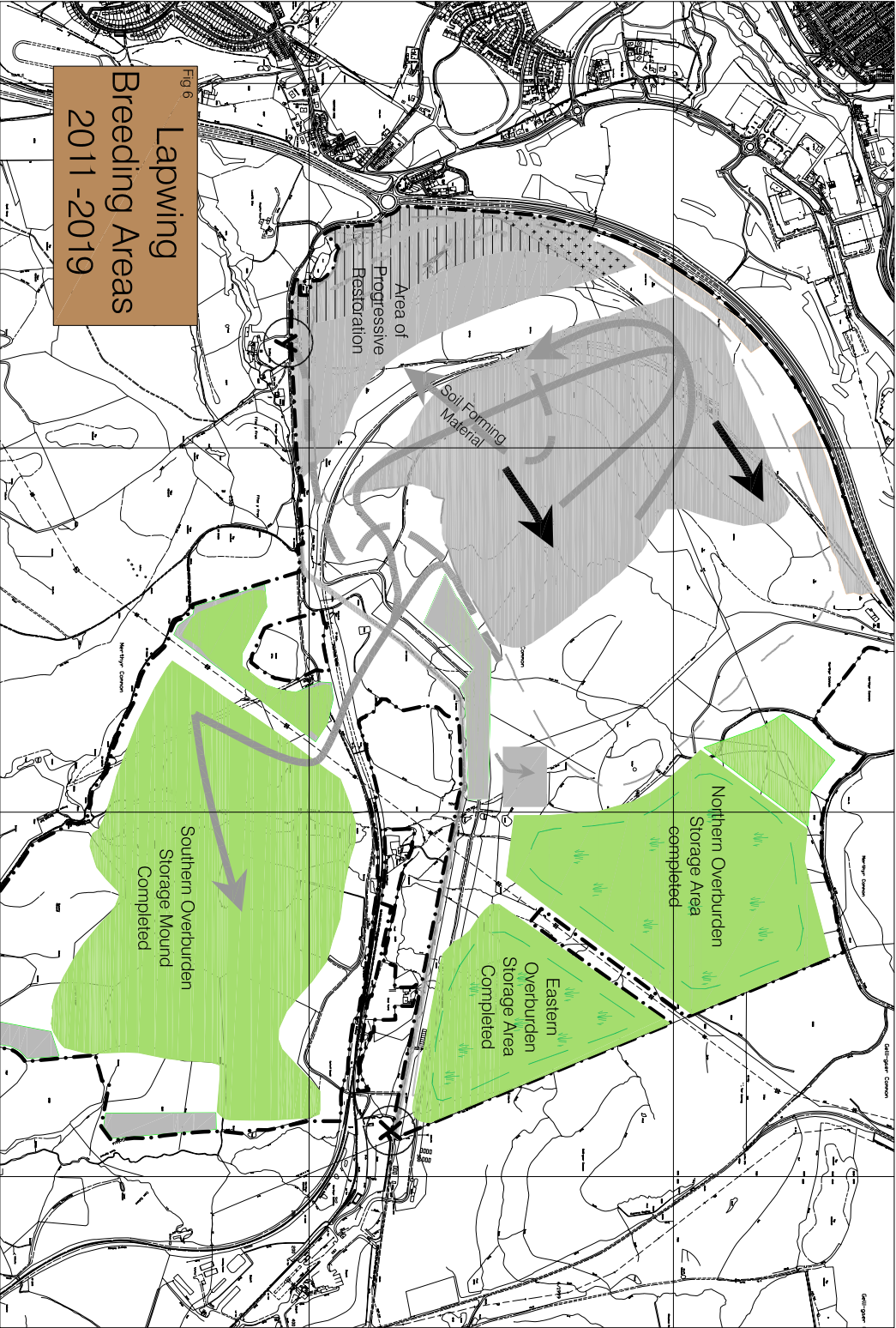
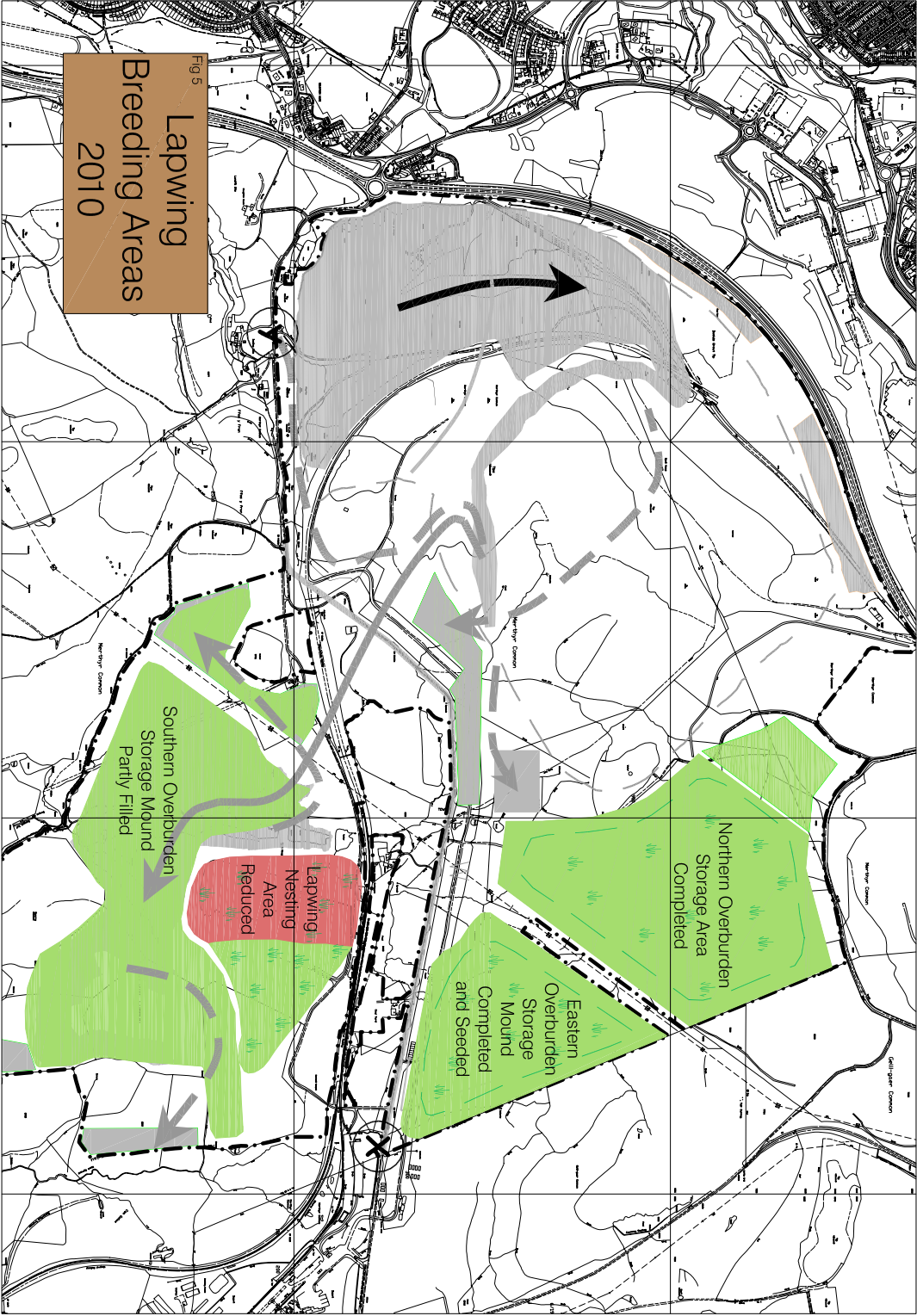
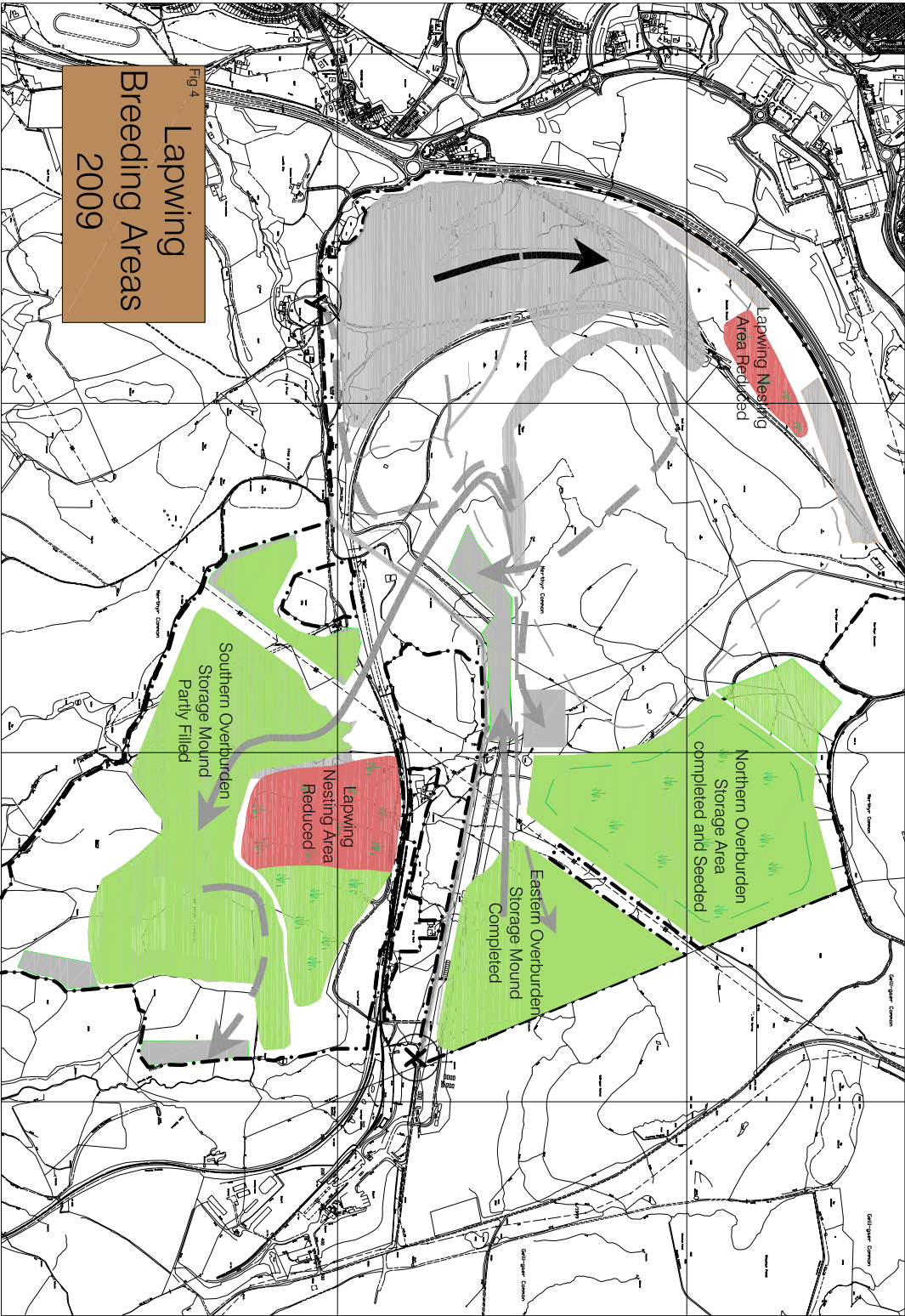
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Project: Ffos-y-Fran Land Reclamation Scheme

Title: Provision of Lapwing Habitat

Project Number	Figure Numbers
4533	1-3
Scale	Date
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Key

- Lapwing Nesting Habitat
- Site Boundary
- Limit of Excavation
- Direction of Working
- General material or plant movement direction dashed where intermittent

RPS

Project
Ffos-y-Fran
Land Reclamation Scheme

Title
Provision of Lapwing Habitat

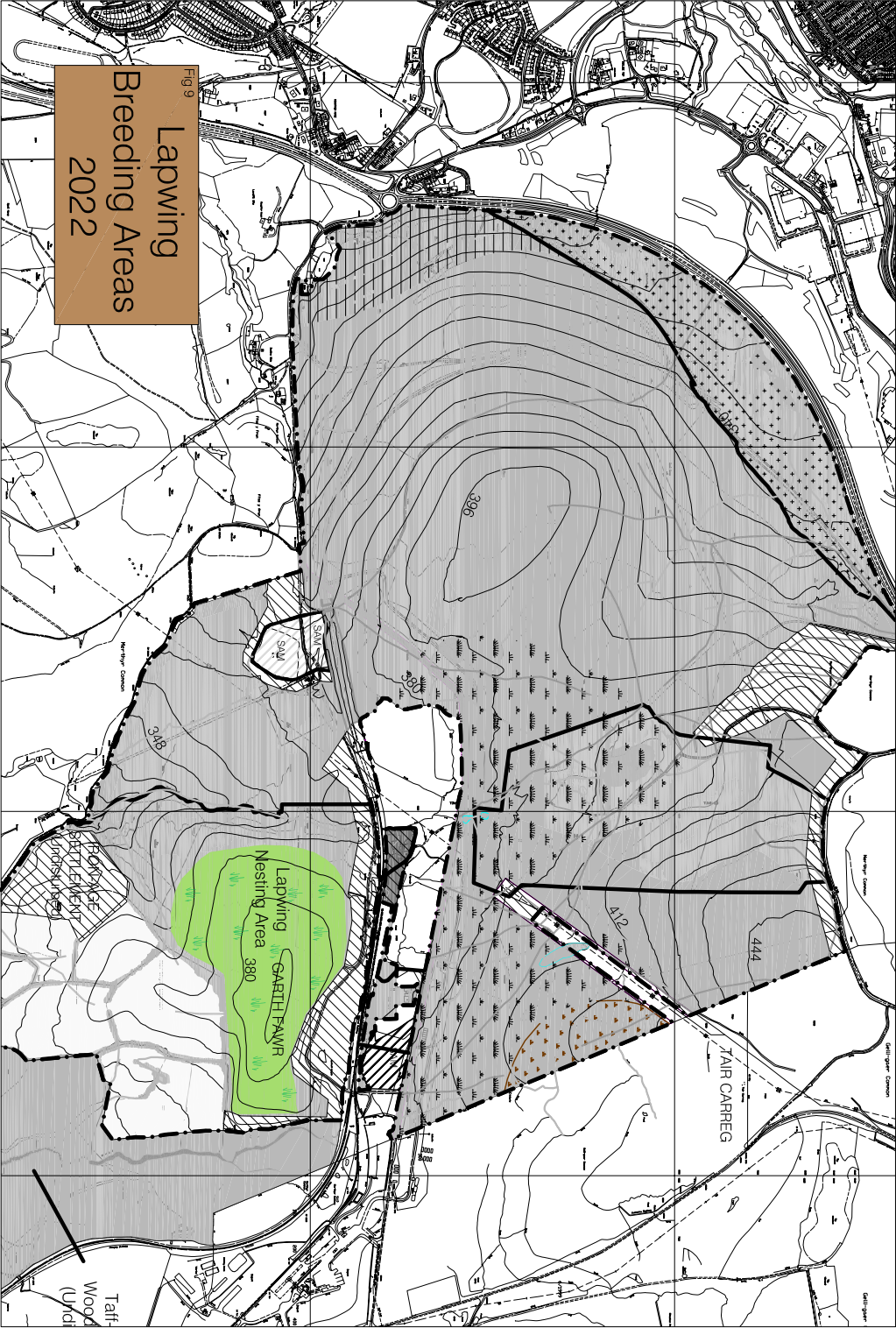
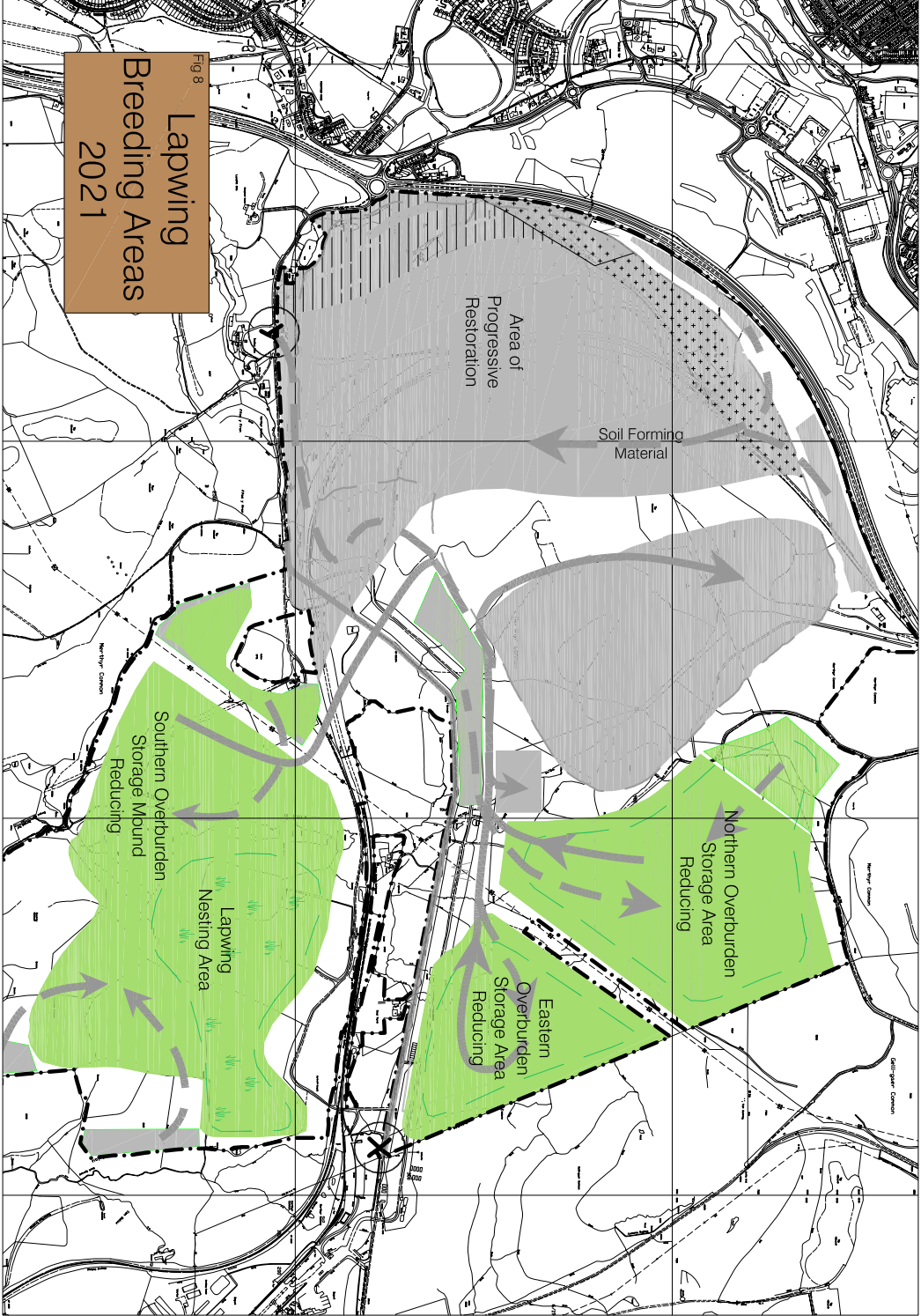
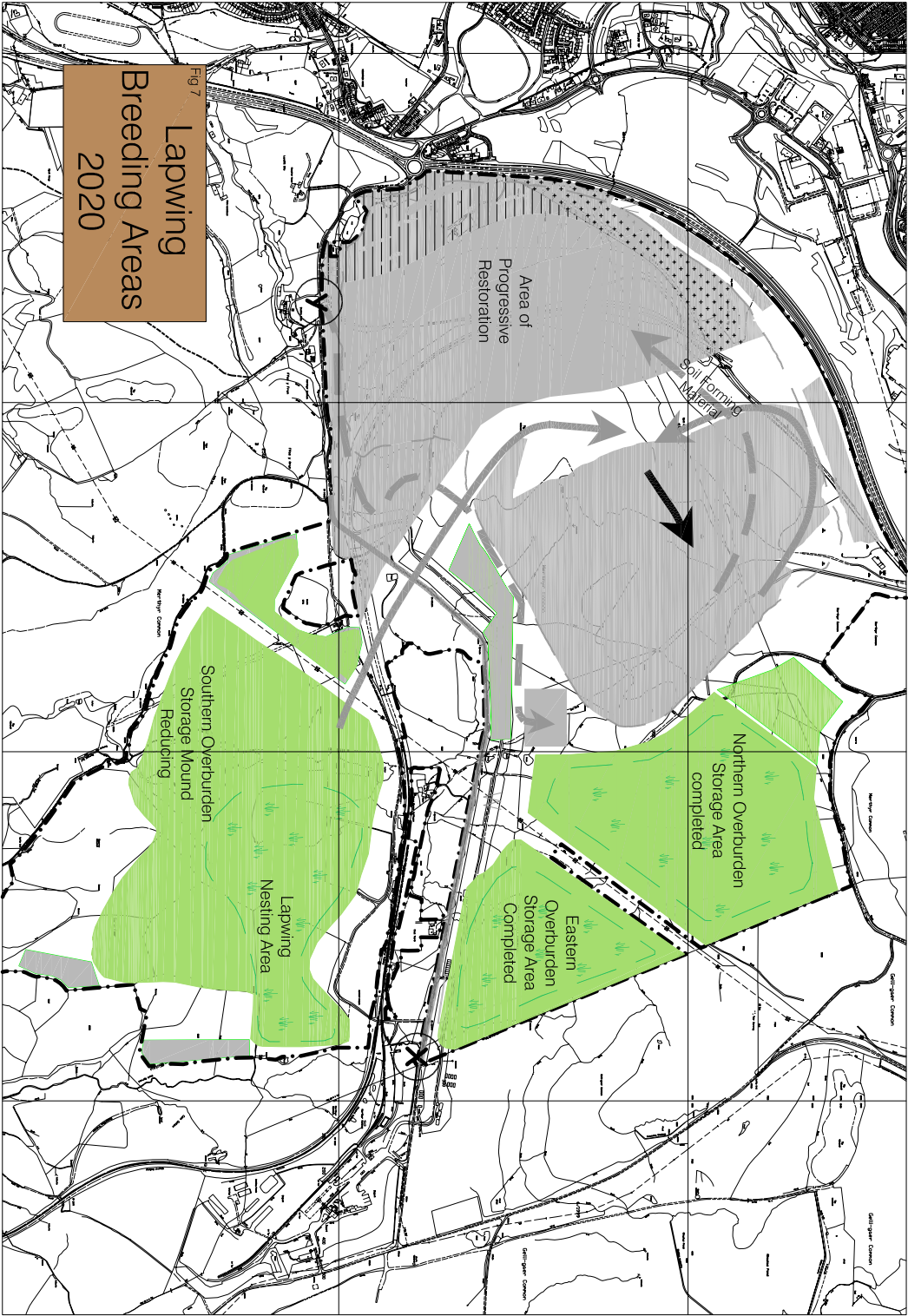
Project Number
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Figure Numbers
4-6

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Key

- Lapwing Nesting Habitat
- Site Boundary
- Limit of Excavation
- Direction of Working
- General material or plant movement direction dashed where intermittent

RPS

Project: Ffos-y-Fran Land Reclamation Scheme

Title: Provision of Lapwing Habitat

Project Number	4533	Figure Numbers	7-9
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APPENDIX 4

Hydrological Analysis Report

Ffos y Fran Land Reclamation Scheme

Hydrological Analysis Report



December 2015

Amec Foster Wheeler Environment
& Infrastructure UK Limited



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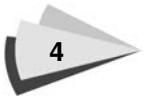
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Document revisions

No.	Details	Date
1	First draft for client review	09/06/15
2	Final issue to client	19/06/15
3	Updated with MicroDrainage approach and issued as DRAFT	11/11/15
4	Final review comments added	17/11/15
5	Additional comments added from MTC meeting, report amended for runoff coefficient =0.5 and FEH parameters used	11/12/15

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Appendix D	Morlais C and D - MicroDrainage Inputs and Results	



1. Introduction

This Hydrological Analysis Report has been prepared by Amec Foster Wheeler (AFW) for Miller Argent South Wales Limited (the Client) to support the development of a Surface Water Management Plan (SWMP) for the Ffos-y-fran Land Reclamation Scheme (FLRS) near Merthyr Tydfil, UK. The site location is shown on Figure 1 contained in Appendix A. Specifically, this report has considered the following:

- An overview of the existing surface water management arrangement together with a description of the proposed land reclamation scheme SWMP, including how the site is divided into sub-catchments, the configuration of major drainage pathways, location of attenuation ponds and site outfalls;
- data and information regarding the catchment characteristics required to undertake the hydrological analyses;
- calculations of peak surface water runoff from the Ffos-y-fran reclamation scheme and associated off-site catchments;
- an assessment of the hydraulic capacity of the off-site receiving watercourses in order to ensure that surface water discharged from Ffos-y-fran does not result in off-site flooding for the design event (1 in 100 years +30% climate change allowance); and
- preliminary estimates of on-site attenuation storage requirements in order to provide the necessary control of site discharges to prevent increase in off-site flood risk and to indicate the location and approximate footprint of on-site attenuation ponds.

1.1 Background

The Ffos-y-fran site encompasses four small catchments, namely: the Cae Harris, the Nant Morlais, the Cwm Blacs and the Bargoed Taff. Only the Nant Morlais and Cwm Blacs catchments are relevant to this report. Both the Nant Morlais and Cwm Blacs flow west where they converge with the Afon Taf.

The site is currently in operation and coal will continue to be extracted into the 2020's. Excavations are progressing in a north easterly direction while the south, southwest and western areas of the site have already been restored as the void is progressively backfilled from the south. This is shown in the Aerial Photography Figure contained in Appendix A. This pattern of progressive restoration of the newly backfilled areas will continue as the works progress northwards, as indicated by the restoration phasing plan as shown on Figure 2 and Figure 3 also contained in Appendix A.

Ffos y Fran utilises six discrete surface water discharge locations, namely: Morlais A; Morlais B; Morlais C; Morlais D; Cwm Blacs A; and Cwm Blacs Intermediate. These discharge locations are shown on Figure 1 contained in Appendix A.

1.2 Regulatory Context

During the meeting of 26 March, 2015, Merthyr Tydfil County Borough Council confirmed their satisfaction with the conceptual SWMP (as broadly shown on Figure 1) and requested that additional analyses be carried out to assess the capacity of the off-site receiving watercourse of the Morlais A and Morlais B catchments for a design (1 in 100 year +30% climate change) flood event. This requested information is presented herein and has played a significant part in the estimation of the on-site attenuation storage requirements.

1.3 Report Structure

The remainder of the report is set out as follows:

- Section 2** provides an overview of the existing and proposed Ffos-y-fran water management arrangements;
- Section 3** presents the parameters and assumptions used in the design of the on-site surface water runoff calculations associated with the restored areas of the site;
- Section 4** presents an analysis of the hydraulic capacity of the relevant off-site receiving drainage features needed to accommodate the on-site runoff (namely those into which the Morlais A and Morlais B culverts discharge);
- Section 5** presents the on-site drainage calculations and results to accommodate the surface water attenuation/runoff from the restored areas of the site; and
- Section 6** provides a summary of the results and recommendations.

1.4 Design Undertaken

The following design has been undertaken as part of this analysis in order to help support the basis of the regulatory review:

Table 1.1 Summary of the design undertaken as part of this analysis

Catchment	Design undertaken as part of this analysis
	<ul style="list-style-type: none"> • Green field runoff calculations • Receiving channel capacity assessment • High level attenuation calculations • Indicative pond arrangement details
	<ul style="list-style-type: none"> • Green field runoff calculations • Detailed receiving channel capacity assessment • Detailed attenuation calculations and conveyance design • Detailed swale, grip and pond design and layouts
Morlais C & D	<ul style="list-style-type: none"> • Green field runoff calculations • High level attenuation calculations to accommodate additional area • Indicative pond location reference
Cwm Blacs A / Intermediate	<ul style="list-style-type: none"> • Not assessed as part of this analysis

2. Current and Proposed Surface Water Management

This section provides an overview of the existing surface water management arrangements and then an overview of the proposed reclamation scheme surface water management plan. Reference should be made to the Figures and plates contained in Appendix A when referring to this section.

2.1 Existing Water Management

The Ffos-y-fran site is located within the hydrological catchments of the Cae Harris, Nant Morlais, the Nant Cwm Blacs and the Bargoed Taff. The Bargoed Taff does not significantly impact the development of the SWMP for this stage of the reclamation scheme and will therefore not be discussed in detail. Similarly, the Cae Harris 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 (see Figure 2). Therefore, the Cae Harris will not be considered further in this report.

2.1.1 Nant Morlais Catchment

The Nant Morlais and Cwm Blacs catchments and their principal watercourses have been significantly modified since mining operations began at Ffos-y-fran - to the extent that very little of the original Nant Morlais topography and watercourses remain. Currently, a water treatment area (WB) is located in the west of the site (see Figure 2) into which water is pumped from a sump at the base of the void. This water is then discharged via a consented outfall into the Nant Morlais.

There are ditches along most of the western boundary of the site that intercept runoff from the already restored interim areas and the A4060 (see Plates 1 and 2). These ditches were constructed as part of the East Merthyr Reclamation Scheme (Phase II) 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. These two culverts were designed in accordance with the 'East Merthyr Reclamation Scheme Phase II (Great White Tip) and Revised Phase III' and sized accordingly. They are shown on Plates 3 and 4 and on Figure 1 as 'Nant Morlais A Culvert' and 'Nant Morlais B Culvert'. These culverts will continue to provide two discrete outfalls from the on-site Nant Morlais catchment under the new SWMP. The 'Nant Morlais A' sub-catchment will drain to the Morlais Culvert A. The 'Nant Morlais B' catchment will drain to the Morlais Culvert B.

A further area of the site to the south is identified on Figure 1 in Appendix A as Nant Morlais C. In accordance with the restoration contours shown on Figure 1, this area of land 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. These culverts are shown as 'Nant Morlais C' and 'Nant Morlais D' Culverts on Figure 1.

The Morlais C and D culverts have been observed as passing a small discharge into an existing highways drain under the A4060.

During the meeting of 26 March, 2015, Merthyr Tydfil County Borough Council stated that as long as there is no material change to the contributing catchments as a result of the reclamation scheme then there is no requirement to formally assess the adequacy of these culverts. However during the detailed design of Morlais B catchment a requirement arose to route a small volume of additional flow via the Morlais C and D culverts. It is therefore now proposed to control these additional flows to green field runoff rates by introducing attenuation in Morlais C and D catchment prior to discharge through the culvert. The control of flows from these two catchments are considered further in Section 5.3.

There is a small parcel of land that does not directly drain to the Morlais C and D culverts which is located in the southeast-most corner of catchment C. The pond at this location receives flows from the portion of the catchment above via overland flow/infiltration. Discharge from this pond is assumed to be by overland

flow/percolation (i.e. not via a discrete outfall). The pond is not under the control of the Client. No analysis has therefore been undertaken on this small parcel of land.

2.1.2 Nant Cwm Blacs Catchment (on-site)

The Cwm Blacs is the more complex of the two catchments and is effectively divided into onsite and offsite sub-catchments. On site, it can be seen that the Cwm Blacs stream effectively rises at the head of the railway cutting (see Figures 1 and 2). From there it drains to the west, underneath the Bogey Road via a small culvert (see Figure 2 and Plate 5), into a small wetland (see Plate 6). From this area of wetland, surface water in the wetland either flows back under the Bogey Road (see Plate 7) 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 (see Figure 1).

A discrete outfall structure is located in the far southwest of the on-site area of the Cwm Blacs catchment and is shown on Figures 1 and 2 and Plates 8 and 9. Currently, only a residual flow of 1-2 l/s has been observed flowing out of this culvert and is assumed to comprise only groundwater. The culvert itself was recently severed approximately 70m upslope from its outfall and backfilled as part of the ongoing restoration in this area of the site.

The ultimate outfall into the Cwm Blacs, indicated as Cwm Blacs A Culvert Outfall on Figure 1, has not yet been observed in detail. An aerial photograph, dating back to 1990, shows that the land between the site inflow structure and off site discharge point comprised an open channel at that time. However, this gully has since been infilled and a pipe run constructed. The Client is currently in discussions with the landowner with a view to obtaining permission to survey this culvert in more detail.

The Cwm Blacs A culvert now has a much reduced catchment area than prior to the reclamation scheme. This is partly by design since (i) it has not been possible (for land access reasons) to robustly survey the off-site drainage infrastructure to demonstrate its capacity, and (ii) Miller Argent South Wales Limited has made a concerted effort to reduce discharges to the Cwm Blacs due to the concerns of neighbouring property owners. The Cwm Blacs Intermediate culvert only discharges intermittently from a wetland and provides no significant contribution to flow in the Cwm Blacs.

2.1.3 Nant Cwm Blacs Catchment (off-site)

Off site, the Sarn Howell pond (see Figure 1) effectively comprises the headwater of the Cwm Blacs catchment. While there is an apparently disused penstock to the west of the dam, and evidence that the dam has overtopped in the past, no other means of the pond contributing surface water to the Cwm Blacs has been observed. An area of saturated ground was observed to the immediate west of the Sarn Howell Pond dam and it is from this area that the off-site Cwm Blacs appears to rise. While this area appears to receive runoff and shallow sub surface flow from the 'Pillow Mound' to the south, the saturation is thought to be also due to dam and basal seepage, as well as residual leakage through the disused penstock.

In most sections between the Cwm Blacs Intermediate Culvert (shown on Figure 1) and just upstream of Incline Side, a small yet discrete main channel was observed, generally <1m in width throughout and with first stage bank heights <0.5m. The channel is contained within a well-defined, small valley, generally several metres in width. The top of the right bank is effectively formed by the southern verge of the Bogey Road from where the depth to the base of the channel from the road level ranges up to several metres. The left bank comprises of shales, and is generally steeper and higher than the right bank, but is <10m in vertical height.

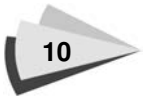
No surface flow was observed (August 2014) in the upper sections of the observed reach though flow estimated at up to ~10 l/s was observed at the downstream end just upstream of Incline Side (shown on Figure 1 & 2). The observed flow accretion was not commensurate with discrete inflows from tributaries, pipes or drains and therefore it is assumed that flow is also transmitted beneath the channel bed surface within an alluvial matrix and that there may also be discrete or diffuse groundwater inflow throughout the reach. The channel is heavily vegetated in sections, whilst in other sections, the channel bed appears to comprise bedrock.

The outfalls from the contour grips draining the restored spoil tip to the immediate south were observed as small formalised concrete spillway structures. No flow was observed in these drains at the time of the walkover (August 2014).

2.2 Proposed Water Management

The proposed water management scheme is as follows and should be read in conjunction with Figure 1.

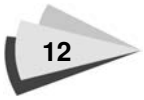
- The Nant Morlais catchment will be divided into four sub-catchments shown on Figure 1, namely Morlais A, B, C and D.
- The Nant Morlais A and B catchments will drain to the Nant Morlais A and B culverts via newly constructed main channels with associated tributary ditches and/or contour grips draining the wider catchments to the main channels.
- Flow through the Nant Morlais A and B culverts will be controlled via a network of attenuation ponds to ensure their capacity is not exceeded and that off-site flooding is adequately mitigated.
- The Nant Morlais C and D catchments will continue to drain to the Nant Morlais C and D culverts but may require some form of additional attenuation to help control flows prior to discharge.
- The conceptual scheme gives due consideration to the possible requirement to retrofit additional attenuation storage should the industrial park in the west of Ffos-y-ffran be developed in the future, thus ensuring the integrity of the scheme presented is not compromised.
- Due consideration is also given to the possible future development of a railway line through the site, clearly indicated on Figure 1 by the specification of a ditch on the upslope side of the railway cutting. Further design of the railway ditch will be carried out at detailed design stage in the future.
- The majority of what used to be the natural catchment of the Cwm Blacs A culvert will now be routed to the Morlais B culvert, although the Cwm Blacs A outfall structure will remain. As such no detailed analysis has been undertaken on the Cwm Blacs outfall/catchment.
- Adequate provision, in terms of design and construction planning, should be made for the phasing of the reclamation scheme since all of the elements will not be fully constructed until the 2020's as progressive backfilling and restoration continues.



3. Basis of the On-Site Runoff Design

This section summarises the key parameters and assumptions used to help design the key drainage features needed to accommodate and manage the runoff from Morlais A and B of the FLRS. These parameters and assumptions have then been used in the preparation of MicroDrainage © modelling to help support the on-site design, especially with respect to identifying the attenuation requirements.

Rainfall Derivation:	Flood Estimation Handbook parameters have been used, namely $C = -0.027$, $D1 = 0.460$, $D2 = 0.444$, $D3 = 0.367$, $E = 0.292$ and $F = 2.510$
Catchment Delineation:	The catchment delineation process was based on the proposed restoration contours as shown in Figure 1 contained in Appendix A. The Bargoed Taff and Cae Harris catchments do not influence the reclamation scheme at this stage and thus do not form part of this assessment. The catchment area was subsequently slightly adjusted to accommodate the earthworks necessary to situate suitably sized attenuation ponds in the Morlais B catchment, indicated by the detailed MicroDrainage © model. Reference should be made to Section 5 for further details.
Catchment Area:	Required for the runoff and attenuation calculations.
Flowpath Length:	Required for the runoff calculations in order to calculate subsequent parameters and runoff.
Max/Min Elevations:	Required to calculate the time of entry (T_e) for each catchment in order to determine the appropriate rainfall intensity duration frequency (IDF) parameters ultimately used in the MicroDrainage © model. Max and min elevations are taken from the elevation of the restoration contours at the topographic highs and outfalls in each catchment.
Flowpath Slope:	Also required to calculate T_e and based on the difference in max and min elevation divided by the flow path length (both terms as described above).
Land cover/Runoff Coefficient:	Used to determine runoff coefficients in the runoff calculations. The wild-grass / meadow land cover currently observed in the restored areas is assumed to cover the entire restored site and the overall runoff coefficient used in the MicroDrainage © model has been set at $C = 0.5$ (i.e 50%) in liaison with Merthyr Tydfil County Borough Council. This equates to a PIMP of 60% when used in conjunction with the winter volumetric runoff coefficient $C_v = 0.84$
Receiving channel capacities:	Used to calculate the attenuation/storage volumes (discussed in Section 4)
Swale/grip design:	Use of locally won materials and shaped in order to provide the required capacity to accommodate flow volumes, velocities and flow rates. Roughness coefficient used is $n = 0.065$. Key features have been represented in the MicroDrainage © model.
Climate Change:	All calculations used in the detailed MicroDrainage © model makes allowance for climate change by applying 30% increase in rainfall depth for all storm durations to the 1 in 100 year return rainfall event. Climate change factor of 30% are in line with guidance in the SuDS Manual (2007 & 2015), for projections for the years 2085-2115 as the reclamation scheme design is not due for completion until the 2020's.



4. Off-Site Hydraulic Capacity Calculations

This section presents the analysis of the critical hydraulic capacity of the off-site drainage features associated with Morlais A and B catchments in order to determine the sizing of any on site attenuation storage. Reference should be made to the supporting Figures and Plates contained in Appendix A when referring to this section.

4.1 Confirmation of the Capacity of the Key Drainage Feature

It was noted from the Phase II and Revised Phase III Report of the East Merthyr Reclamation Scheme that the following design capacities for the Morlais A culvert (named IIIB in the report) and Morlais B (named IIIA in the report) culvert had been identified:

Morlais A (IIIB):	Diameter = 1,400 mm	Design Capacity = 2,500 l/s
Morlais B (IIIA):	Diameter = 1,500 mm	Design Capacity = 3,400 l/s

However, after completing further surveys of the receiving watercourses downstream of Morlais A and B culverts (i.e in Bradley Gardens and Goat Mill catchments), these were found to have a smaller capacity than the corresponding culvert sizes stated above. As such, the downstream watercourse capacity is deemed to have the critical defining capacity that must be accommodated in order to successfully manage the runoff from Morlais A and B catchments.

The following sections sets out the methodology used to determine the critical capacities of the downstream watercourses for each catchment

4.1.1 Channel Geometry of the Downstream Watercourse

Prior to performing the analysis, it was important that accurate topographic survey data for the watercourses was available. To this end, Miller Argent South Wales Limited undertook an extensive GPS topographic survey of the off-site watercourses and it was on this information that this analysis is based. The location of the survey areas and cross-sections are shown in the Amec Foster Wheeler Figure entitled 'Bradley Gardens and Goat Mill catchments and location of topographic survey channel cross sections'.

It can be seen that over 70 cross sections were surveyed along the Bradley Gardens watercourse and nearly 50 cross-sections surveyed along the Goat Mill catchment watercourse. The individual cross sections were analysed and their effective cross-sectional area (i.e. the channel area up to the height of the lowest bank – also known as the bankfull height) was calculated, along with the associated wetted perimeter.

The cross section with the smallest area in each of the Bradley Gardens (see Plate 10) and Goat Mill (Plates 15 and 16) catchments was taken forward as the basis for calculating the maximum flow capacity in that channel.

4.1.2 Hydraulic Calculation used to Determine the Capacity of the Downstream Watercourse

An estimate of channel capacity at the two selected cross-sections was made by using the following mass balance equation and substituting V for the Manning's equation for calculating flow velocity. These equations are respectively given by:

$$Q = VA \quad \text{Eq. 4}$$

$$V = \frac{Wp^{0.66} S^{0.5}}{n} \quad \text{Eq. 5}$$

where Q is discharge (m^3/s), V is flow velocity (m/s), A is the cross sectional area of flow (m^2), Wp is the wetted perimeter (m), S is the energy slope (m/m), approximated by the bed slope, and n is the non-dimensional Manning's roughness coefficient.

As discussed above, the cross-sectional areas and wetted perimeters of flow were calculated from the topographic data. The slope was taken as the average through seven cross sections, adjacent to the selected cross-section. The value of n (channel roughness, used in the Manning's equation) was taken as 0.05 for both the Bradley Gardens and Goat Mill ditches. 0.05 is the recommended lower end of the range of values for "sluggish, weedy reaches". While the Bradley Gardens reach is clearly grassy, it has been known to have become overgrown and thus a value of 0.05 is considered appropriate should a lack of maintenance of the reach periodically lead to elevated channel roughness. Moreover, 0.05 is appropriate for use at the Goat Mill reach.

It was observed at the time that the channel that flows through Bradley Gardens, corresponding with the location of the minimum flow cross section, is in need of maintenance due to significant accretion of sediments deposited prior to the channel being cleared of extensive in-channel vegetation. This has resulted in raised bed levels.

The ongoing maintenance responsibilities of the Bradley Gardens and Goat Mill watercourses should be established to ensure that the channel capacities are not reduced in the future and that the efficacy and integrity of the Ffos-y-fran SWMP is not compromised.

4.1.3 Off-Site Hydraulic Calculation Results

The parameters and results of the off-site hydraulic analysis are shown in Table 4.1 below where it can be seen that the maximum discharge (inclusive of a 300mm freeboard allowance between the peak water level and the lowest bank height) is $0.845\text{m}^3/\text{s}$ through Bradley Gardens and $0.652\text{m}^3/\text{s}$ in the Goat Mill Catchment watercourse just downstream of its convergence with the Morlais A outfall discharge.

Table 4.1 Summary of the off-site hydraulic calculation parameters and results

Parameter	Goat Mill (i.e downstream of Morlais A Culvert)	Bradley Gardens (i.e downstream of Morlais B Culvert)
XS Selected minimum capacity cross section	200	
Hmax Bankfull level minus 300mm (mAOD)	0.431	0.710
n Manning's roughness coefficients (dimensionless)	0.050	0.050
R Hydraulic Radius (m)	0.158	0.177
Vmax Maximum velocity (m/s)	1.514	1.189
Qmax Maximum discharge (m^3/s)	0.652	0.845

The capacity of the off-site watercourses were then used to help prepare a MicroDrainage © model for Morlais A and B in which to calculate the on-site attenuation storage requirements. This has been explained further in Section 5.

5. On-Site Storage Calculations

The on-site attenuation storage requirements have been calculated from the runoff which will be generated from the FLRS. This is needed to help minimise the risk of surcharging the receiving watercourses downstream of Morlais A & B culverts that the runoff will enter as discussed in Section 4.

It should be noted that these storage calculations are based on the storage required to attenuate the 1 in 100 year + 30% event high intensity peak runoff event.

5.1 Morlais A Attenuation

To identify the necessary attenuation volume needed to accommodate the runoff from this catchment, a MicroDrainage © storage estimate model was prepared. The modelling uses key parameters as set out in Section 3 of this report and re-iterated in the calculations contained in Appendix B.

The modelling results show that in order to attenuate the 1 in 100 year+30% flows with the resulting outflow matching the capacity of the receiving channel at Goat Mill (i.e no greater than 0.652 m³/s), a volume in the order of 78,000m³ is needed. A summary of the modelling results together with the attenuation required to prevent an increase in flood risk, and a typical arrangement of this storage has been shown in Appendix B.

The estimation of required on-site storage is likely to be conservative and will be subject to refinement during the detailed design when more detailed hydraulic modelling will be used to accurately specify the required ditch sizes and configuration, pond sizes and outfall and control structure requirements. During this process, allowance for attenuation within the on-site channels through in-channel storage may result in the final storage and pond size requirements being lower. However the values reported here are expected to be sufficient for planning, permitting and for developing bills of quantities.

5.2 Morlais B Attenuation

To calculate the required attenuation volume needed to accommodate the proposed restoration, a MicroDrainage © model was prepared. The model incorporates the main features and necessary dimensions of the receiving on site ditches/swales which convey flows into a receiving attenuation pond arrangement. This pond arrangement has been split into two sections to help accommodate the proposed restoration levels and earthworks balancing.

The model was set up using the key parameters identified in Section 3 of this report and tested for a range of storm durations to determine the critical storm event and hence volume of attenuation needed. The total area for this catchment has been measured as 53.8ha excluding any industrial zone plot development area or pond area. However this has been adjusted to 52.5ha in the modelling for the reasons outlined in Section 5.3.

The modelling results show that in order to attenuate the 1 in 100 year+ 30% flows from the restoration zone with the resulting outflow matching the capacity of the receiving channel at Bradley Gardens (i.e no greater than 0.845 m³/s), a volume of 20,000m³ is needed (i.e 10,000m³ per pond). The main control devices needed to accommodate this volume would be a set of orifice plates.

Confirmation of the key parameters used in the model together with the modelling results, the scheme layout and attenuation requirements to help mitigate the risk of flooding has been included in Appendix C.

5.3 Morlais C & D Attenuation

Due to the complexities of the earthworks associated with shaping the pond arrangement for the Morlais B catchment, some of the catchment area from Morlais B has had to be re-directed into the Morlais C & D catchment.

A summary of the revised areas associated with the Morlais C and Morlais D catchments is given in Table 5.1.

Table 5.1 Summary of the Revised Areas

Description	Area
Area removed from the southwest boundary of Morlais B catchment and added to Morlais C and Morlais D catchment	1.3ha (1.0ha for Morlais C and 0.3ha for Morlais D)
Amended restoration zone area used in Morlais B calculations	52.5ha (ie 53.8 ha - 1.3ha)
Amended area used in the Morlais C calculations	3.0ha (i.e 2ha + 1.0ha)
Amended area used in the Morlais D calculations	1.3ha (i.e 1ha + 0.3ha)

As a result of the increase in contributing area of 1.0ha to Morlais C outfall, it is recommended that additional attenuation is provided near the outfall to ensure existing green field rates are not exacerbated. Subject to further discussion and agreement with Merthyr Tydfil County Borough Council. Initial calculations indicate that approximately 384m³ of additional surface water storage may be needed. This can be provided by incorporating an oversized swale at the detailed design stage. Drawing 35739/LEA/CVD/004 included in Appendix C shows an indicative location for where this attenuation could be sited. A breakdown of this calculation has been provided in Appendix D.

As a result of the increase in contributing area of 0.3ha to Morlais D outfall, it is recommended that additional attenuation is provided to deal with this increase near the outfall to ensure existing greenfield rates are not exacerbated. Subject to further discussion and agreement with Merthyr Tydfil County Borough Council. Initial calculations identify that approximately 115m³ of additional storage may be needed. This can be provided by incorporating an oversized swale at the detailed design stage. Drawing 35739/LEA/CVD/004 included in Appendix C shows an indicative location for where this attenuation could be sited. A breakdown of this calculation has been provided in Appendix D.

6. Summary and Recommendations

This report provides an overview of the existing surface water management arrangements and the proposed Surface Water Management Plan for the Ffos-y Fran Land Reclamation Scheme, located in Merthyr Tydfil. It provides the data and information needed to undertake the hydrological analyses for the off-site downstream receiving watercourses and on-site catchments. Where appropriate, detailed drainage modelling has been undertaken to identify critical conveyance flows and attenuation storage.

The catchments and extent of design undertaken as part of the analysis has been summarised below

Table 6.1 Summary of the design undertaken as part of this analysis

Catchment	Design undertaken
	<ul style="list-style-type: none"> Green field runoff calculations Detailed receiving channel capacity assessment Detailed attenuation calculations and conveyance design Detailed swale, grip and pond design and layouts
Morlais C & D	<ul style="list-style-type: none"> Green field runoff calculations High level attenuation calculations to accommodate additional area Indicative pond location reference
Cwm Blacs A / Intermediate	<ul style="list-style-type: none"> Not assessed as part of this analysis

The main findings of the assessment are as follows:

- The capacity of the existing Morlais A and B culverts under the A4060 far exceed the capacity of the receiving watercourses and, as such, extensive on-site water management is required to provide the requisite level of attenuation to mitigate any future flood risk impacts arising from the Ffos-y-fran land reclamation scheme.
- The required attenuation will be provided by a series of attenuation ponds. Further details of these ponds have been provided in Appendix B, C and D. Runoff from Morlais A will be attenuated by introducing a series of ponds with a total volume in the order of 78,000m³ in accordance with the FEH parameters while Morlais B catchment will be attenuated by introducing two ponds, each having a capacity of 10,000m³ in accordance with the FEH parameters. The extra volume needed to accommodate the redistributed area from Morlais B is 384m³ with respect to Morlais C and 115m³ respect to Morlais D. Again this storage estimate is in accordance with the FEH parameters.
- The calculations undertaken for this report are based on the topographic characteristics of the off-site watercourse at the time of the surveys in Q1, 2015. It was observed at the time that the channel that flows through Bradley Gardens, corresponding with the location of the minimum flow cross section, is in need of maintenance due to significant accretion of sediments deposited prior to the channel being cleared of extensive in-channel vegetation. This has resulted in raised bed levels. It should be noted that Miller Argent South Wales Limited has no control over the ongoing maintenance of these channels.

The following recommendations are made without prejudice:

- The ongoing maintenance responsibilities of the Bradley Gardens and Goat Mill watercourses should be established to ensure that the channel capacities are not reduced in the future. This in turn will

help to ensure the efficacy and integrity of the Ffos-y-fran Surface Water Management Plan is not compromised;

- Detailed on-site attenuation storage calculations for Morlais A, C and D catchments should be undertaken at the appropriate detailed design stage. This is expected to involve further discussions with Merthyr Tydfil County Borough Council as appropriate; and
- Detailed geotechnical design of the Morlais B pond construction will be required before construction of the pond in this area commences.



Appendix A

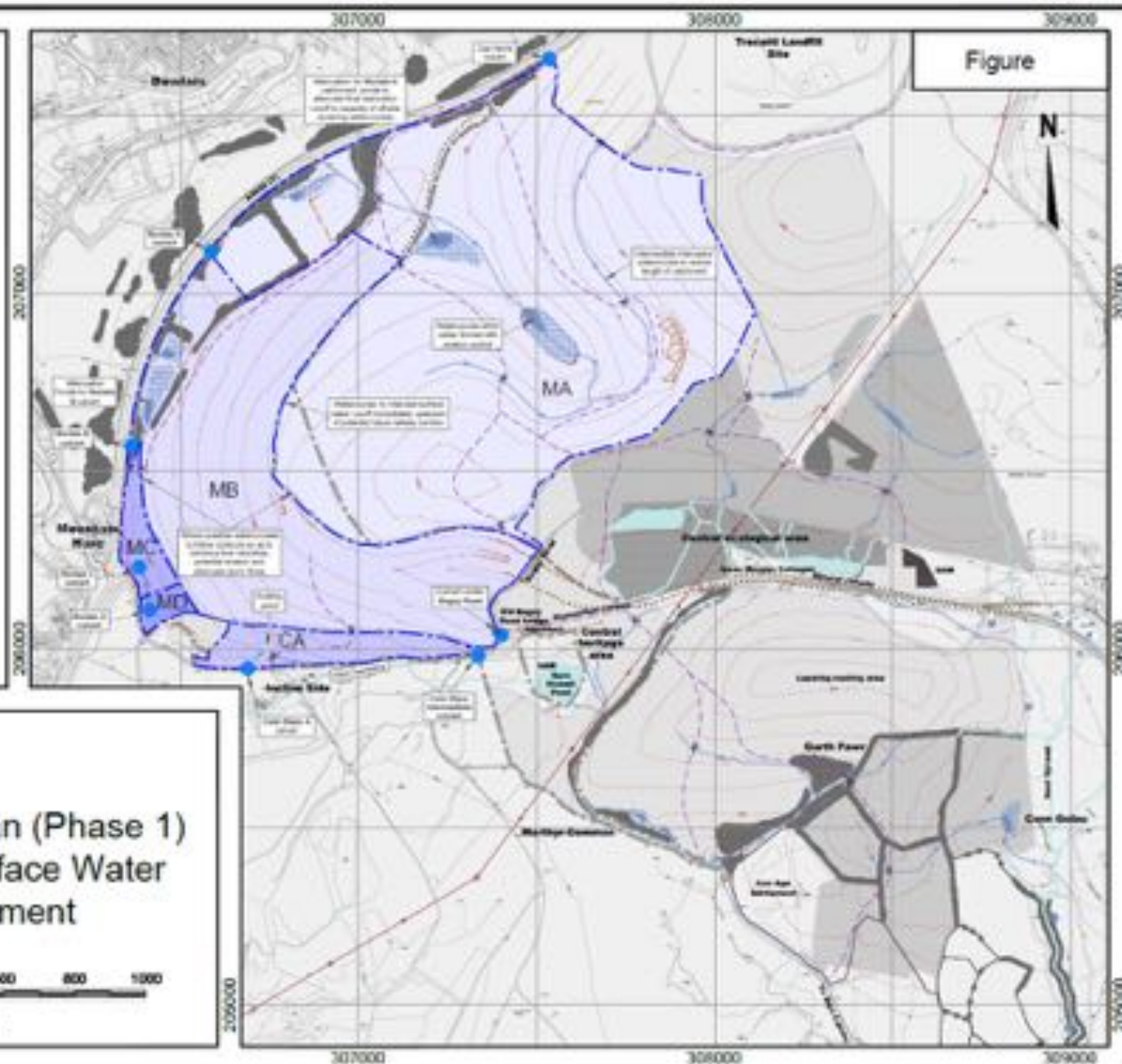
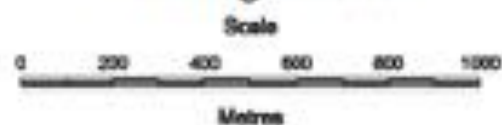
Figures & Plates



Legend:

- Ecoregion of Phase 1
- Restoration options (2-5 km intervals)
- Watercourses & Watersheds**
- Streams
- Roads
- Roads for Great Crested Newts
- Existing drains
- Catchment Areas**
- Towns
- Catchment area boundaries
- Waters A Catchment (100 ha)
- Waters B Catchment (100 ha)
- Waters C Catchment (1 ha)
- Waters D Catchment (1.2 ha)
- Core Waters A Catchment (1.2 ha)

Restoration Plan (Phase 1) Proposed Surface Water Management

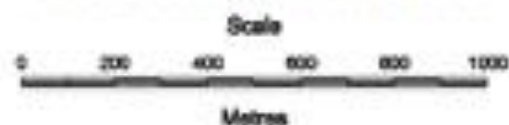


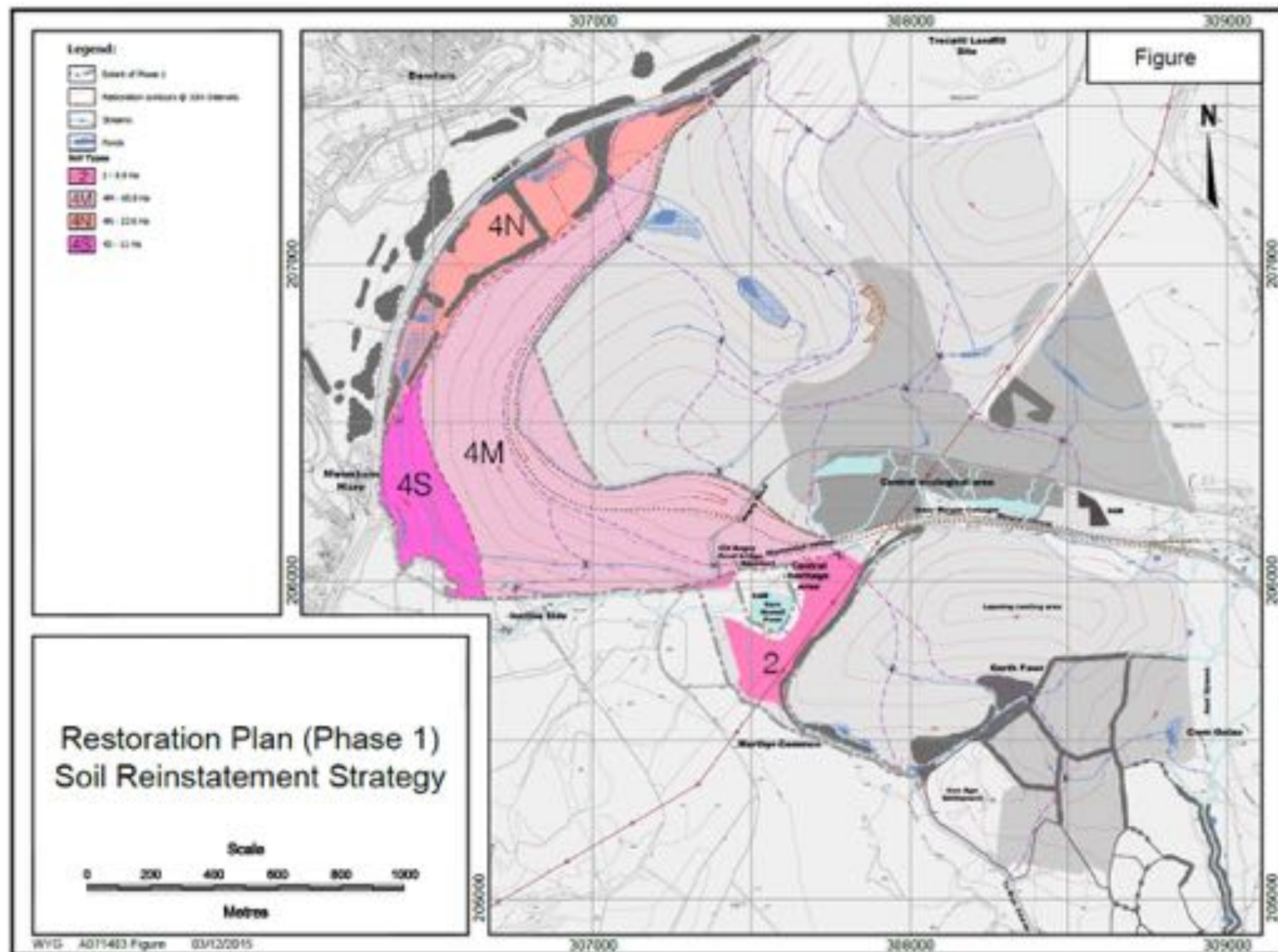
Figure

Legend

-  Boundary of Phase 1
-  Restoration schedule by date
- Restoration Schedule**
-  Before 2015/16
-  2015/16
-  Proposed 2016/17
-  Proposed 2017/18

Restoration Plan (Phase 1) Proposed Restoration Schedule







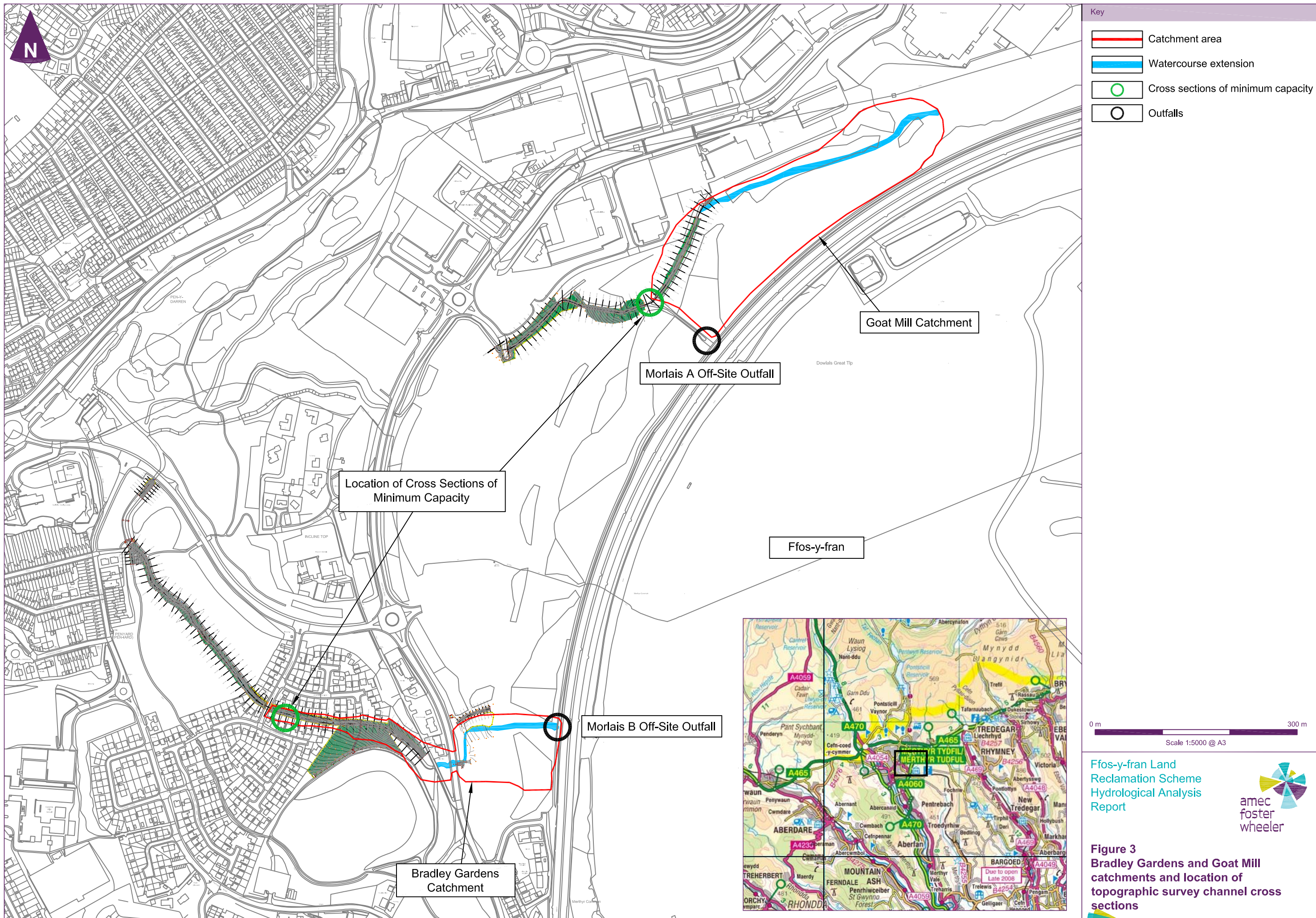




Plate 1. Ditch upstream of Nant Morlais A culvert



Plate 2. Ditch upstream of Nant Morlais B culvert



Plate 3. Nant Morlais A culvert



Plate 4. Nant Morlais B culvert



Plate 5. Culvert from under Bogey road draining the railway cutting



Plate 6. Wetland to south of railway cutting/Bogey Road culvert



Plate 7. Outfall from wetland back under the Bogey Road



Plate 8. Headwall immediately upstream of Cwm Blacs A site inflow structure



Plate 9. Cwm Blacs A culvert inflow structure



Plate 10. Looking upstream in the Bradley Gardens catchment watercourse at the smallest flow capacity cross section



Plate 11. Looking downstream immediately downstream of the road culvert in Bradley Gardens



Plate 12. Engineered channel immediately downstream of the Morlais A outfall



Plate 13. Engineered channel immediately downstream of the Morlais B outfall



Plate 14. Upper Goat Mill catchment channel



Plate 15. Goat Mill catchment channel taken from location of minimum flow capacity cross section looking up at the channel from the Morlais A outfall



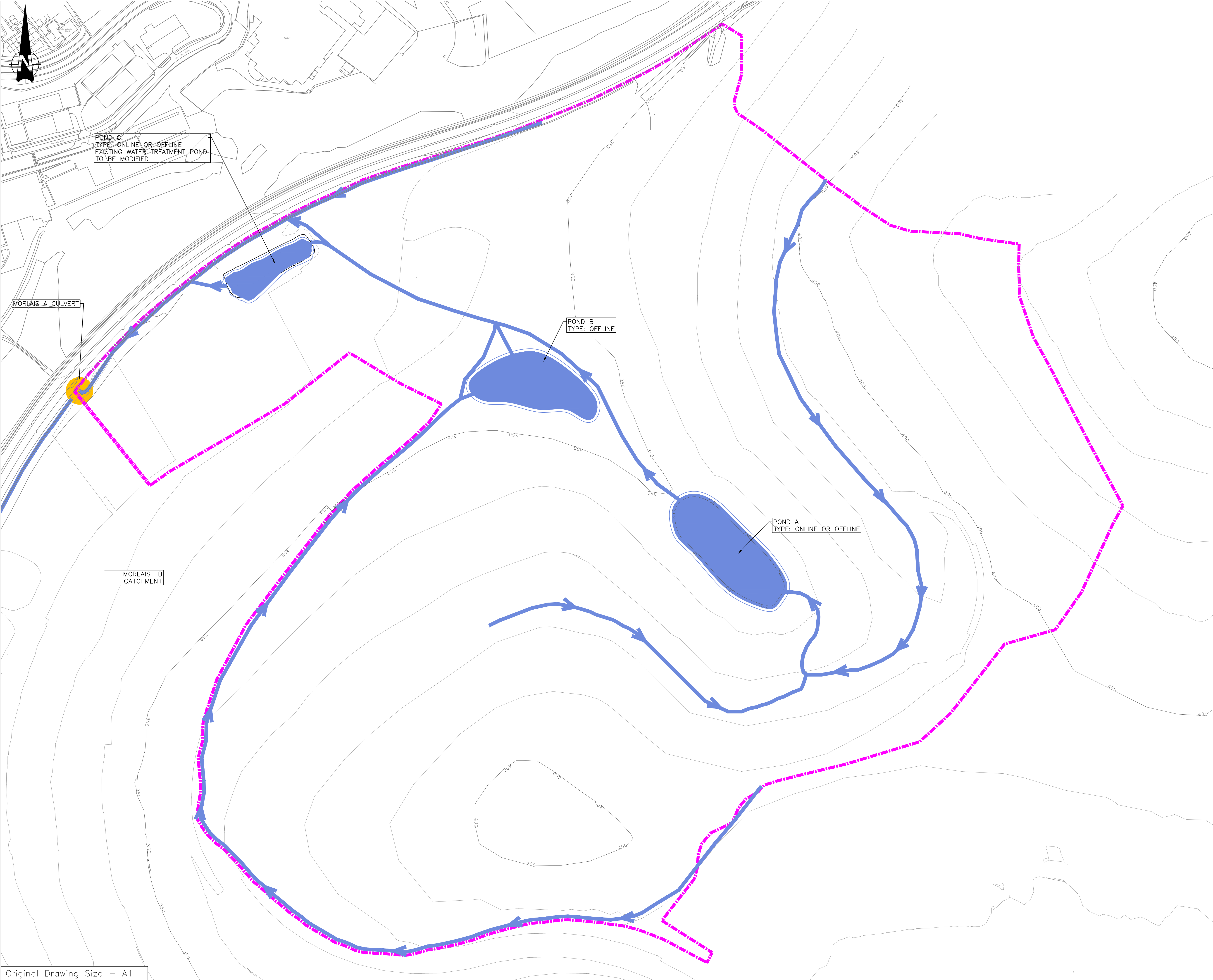
Plate 16. Goat Mill catchment channel taken upstream of confluence with channel from Morlais A outfall



Appendix B

Morlais A - MicroDrainage Inputs, Results and Drawings





DESCRIPTION

REV	DATE		DWN	CHK	APP
A	OCT 2015	FIRST ISSUE	VHG	NW	NW

REVISIONS

REV	DATE		DWN	CHK	APP
B	NOV 2015	SUBCATCHMENT AREA OUTSIDE BOUNDARY DELETED, POND 'D' DELETED	VHG	NW	NW
C	NOV 2015	VOLUME ADDED TO PONDS 'A' AND 'B' MINOR CHANGES TO ANNOTATIONS AND CONTOURS.	VHG	NW	NW
D	DEC 2015	NOTE 4 REVISED.	VHG	NW	NW

NOTES:

1. ALL DIMENSIONS ARE IN METRES UNLESS SHOWN OTHERWISE.

2. PONDS A AND B SHALL TYPICALLY BE NO DEEPER THAN 2.0m AND WITH 1:4 SIDE SLOPES.

3. ALL SWALES, PONDS AND GRIPS STILL SUBJECT TO A DETAILED DRAINAGE MODELING ANALYSIS.

4. PRELIMINARY MODELLING SUGGESTS AN ATTENUATION CAPACITY OF APPROXIMATELY ≈ 78,000m³ WILL BE REQUIRED TO ACCOMMODATE RUN OFF VOLUMES FROM THE 100 YEAR + 30% CLIMATE CHANGE EVENT.

5. LOCATIONS AND DIMENSIONS SHOWN ARE APPROXIMATE ONLY AND COULD BE SUBJECT TO CHANGE.

KEY

MORLAIS A CATCHMENT BOUNDARY

PROPOSED SWALES INCLUDING DIRECTION OF FLOW DIMENSIONS STILL TO BE DETERMINED

MORLAIS A CATCHMENT CULVERT OUTFALL LOCATION

PROPOSED ATTENUATION POND

PROPOSED FINISHED RESTORATION CONTOUR

STATUS: FOR APPROVAL

SCALES: 1:2500 © A1

PROJECT TITLE:

FFOS Y FRAN LAND RECLAMATION SCHEME

DRAWING TITLE:

PROPOSED SURFACE WATER DRAINAGE STRATEGY FOR MORLAIS A CATCHMENT

CLIENT:

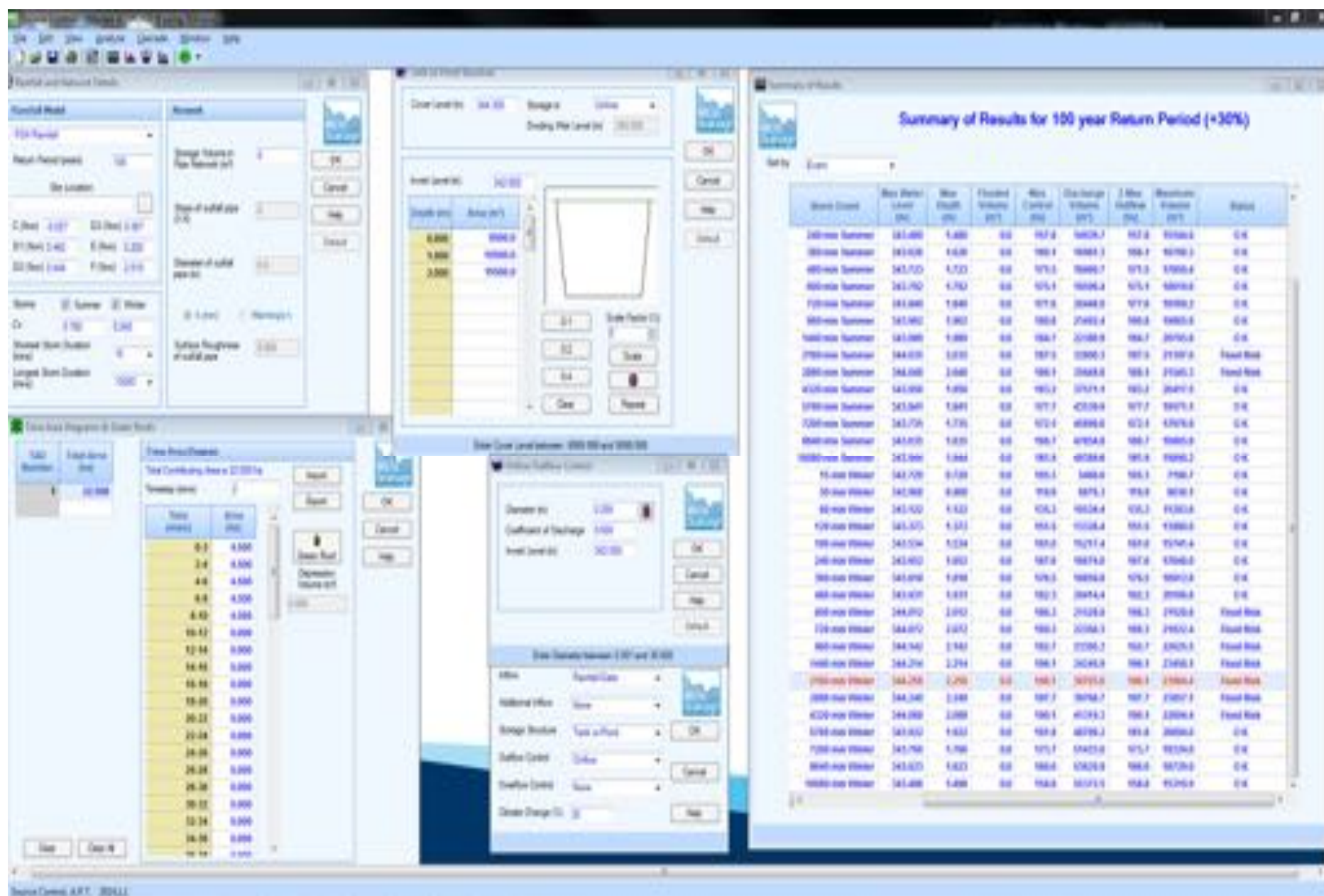
millerargent

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amec foster wheeler

DRAWING No.

35739/LEA/CVD/010

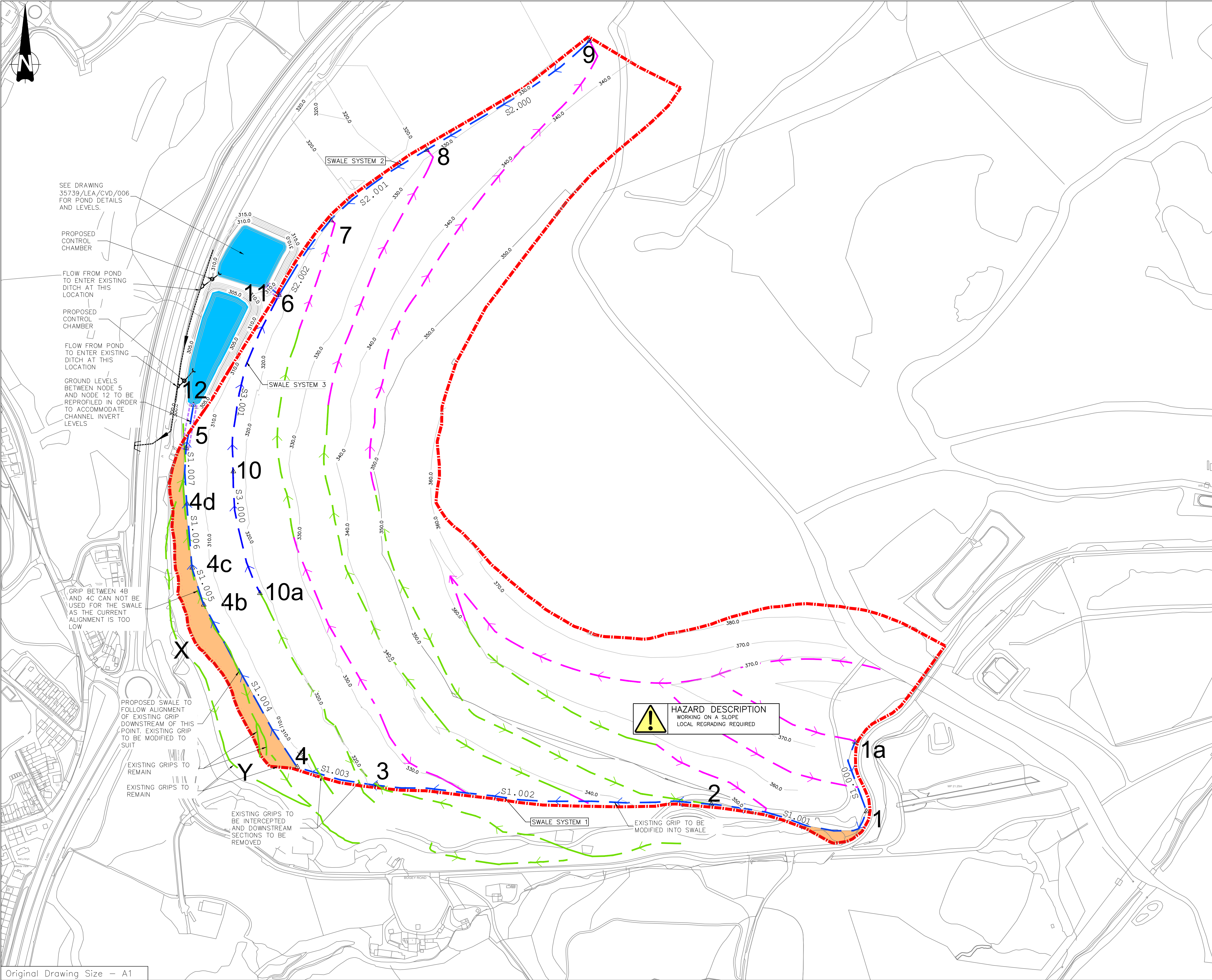




Appendix C

Morlais B - MicroDrainage Inputs, Results and Drawings





DESCRIPTION

REV	DATE		DWN	CHK	APP
A	SEPT 2015	FIRST ISSUE	OA	NW	NW

REVISIONS

REV	DATE		DWN	CHK	APP
B	OCT 15	DESIGN UPDATED FOLLOWING CLIENT DISCUSSIONS	VHG	NW	NW
C	OCT 15	OS MAP ADDED, DETS REMOVED, NOTES CHNGD	VHG	NW	NW
D	NOV 15	SWALEZ/GRIP ALIGNMENT CHNGD, NTES UPDATED	VHG	NW	NW
D	DEC 15	SWALEZ ALIGNMENT CHNGD, AREA EQUALISED	VHG	NW	NW

NOTES:

1.

ALL DIMENSIONS ARE IN METRES UNLESS SHOWN OTHERWISE.

2.

DRAWING TO BE READ IN CONJUNCTION WITH 35739/LEA/CVD/009 FOR SECTION DETAILS AND SWALE SIZING CHART.

3.

SWALE DESIGN BASED ON THE FOLLOWING;

- CONTRIBUTING AREA CONTAINED WITHIN THE REDLINE BOUNDARY
- ALL GRIPS WILL BE OPEN AND SEEDED TO GRASS. THESE HAVE BEEN DESIGNED TO ACCOMMODATE LOW FLOW EVENTS ONLY. ARISING FROM STONE PICKING OPERATIONS MAY BE PLACED TO THE BASE.
- INFILTRATION RATE ASSUMED TO BE ZERO.
- VELOCITY IN SWALES ASSUMED TO BE NO GREATER THAN 3.4m/s
- MANNING'S n ASSUMED TO BE IN THE ORDER OF 0.065.
- BASE WIDTH MINIMUM OF 1.0m.
- DEPTH ASSUMED TO BE A MINIMUM OF 1.0m or 1.2m TO ACCOMMODATE DESIGNED FLOWS BUT NOT MORE THAN 1.5m.
- TIME OF ENTRY SET AT 8 MINS
- 60% PIMP ASSUMED WHICH GIVES RUNOFF COEFFICIENT = 0.50

5.

MICRODRAINAGE MODELLING HAS BEEN CARRIED OUT ON THE SWALES AND THE POND. FOR FURTHER DETAILS, ESPECIALLY TARGET INVERT LEVELS AT EACH NODE. REFERENCE SHOULD BE MADE TO DRAINAGE MODEL '35739-010-MORLAIS B'

6.

THE SWALES HAVE BEEN DESIGNED TO ACCOMMODATE THE 1 IN 100 YEAR EVENT PLUS 30% CLIMATE CHANGE.

7.

IF BIGGER BLOCKSTONE UP TO 1m IN LENGTH ARE AVAILABLE FOR THE CONSTRUCTION OF THE SWALE, CONTRACTOR TO BE ALLOWED TO USE THESE SUBJECT TO ENGINEER'S APPROVAL.

8.

GRIPS TO BE CONSTRUCTED AT A SLOPE OF APPROX 1 IN 100

KEY

MORLAIS B CATCHMENT BOUNDARY

PROPOSED GRIPS INCLUDING DIRECTION OF FLOW

EXISTING GRIPS INCLUDING DIRECTION OF FLOW

PROPOSED SWALES INCLUDING DIRECTION OF FLOW

LOCATION OF EXISTING DITCH ADJACENT TO THE HIGHWAY INCLUDING DIRECTION OF FLOW

PROPOSED ATTENUATION POND

MORLAIS B EXISTING OUTFALL LOCATION

SWALE SECTION NODE, SEE SWALE SIZING CHART IN DRAWING 35739/LEA/CVD/009.

MICRODRAINAGE MODEL DITCH/SWALE NUMBERS

PROPOSED DRAINAGE SYSTEM FROM PONDS

STEPS FROM SWALE TO POND WITH SILT TRAP ARRANGEMENT TO SUIT FINAL POND LEVEL (SEE DETAIL X AND Z FOR FURTHER INFORMATION ON DRG 35739/LEA/CVD/009)

PROPOSED FINISHED RESTORATION CONTOUR

UNATTENUATED AREA (1.3HA) OF MORLAIS B CATCHMENT TO BE TRANSFERRED INTO MORLAIS C (1.0HA) AND MOLAIS D CATCHMENT (0.3HA) FOR ATTENUATION

LOCATION IN MORLAIS C/D CATCHMENT WHERE ADDITIONAL ATTENUATION MAY BE NEEDED TO ACCOMMODATE THE MORLAIS B UNATTENUATED AREA

STATUS: FOR APPROVAL

SCALES: 1:2500 @ A1

PROJECT TITLE:

FFOS Y FRAN LAND RECLAMATION SCHEME

DRAWING TITLE:

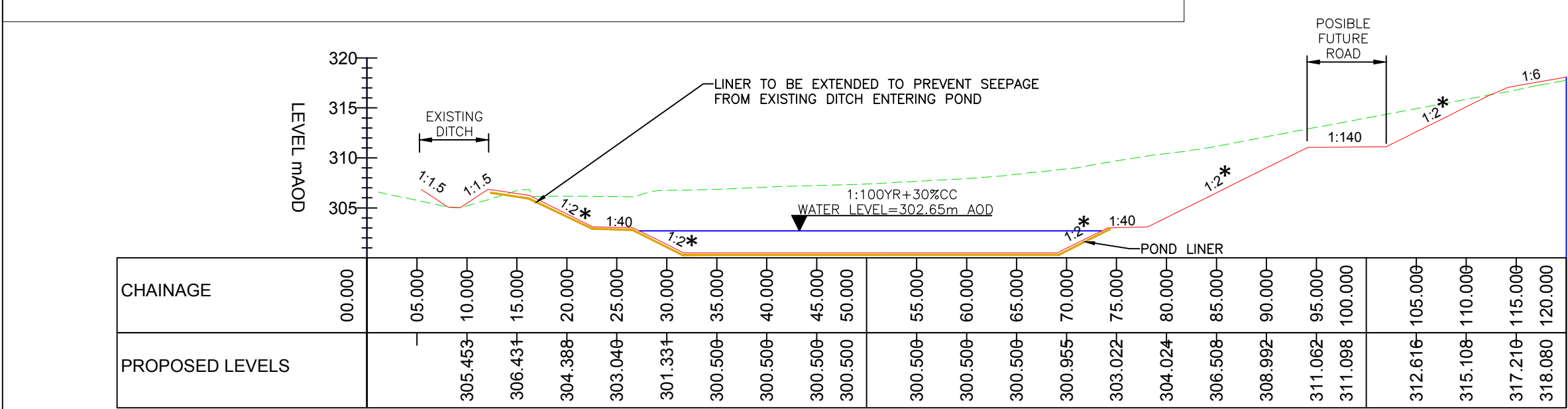
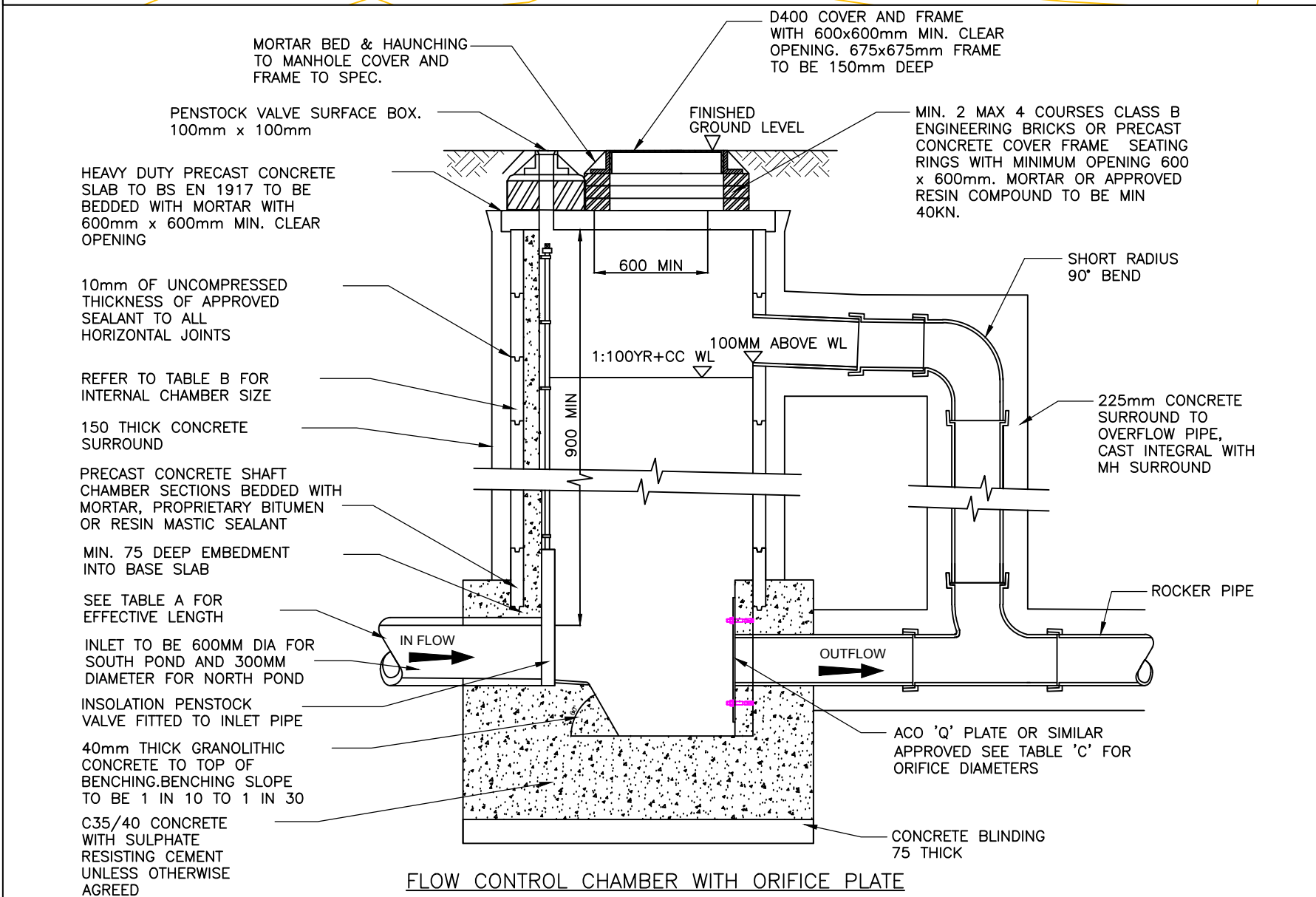
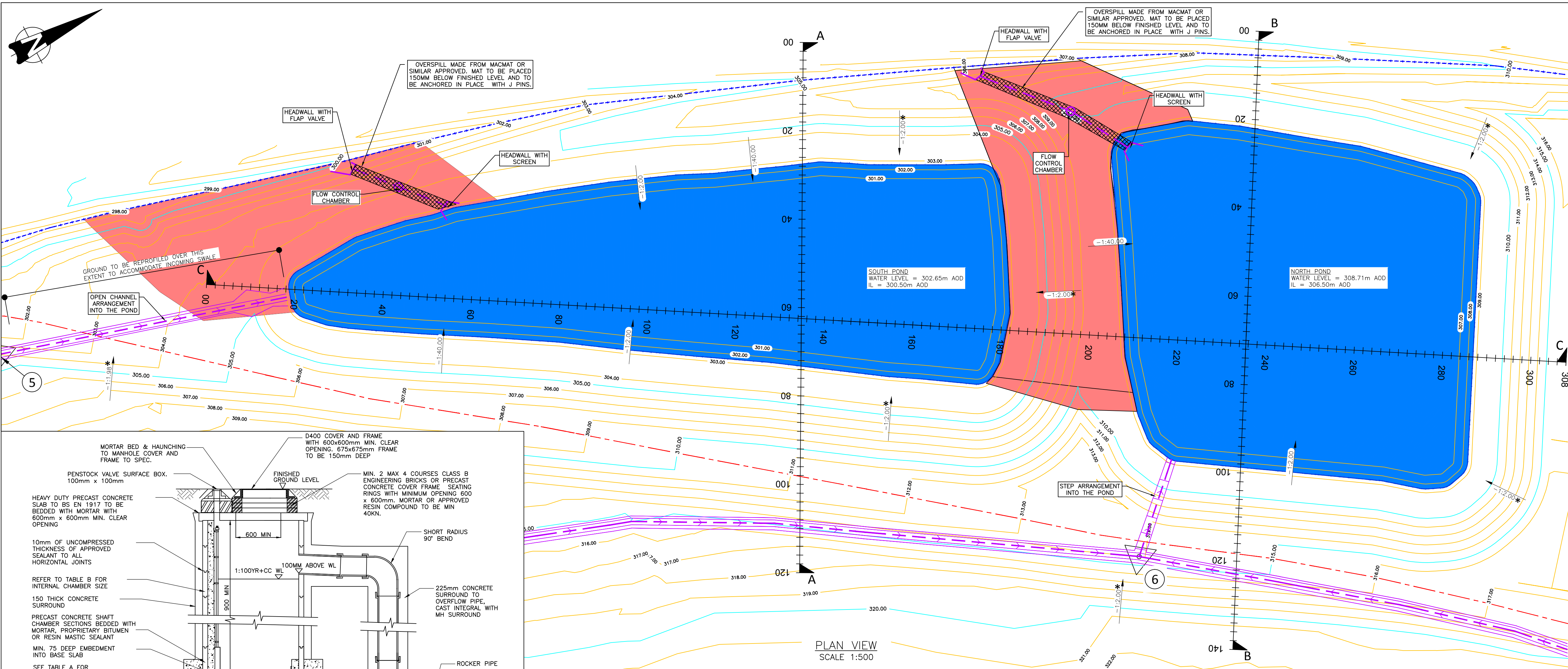
PROPOSED SURFACE WATER DRAINAGE STRATEGY FOR MORLAIS B CATCHMENT DITCH/SWALE ARRANGEMENT

CLIENT:

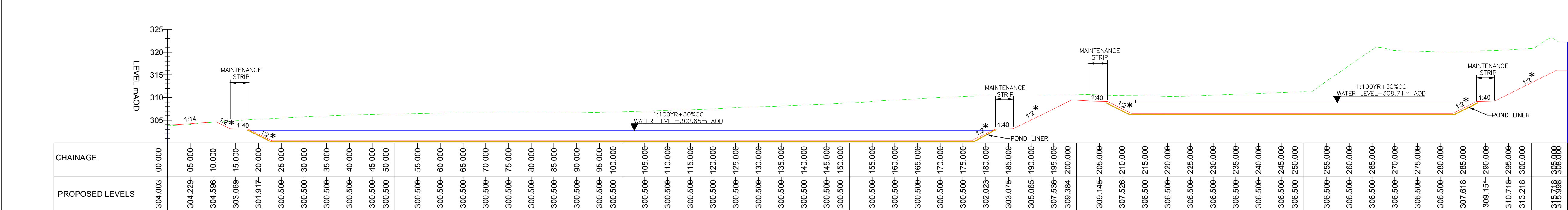
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DRAWING No.

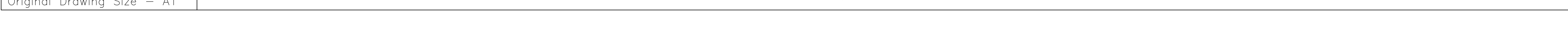
35739/LEA/CVD/004



SECTION A-A
SCALE: H 1:500, V 1:500, DATUM: 300.000.000



SECTION B-B
SCALE: H 1:500, V 1:500, DATUM: 305.000.000



SECTION C-C
SCALE: H 1:500, V 1:500, DATUM: 300.000.000

DESCRIPTION

REV A OCT 2015 FIRST ISSUE

DWN VHG

CHK NW

APP NW

REVISIONS

REV B NOV 2015 NEW POND LEVELS, AREA TO BE ASSESSED FURTHER AND FLOW CONTROL CHAMBER DETAIL SHOWN

DWN VHG

CHK NW

APP NW

REV C DEC 2015 WATER LEVELS AND ORIFICE DIAMETRES AMENDED

DWN VHG

CHK NW

APP NW

NOTES:

1. DRAWING TO BE READ IN CONJUNCTION WITH 35739-LEA-CVD-004 AND 009.

2. ALL PONDS TO BE INSTALLED WITH BUTYL LINER

3. ALL POND DESIGN STILL SUBJECT TO ADDITIONAL GEOTECHNICAL ASSESSMENT

4. WHERE SIDE SLOPES ARE STEEPER THAN 1:2.5 SLOPE PROTECTION WILL BE REQUIRED. POSSIBLE SOLUTIONS COULD INCLUDE GABION WALLS AND/OR SOIL NAILING. FURTHER G1 TESTING AND ANALYSIS REQUIRED BEFORE FINAL SOLUTION CAN BE CONFIRMED.

KEY

CATCHMENT BOUNDARY OF MORLAIS B RESTORATION

EXISTING DITCH

PROPOSED CONTOUR LINES WITH LEVELS

PROPOSED OVERSPILL

POND DESIGN TO BE SUBJECTED TO IN DEPTH GEOTECHNICAL ASSESSMENT TO AVOID EMBANKMENT FAILURE

PROPOSED 1:100 YEAR + 30% CC POND WATER LEVEL

PROPOSED MANHOLE

PROPOSED HEADWALL

PROPOSED SWALE SHOWN INDICATIVELY REFER TO DRAWING 35739/LEA/CVD/004 AND 009 FOR FURTHER DETAILS

SWALE NODE SYMBOL WITH NUMBER

SECTION KEY

EXISTING LEVELS

FINISHED LEVELS

PROPOSED 1:100 YEAR + 30% CC POND WATER LEVEL

INDICATIVE SLOPE. DUE TO THE NATURE OF THE MATERIAL USED TO CREATE THESE SLOPES IT IS ANTICIPATED THAT ADDITIONAL SLOPE STABILITY MEASURES THROUGH FURTHER GROUND INVESTIGATION WILL NEED TO BE INTRODUCED PRIOR TO CONSTRUCTION

TABLES

TABLE A - ROCKER PIPE EFFECTIVE LENGTHS

NOMINAL PIPE DIAMETER	ROCKER PIPE EFFECTIVE LENGTH
150	600
601 - 750	1000mm
> 750	1250mm

TABLE B - MANHOLE DIAMETERS

DIAMETER OF LARGEST PIPE	INTERNAL DIAMETER OF MANHOLE
LESS THAN 375	1200
375 - 450	1350
450 - 500	1500
500 - 700	1600
700 - 900	1800
GREATER THAN 900	PIPE DIAMETER + 900

TABLE C - ORIFICE DIAMETERS

POND REFERENCE	ORIFICE DIAMETER (mm)
NORTHERN POND	430
SOUTHERN POND	320

NOT FOR CONSTRUCTION

STATUS: FOR APPROVAL

SCALES: AS SHOWN

PROJECT TITLE:

FFOS Y FRAN LAND RECLAMATION SCHEME

DRAWING TITLE:

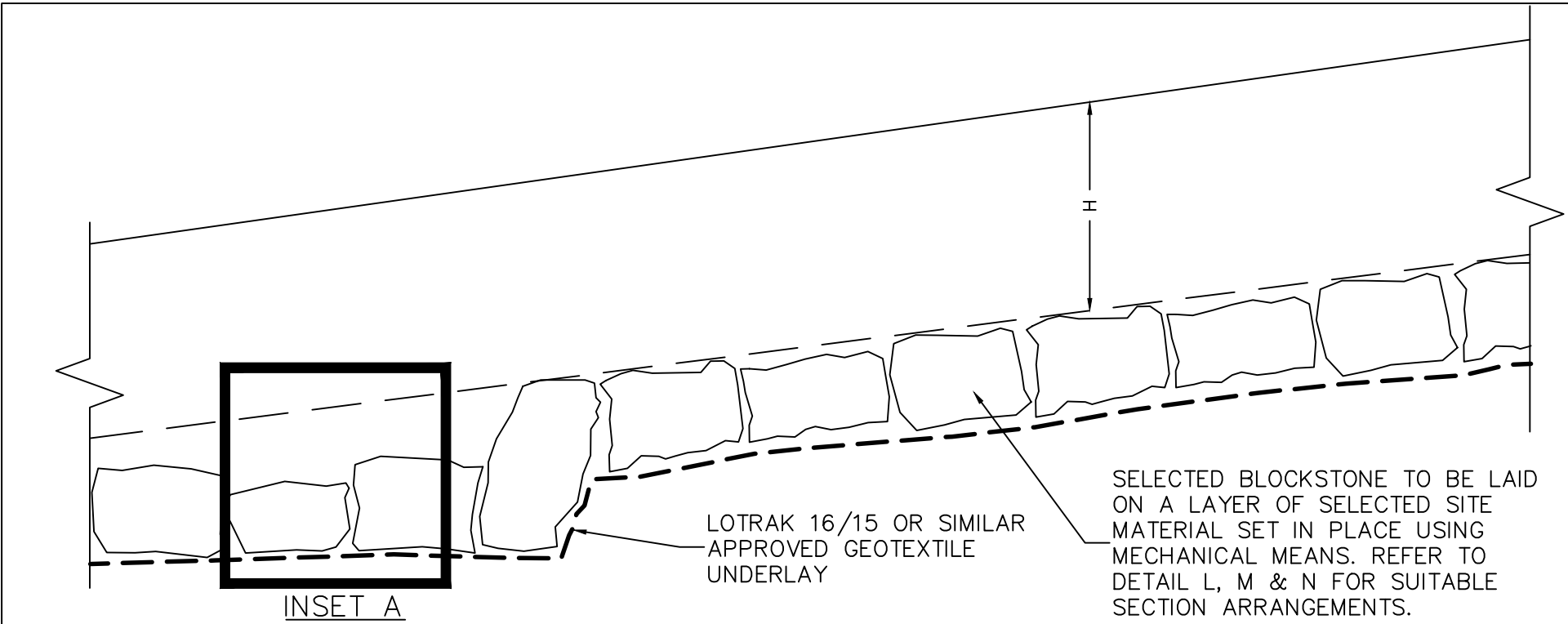
PROPOSED SURFACE WATER DRAINAGE STRATEGY FOR MORLAIS B CATCHMENT POND ARRANGEMENT

CLIENT:

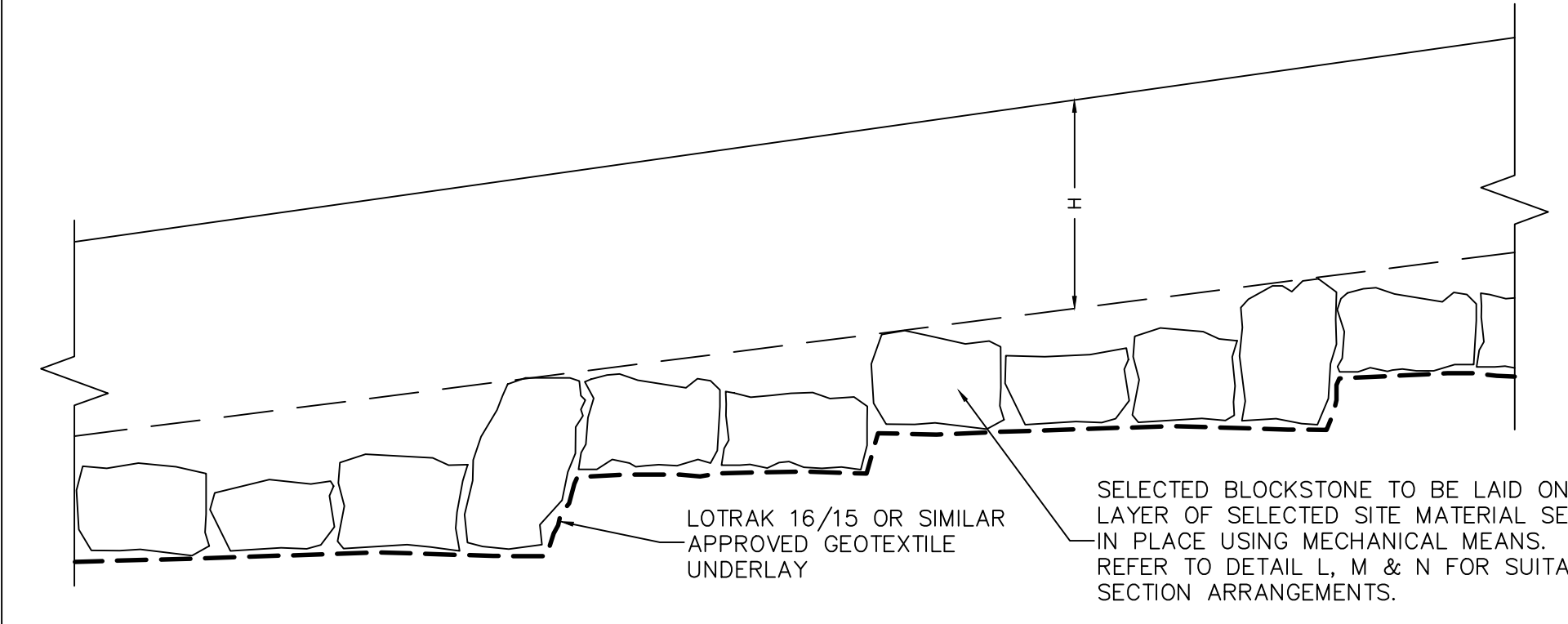
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DRAWING No.

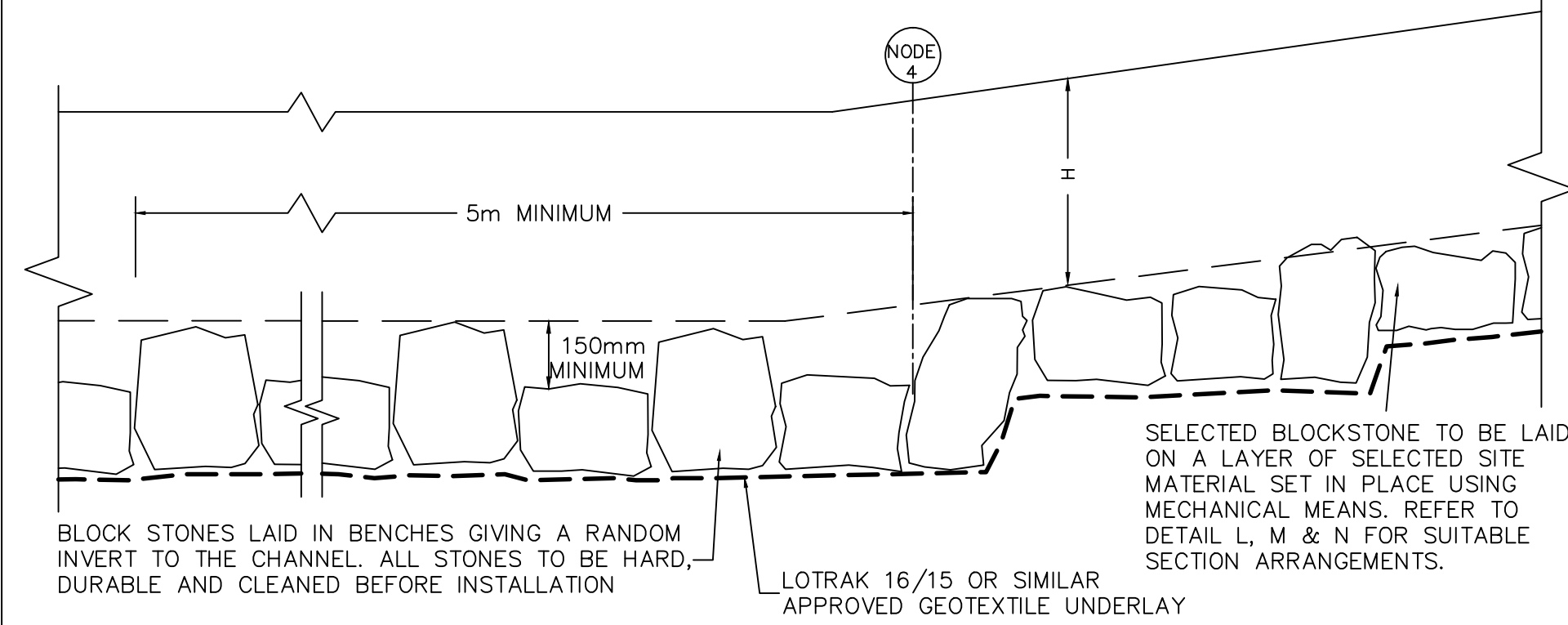
35739/LEA/CVD/006



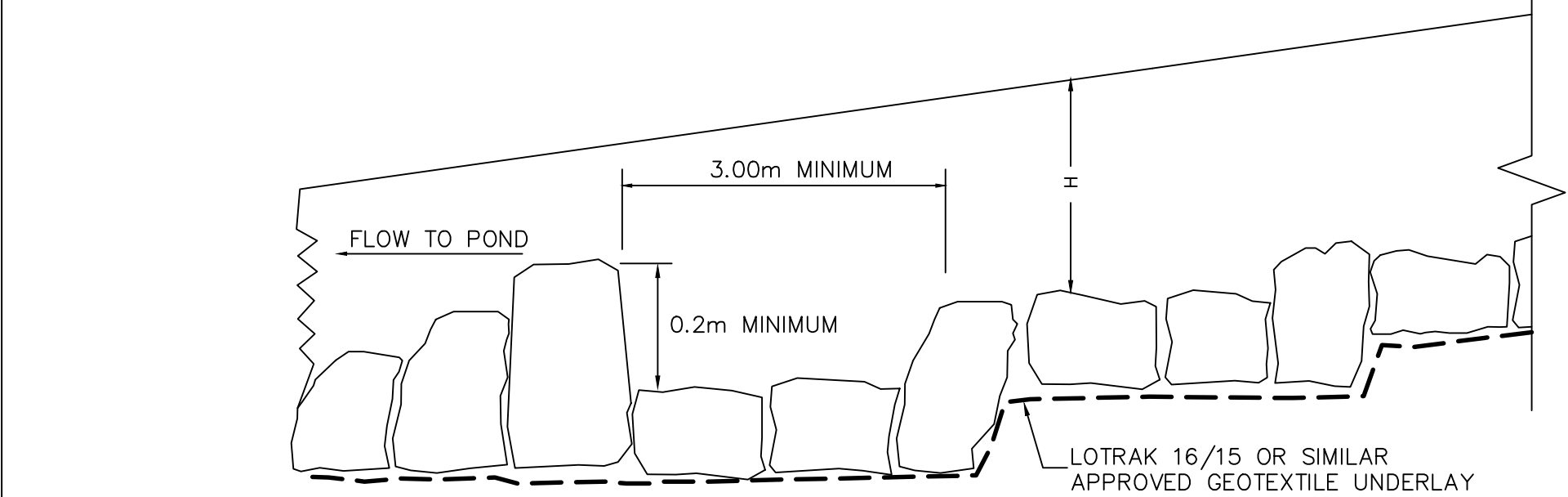
DETAIL W: TYPICAL SLOPE ARRANGEMENT
(NOT TO SCALE)



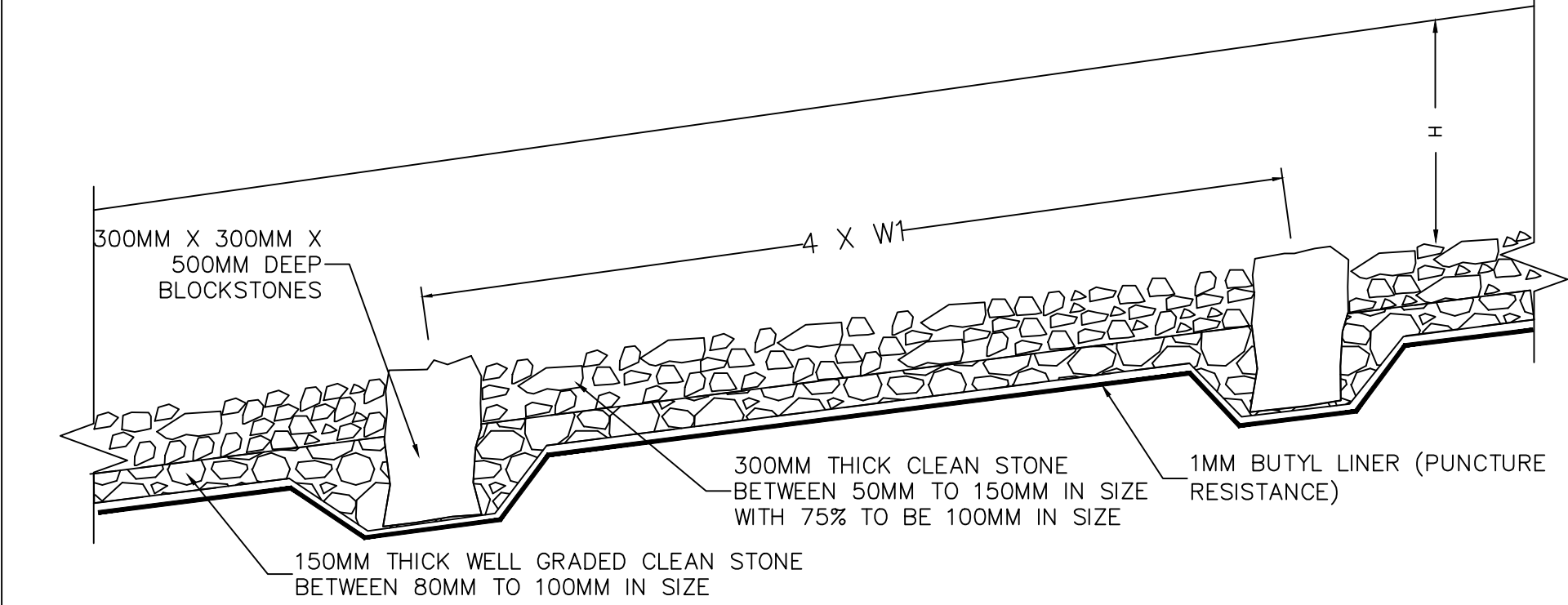
DETAIL X: TYPICAL STEP ARRANGEMENT
(NOT TO SCALE)



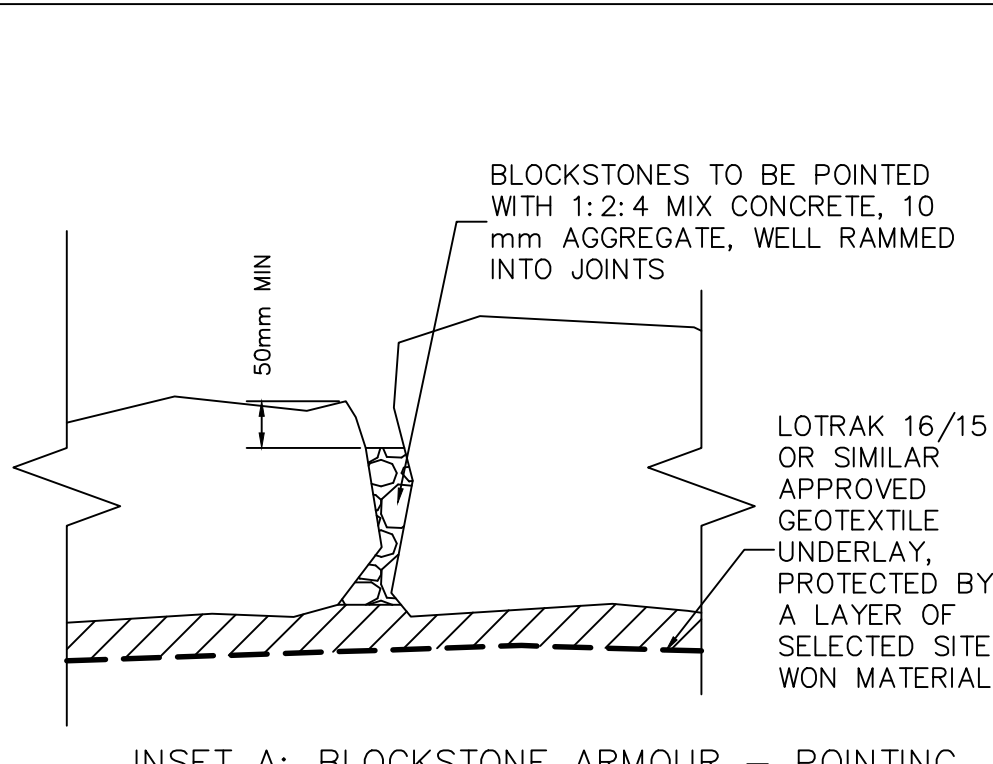
DETAIL Y: TYPICAL ENERGY DISSIPATION FEATURE
(NOT TO SCALE)



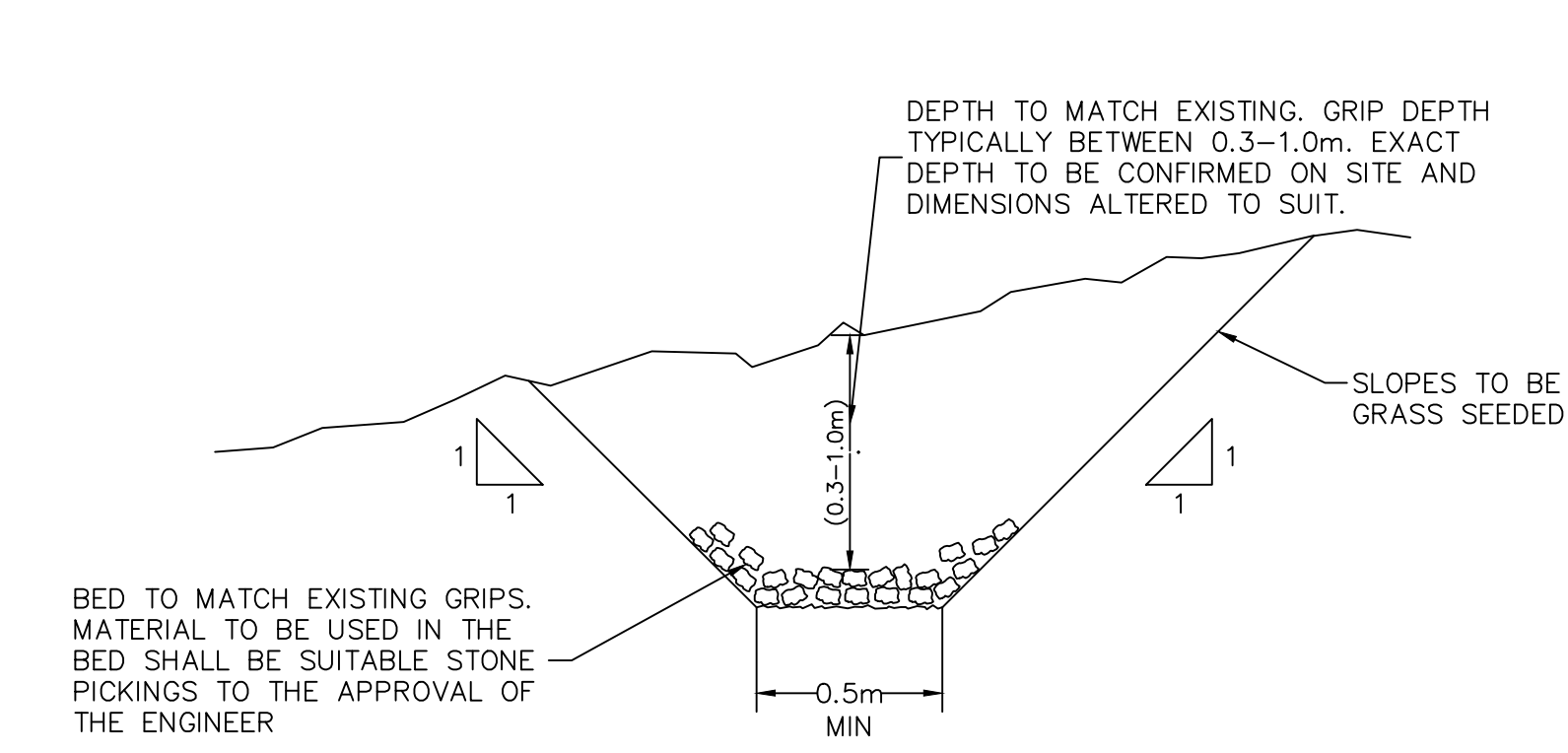
DETAIL Z: SILT TRAP DETAIL JUST BEFORE THE INLET TO THE POND
(NOT TO SCALE)



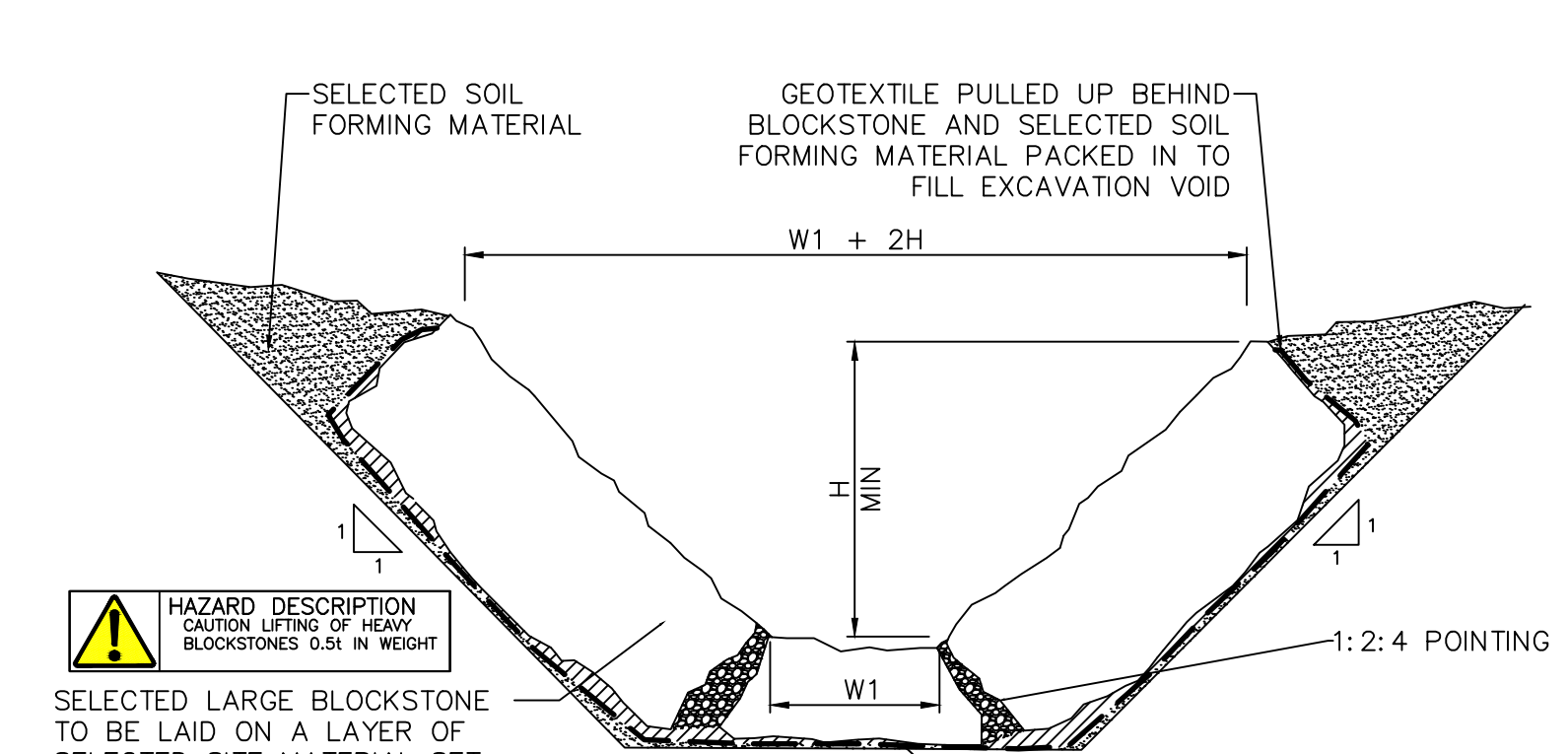
DETAIL H: TYPICAL LONG SECTION TO BE USED WITH DETAIL G
(NOT TO SCALE)



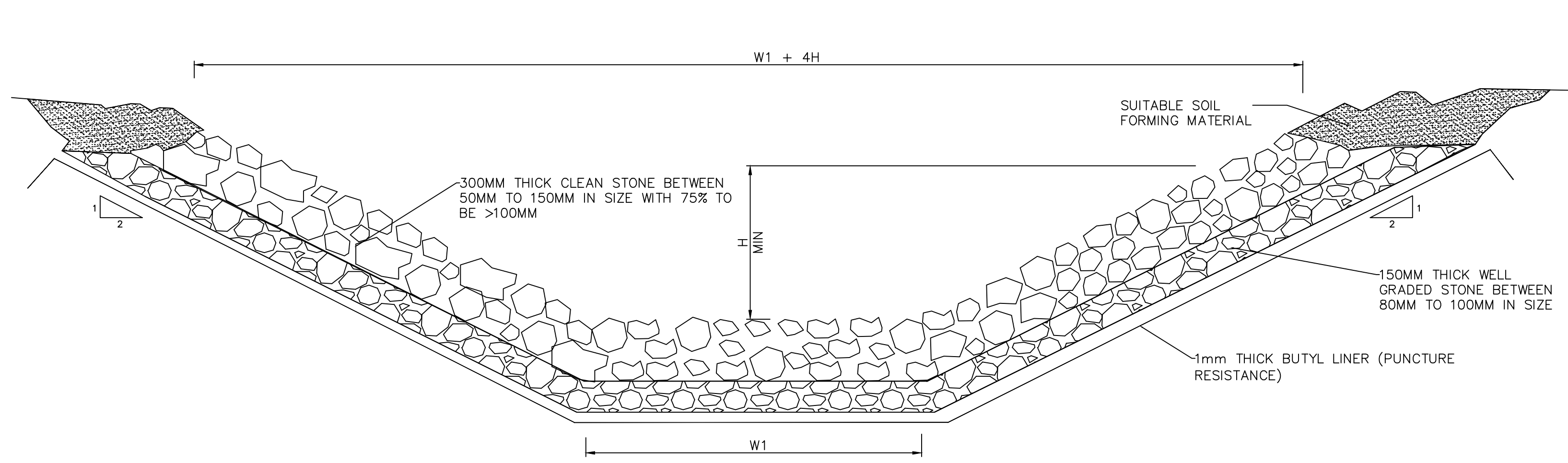
INSET A: BLOCKSTONE ARMOUR – POINTING AND BEDDING DETAIL
(NOT TO SCALE)



DRAINAGE GRIP DETAIL
(NOT TO SCALE)



DETAIL M: DRAINAGE SWALE DETAIL
(NOT TO SCALE)

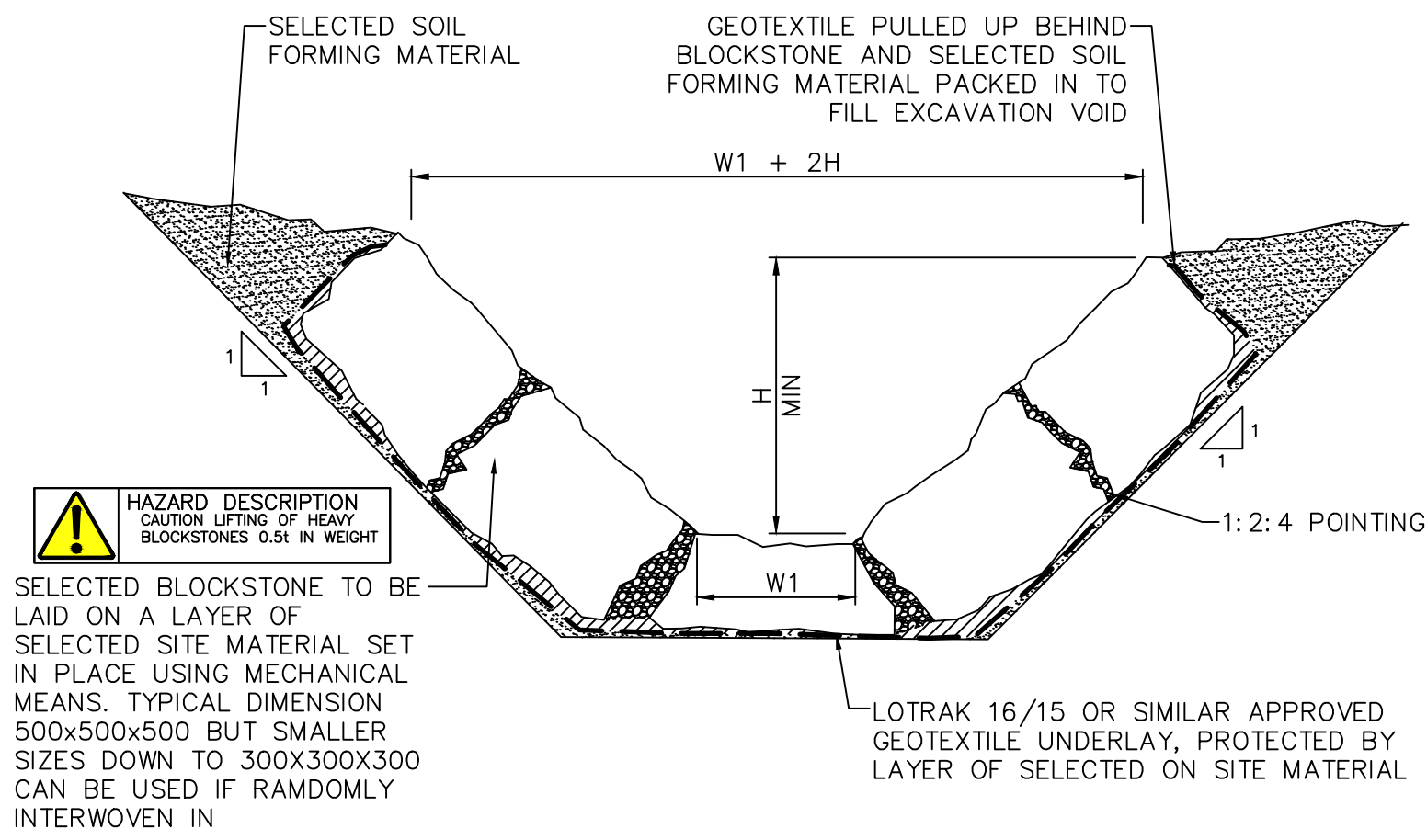


DETAIL G: ALTERNATIVE DRAINAGE SWALE DETAIL TO BE USED WITH DETAIL H
(NOT TO SCALE)

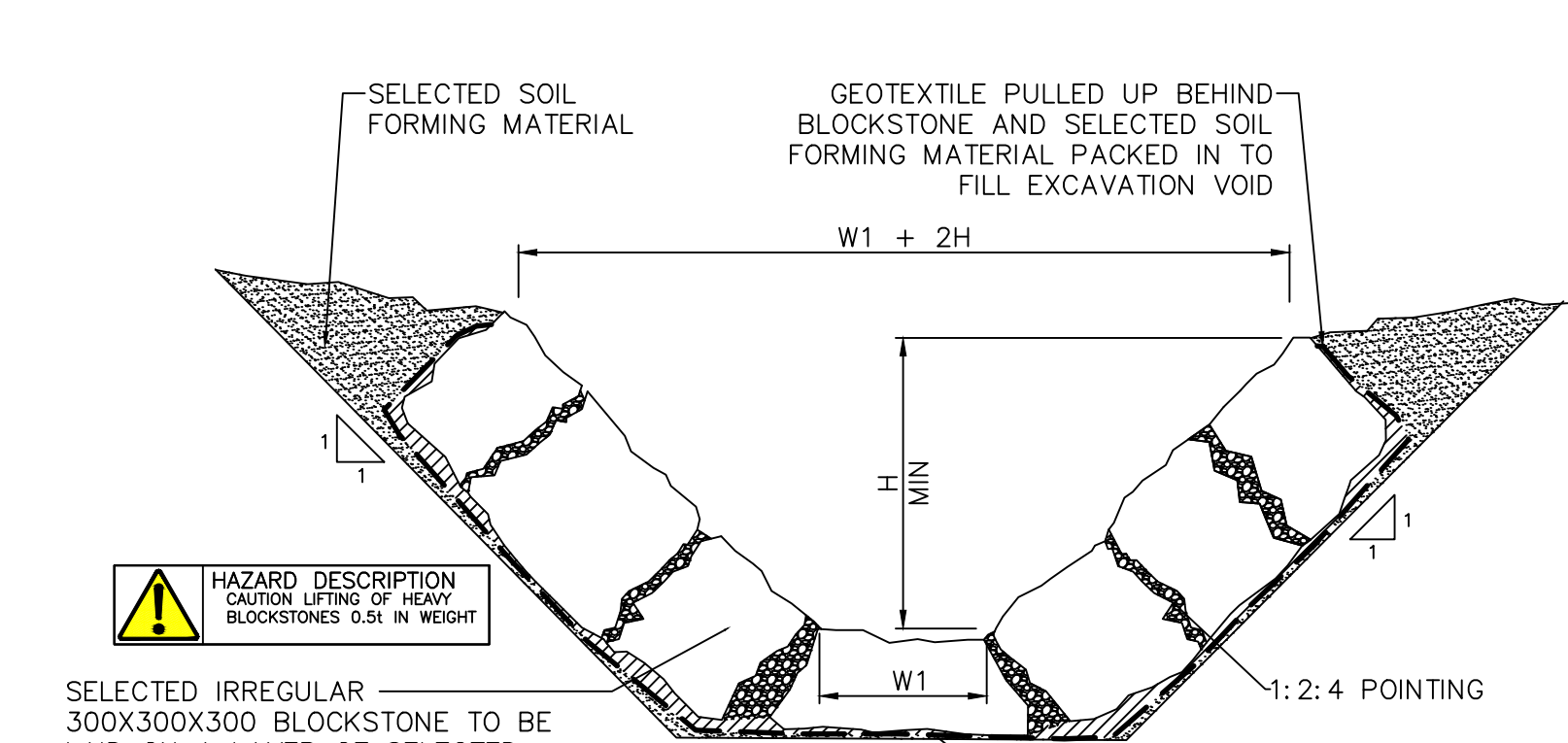
100-YEAR + CC RETURN PERIOD						LONG SECTION DETAIL TO USE	CROSS SECTION DETAIL TO USE
NODE	DESIGN SLOPE	W1(m)	H(m)	Vel(m/s)	SLOPE RANGE ⁽¹⁾		
1a-1	1:12	1.00	1.00	2.8	1:10-1:15	X	SELECTION OF L & M OR L ONLY OR M ONLY
1-2	1:22	1.00	1.00	2.1	1:20-1:50	W OR X	SELECTION OF L & M OR M ONLY
2-3	1:20	1.00	1.00	2.3	1:20-1:50	W OR X	SELECTION OF L & M OR M ONLY
3-4	1:9	1.00	1.00	3.4	1:7-1:10	X WITH Y	SELECTION OF L & M OR L ONLY OR M ONLY
4-4b	1:152	3.00	1.20	1.0	1:100-1:155	W, X OR H*	SELECTION OF L, M & N OR L ONLY OR M ONLY OR G* ONLY
4b-4c	1:126	3.00	1.20	1.1	1:100-1:155	W, X OR H*	SELECTION OF L, M & N OR L ONLY OR M ONLY OR G* ONLY
4c-4d	1:145	3.00	1.20	1.1	1:100-1:155	W, X OR H*	SELECTION OF L, M & N OR L ONLY OR M ONLY OR G* ONLY
4d-5	1:75	3.00	1.20	1.5	1:70-1:80	W OR X	SELECTION OF L, M & N OR L ONLY OR M ONLY
9-8	1:29	1.00	1.00	1.9	1:20-1:50	W OR X	SELECTION OF L & M OR M ONLY
8-7	1:35	1.00	1.00	1.7	1:30-1:50	W OR X	SELECTION OF L & M OR M ONLY
7-6	1:22	1.00	1.00	2.1	1:20-1:50	W OR X	SELECTION OF L & M OR M ONLY
10a-10	1:100	3.00	1.00	1.2	1:20-1:100	W OR X	SELECTION OF L, M & N OR L ONLY OR M ONLY
10-6	1:99	3.00	1.00	1.2	1:20-1:100	W OR X	SELECTION OF L, M & N OR L ONLY OR M ONLY

(1) (2) SEE NOTE 2
(3) (4) SEE NOTE 3

SWALE SIZING CHART



DETAIL L: DRAINAGE SWALE DETAIL
(NOT TO SCALE)



DETAIL N: DRAINAGE SWALE DETAIL
(NOT TO SCALE)

DESCRIPTION

REV A
OCT 2015
FIRST ISSUE

DWN VH
CHK NW
APP NW

REVISIONS

REV B
NOV 2015
SWALE SIZING CHART UPDATED

DWN VH
CHK RB
APP NW

REV C
DEC 2015
SWALE SIZING CHART UPDATED

DWN VH
CHK NW
APP NW

NOTES:

- DRAWING TO BE READ IN CONJUNCTION WITH 35739-LEA-CVD-004.
- DIMENSIONS SHOWN ARE ONLY APPLICABLE IF THE SLOPES MEASURED ON SITE ARE ACTUALLY WITHIN THE RANGE SHOWN IN THE TABLE. IF NOT THEN THE CONTRACTOR MUST LIAISE WITH THE DESIGNER FOR FURTHER ADVICE.
- LONG SECTION H MUST ONLY BE USED WITH CROSS SECTION G
- ALL SITE WON MATERIAL IDENTIFIED FOR USE AS BEDDING UNDER THE BLOCKSTONE TO BE APPROVED BY THE DESIGNER BEFORE LAYING.
- SECTION SELECTION BASED ON ENSURING BLOCKS COINCIDE WITH DEPOSITION BANDING FROM HJULSTROM-SUNDBORG DIAGRAM (SEE BELOW)

STATUS: FOR APPROVAL

SCALES: NOT TO SCALE

PROJECT TITLE:
FFOS Y FRAN LAND RECLAMATION SCHEME

DRAWING TITLE:
PROPOSED SURFACE WATER DRAINAGE STRATEGY FOR MORLAIS B CATCHMENT STANDARD DETAILS

CLIENT:

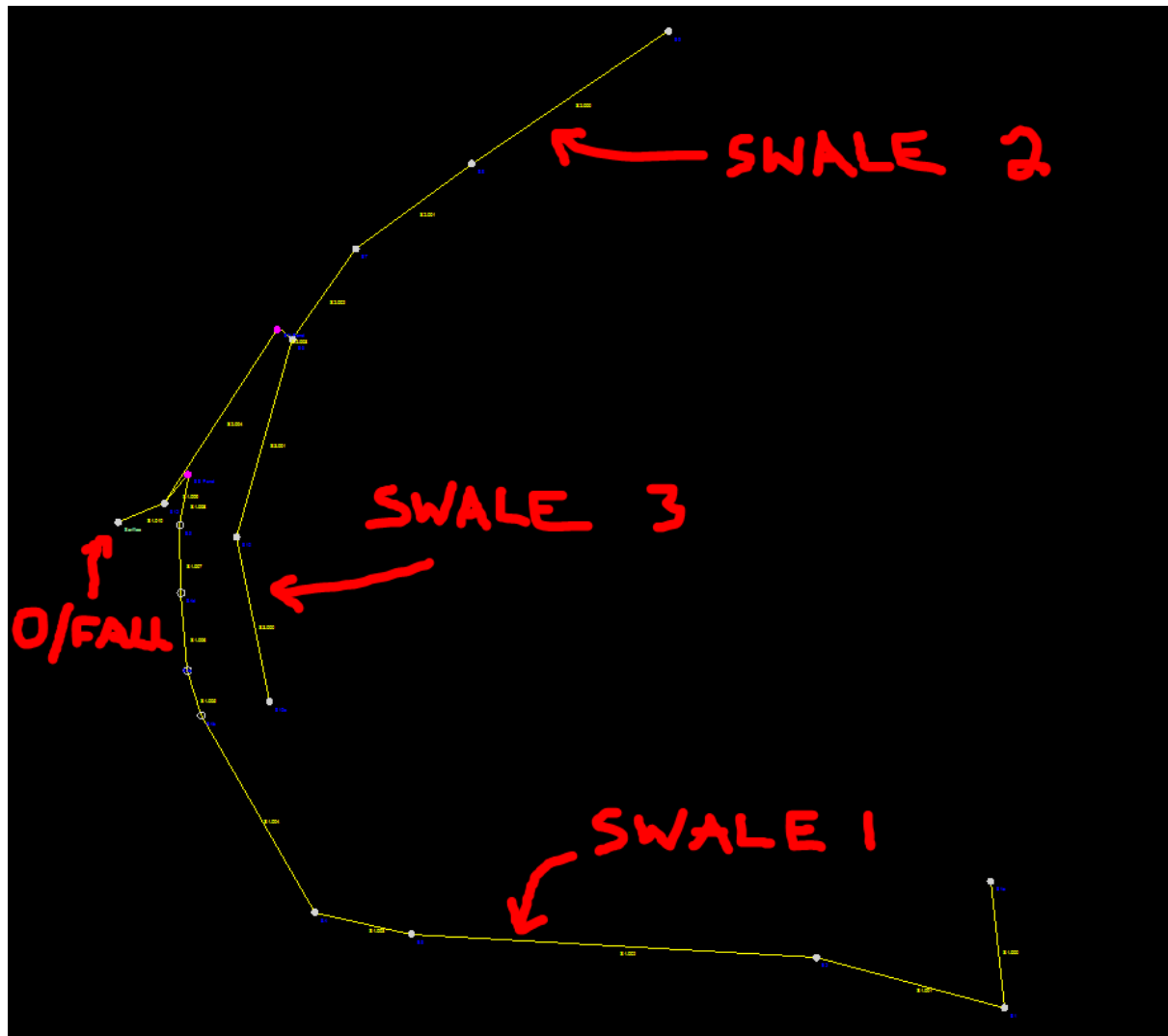
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DRAWING No.
35739/LEA/CVD/009

Ffos y Fran

Morlais B - Supporting Information for the model – Rev B

Plan of Model



Pond South used in the modelling

Pond (Tank/Storage Structure)

Structure Number	D/S Pipe Number	USMri Name	Structure Type
1	1.009	S Pond	Tank or Pond
2	2.004	N Pond	Tank or Pond

Import Clear Clear All

Network Details

Cover Level (m) 305.000

Pipe No. Invert

Lowest Incoming Pipe 1.008 302.500 (m)

Outgoing Pipe 1.009 302.500 (m)

Tank or Pond Details

Invert Level (m) 300.500

Depth (m)	Area (m²)
0.000	3920.0
1.000	4634.0
2.000	5376.0

Scale Factor (%) 0

Scale Repeat

Select downstream Pipe Number

Pond North used in the modelling

Pond (Tank/Storage Structure)

Structure Number	D/S Pipe Number	USMri Name	Structure Type
1	1.009	S Pond	Tank or Pond
2	2.004	N Pond	Tank or Pond

Import Clear Clear All

Network Details

Cover Level (m) 310.000

Pipe No. Invert

Lowest Incoming Pipe 2.003 305.000 (m)

Outgoing Pipe 2.004 305.000 (m)

Tank or Pond Details

Invert Level (m) 305.500

Depth (m)	Area (m²)
0.000	4000.0
1.000	4500.0
2.000	5000.0

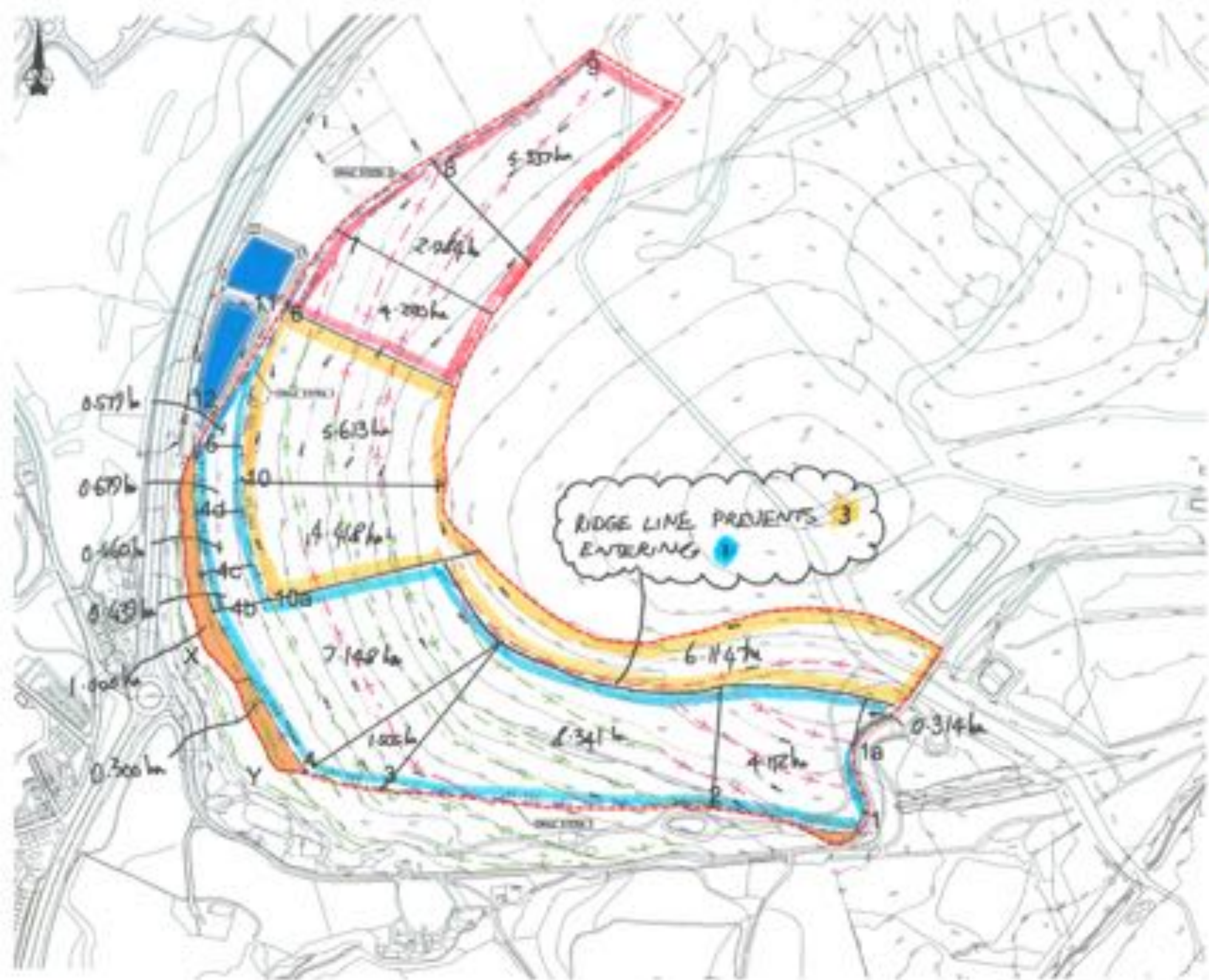
Scale Factor (%) 0

Scale Repeat

Select downstream Pipe Number

Swale Table used in the modelling

Index	Symbol	Major Dim (mm)	Minor Dim (mm)	Side Slope	Corner Splay (mm)	4*Hyd Radius	Area (m²)
-1	V	1000	1000	45.0		2.090	2.000
-2	V	1500	1200	45.0		2.648	3.240
-3	V	1500	1000	45.0		2.310	2.500
-4	V	2000	1200	45.0		2.848	3.840
-5	V	2500	1200	45.0		3.013	4.440
-6	V	3000	1000	45.0		2.745	4.000
-7	V	3000	1200	45.0		3.153	5.040



- 2 TOTAL AREA INTO ZONE 2 = 12.541 ha
- 3 TOTAL AREA INTO ZONE 3 = 16.145 ha
- 1 TOTAL AREA INTO ZONE 1 = 23.777 ha

TOTAL = 52.463 ha

AREA TAKE
OFFS

Morais B Time of Entry Calculation for 1000

Resc

Distance = 65m
= 213 ft

Slope = $\frac{20m}{146m} \times 100\%$
= 13.7%

C = 0.5

fact to be
x by 0.3048

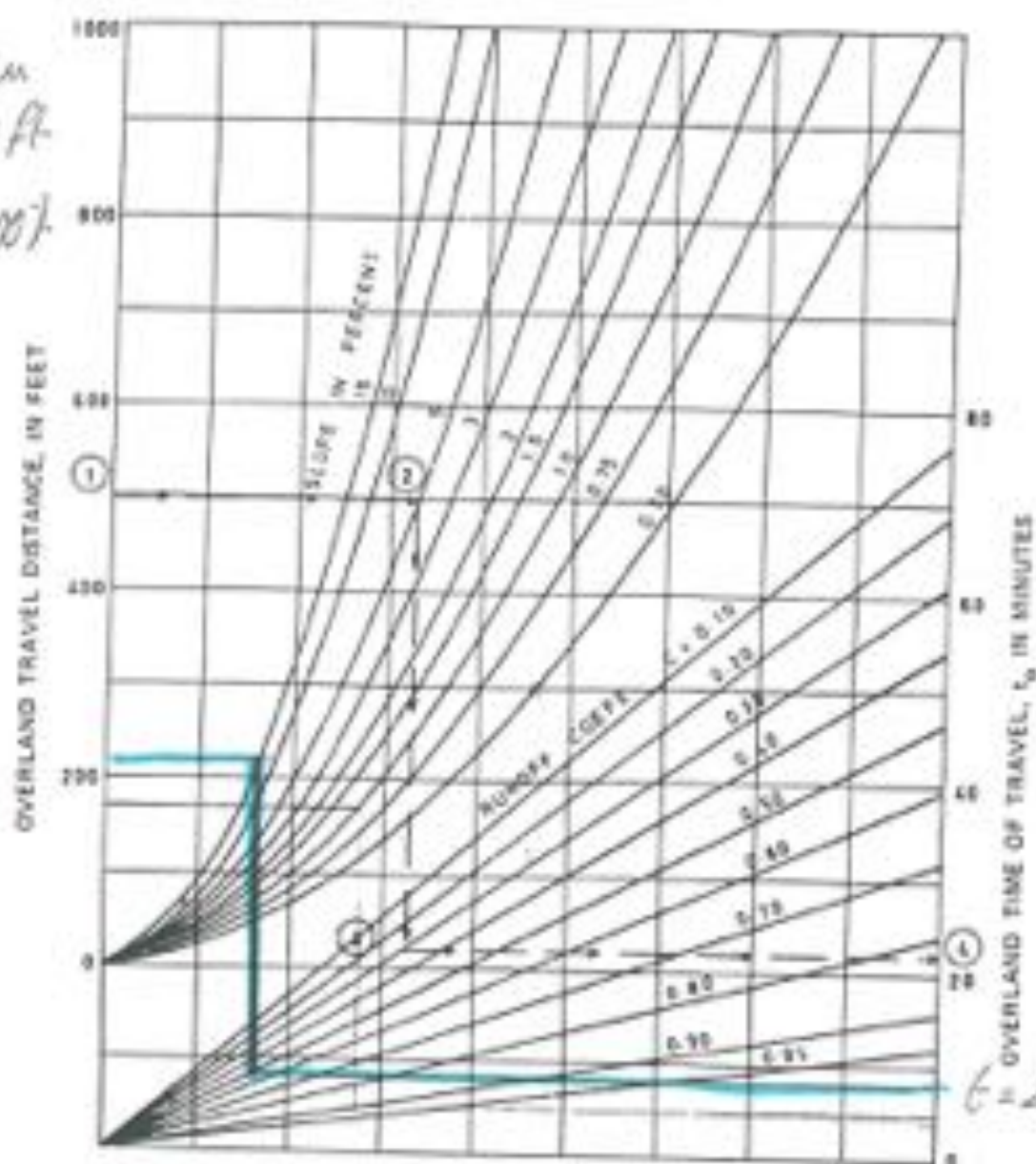


Figure 4.1 Design Chart for Estimation of Overland Time of Flow

Table 4.1 Approximate Stream Velocities

Average Slope of Channel (percent)	Average Velocity (feet/second)
1-2	2.0
2-4	3.0
4-6	4.0
6-10	5.0
10-15	6.0

Marina B Time of Entry calculation for 2.00s

Rev C

Distance = 150m

= 511 ft

Slope = $\frac{20m}{150m} \times 100\%$

= 13.3%

C = 0.5

fact to be
x by 0.3048

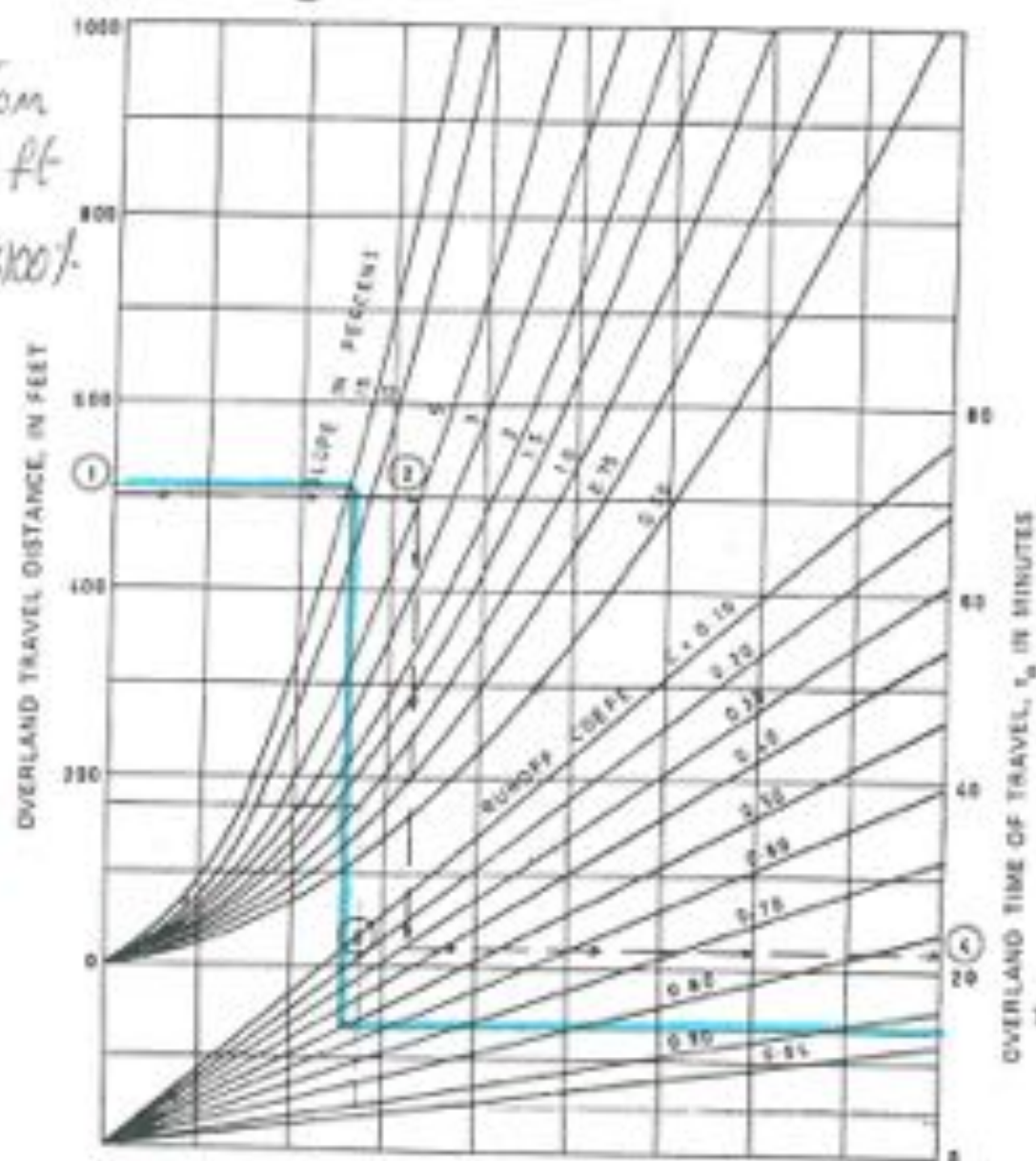


Figure 4.1 Design Chart for Estimation of Overland Time of Flow

Table 4.1 Approximate Stream Velocities

Average Slope of Channel (percent)	Average Velocity (feet/second)
1-2	2.0
2-4	3.0
4-6	4.0
6-10	5.0
10-15	6.0

Module B Time of Entry calculation for 3.060

RMC

Distance = 270m
 = 951 ft

Slope = $\frac{40}{270} \times 100\%$

= 14.8%

$C = 0.5$

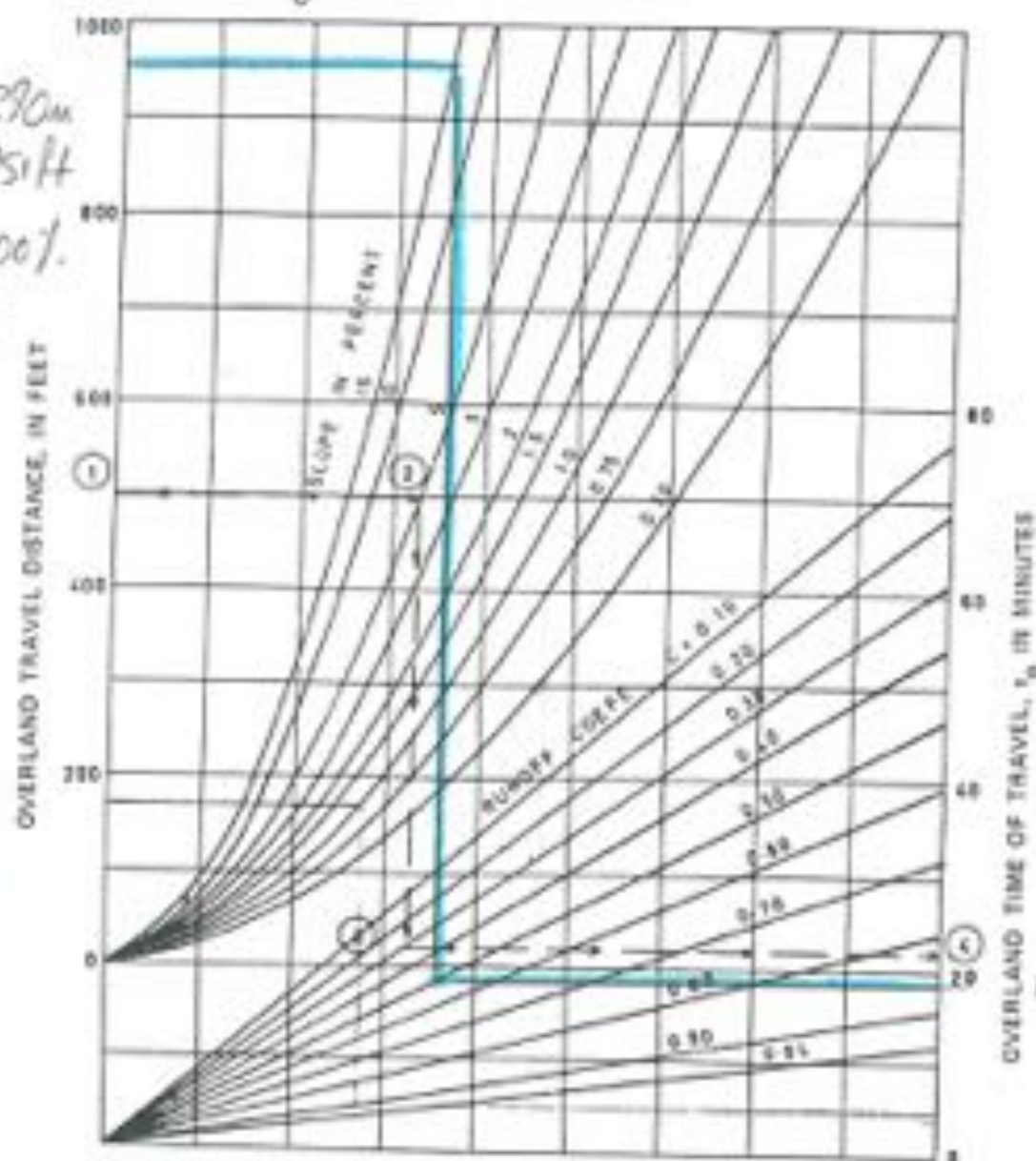


Figure 4.1 Design Chart for Estimation of Overland Time of Flow


Table 4.1 Approximate Stream Velocities

Average Slope of Channel (percent)	Average Velocity (feet/second)
1-2	2.0
2-4	3.0
4-6	4.0
6-10	5.0
10-15	8.0

Morlais B Orifice Calcs

10/12/15

Ffosy Fran Orifice Calcs					10th Dec 2015
Orifice Equation					
$Q=Cd \times A \times (2gH)^{0.5}$					
Parameter	South pond		North pond		Total
Cd	0.60		0.60		
dia	0.32 m		0.43 m		
A	0.08 m2		0.15 m2		
g	9.80 m/s2		9.80 m/s2		
Difference in water level to invert	2.15 m		2.21 m		
Head to centre of orifice, H	1.99 m		2.00 m		
Q calc out of orifice	301.33 l/s		545.47 l/s		846.80 l/s
Q allowable at culvert					845.00 l/s
Notes					
1. free discharge assumed					
2. resulting discharge can be lowered if protruding pipe is used ie set at Cd=0.5					
3. open channel downstream of ponds has roughness to bring down flow rate below 845 l/s					


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Date 10/12/2015 16:07	Designed by nick.wood	
File 35739 -MORLAIS B DRAINA...	Checked by	
Micro Drainage		Network 2014.1.1

Conduit Sections for Storm

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \ / open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from user conduit table

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m ²)
-1	\ /	1000	1000	45.0		2.090	2.000
-6	\ /	3000	1000	45.0		2.745	4.000
-7	\ /	3000	1200	45.0		3.153	5.040

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Gables House Kenilworth Road Leamington Spa CV32 6JX		
Date 10/12/2015 16:07	Designed by nick.wood	
File 35739 -MORLAIS B DRAIN...	Checked by	
Micro Drainage		Network 2014.1.1

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	60	0.314	0.188	0.188
1.001	-	-	60	4.112	2.467	2.467
1.002	-	-	60	8.341	5.005	5.005
1.003	-	-	60	1.505	0.903	0.903
1.004	-	-	60	7.148	4.289	4.289
1.005	-	-	60	0.440	0.264	0.264
1.006	-	-	60	0.660	0.396	0.396
1.007	-	-	60	0.679	0.407	0.407
1.008	-	-	60	0.579	0.347	0.347
1.009	-	-	60	0.000	0.000	0.000
2.000	-	-	60	5.337	3.202	3.202
2.001	-	-	60	2.984	1.790	1.790
2.002	-	-	60	4.220	2.532	2.532
3.000	-	-	60	10.532	6.319	6.319
3.001	-	-	60	5.613	3.368	3.368
2.003	-	-	60	0.000	0.000	0.000
2.004	-	-	60	0.000	0.000	0.000
1.010	-	-	60	0.000	0.000	0.000
				Total	Total	Total
				52.464	31.478	31.478

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D, L (mm)	W (mm)
---------------------	--------------	--------------	--------------	------------------	-----------	--------

S1.010	Sorifice	300.000	296.800	285.300	0	0
--------	----------	---------	---------	---------	---	---


Simulation Criteria for Storm


Volumetric Runoff Coeff	0.500	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.750
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1


Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0


Synthetic Rainfall Details

Rainfall Model	FEH D1 (1km)	0.000	F (1km)	0.000	
Return Period (years)	100 D2 (1km)	0.000	Summer Storms	Yes	
Site Location	D3 (1km)	0.000	Winter Storms	No	
C (1km)	0.000	E (1km)	0.000	Cv (Summer)	0.500

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Date 10/12/2015 16:07	Designed by nick.wood	
File 35739 -MORLAIS B DRAINA...	Checked by	
Micro Drainage		Network 2014.1.1
<p style="text-align: center;"><u>Synthetic Rainfall Details</u></p> <p style="text-align: center;">Cv (Winter) 0.840 Storm Duration (mins) 15</p>		
<p style="text-align: center;">©1982-2014 XP Solutions</p>		

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Date 10/12/2015 16:07 File 35739 -MORLAIS B DRAINA...	Designed by nick.wood Checked by	
Micro Drainage Network 2014.1.1		
<p style="text-align: center;"><u>Online Controls for Storm</u></p> <p><u>Orifice Manhole: SS Pond, DS/PN: S1.009, Volume (m³): 321.9</u></p> <p>Diameter (m) 0.320 Discharge Coefficient 0.600 Invert Level (m) 300.500</p> <p><u>Orifice Manhole: SN Pond, DS/PN: S2.004, Volume (m³): 43.3</u></p> <p>Diameter (m) 0.430 Discharge Coefficient 0.600 Invert Level (m) 306.500</p>		
<p style="text-align: center;">©1982-2014 XP Solutions</p>		

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Date 10/12/2015 16:07 File 35739 -MORLAIS B DRAINA...	Designed by nick.wood Checked by																									
Micro Drainage Network 2014.1.1																										
<div>Storage Structures for Storm</div> <div>Tank or Pond Manhole: SS Pond, DS/PN: S1.009</div> <div>Invert Level (m) 300.500</div> <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>3920.0</td><td>1.000</td><td>4634.0</td><td>2.000</td><td>5376.0</td></tr></table> <div>Tank or Pond Manhole: SN Pond, DS/PN: S2.004</div> <div>Invert Level (m) 306.500</div> <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>4000.0</td><td>1.000</td><td>4500.0</td><td>2.000</td><td>5000.0</td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	3920.0	1.000	4634.0	2.000	5376.0	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	4000.0	1.000	4500.0	2.000	5000.0
Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)																					
0.000	3920.0	1.000	4634.0	2.000	5376.0																					
Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)																					
0.000	4000.0	1.000	4500.0	2.000	5000.0																					
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Micro Drainage Network 2014.1.1		

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coefficient	0.750
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH D1 (1km)	0.460	E (1km)	0.292	Cv (Winter)	0.840
Site Location	D2 (1km)	0.444	F (1km)	2.510		
	C (1km)	-0.027	D3 (1km)	0.367	Cv (Summer)	0.750

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep		Fine Inertia Status	OFF
DTS Status		ON	

Profile(s)

Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080	Summer and Winter
--------------------	---	-------------------

Return Period(s) (years)	100
Climate Change (%)	30

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
S1.000	15 Winter	100	+30%					
S1.001	15 Winter	100	+30%					
S1.002	15 Winter	100	+30%					
S1.003	15 Winter	100	+30%					
S1.004	15 Winter	100	+30%	100/15 Winter				
S1.005	30 Winter	100	+30%					
S1.006	30 Winter	100	+30%					
S1.007	30 Winter	100	+30%					
S1.008	30 Winter	100	+30%					
S1.009	720 Winter	100	+30%	100/15 Winter				
S2.000	15 Winter	100	+30%					
S2.001	15 Winter	100	+30%					
S2.002	15 Winter	100	+30%					
S3.000	30 Winter	100	+30%					
S3.001	30 Winter	100	+30%					
S2.003	30 Winter	100	+30%					
S2.004	360 Winter	100	+30%	100/15 Summer				
S1.010	480 Winter	100	+30%					

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Micro Drainage

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Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water	Surch'ed Depth (m)	Flooded	Flow / Cap.	O'flow	Pipe	Status
		Level (m)		Volume (m³)		(l/s)	Flow (l/s)	
S1.000	S1a	369.105	-0.895	0.000	0.02	0.0	101.1	OK
S1.001	S1	357.223	-0.407	0.000	0.33	0.0	1379.6	OK
S1.002	S2	347.062	-0.038	0.000	0.73	0.0	3288.5	FLOOD RISK
S1.003	S3	321.434	-0.266	0.000	0.54	0.0	3605.8	FLOOD RISK
S1.004	S4	308.122	0.022	0.000	0.82	0.0	4376.5	FLOOD RISK
S1.005	S4b	306.105	-0.195	0.000	0.73	0.0	4294.6	FLOOD RISK*
S1.006	S4c	305.696	-0.154	0.000	0.77	0.0	4260.4	FLOOD RISK*
S1.007	S4d	304.862	-0.338	0.000	0.56	0.0	4264.2	OK
S1.008	S5	303.934	-0.166	0.000	0.77	0.0	4264.6	FLOOD RISK*
S1.009	SS Pond	302.649	1.149	0.000	0.15	0.0	301.5	SURCHARGED*
S2.000	S9	334.572	-0.428	0.000	0.32	0.0	1199.5	OK
S2.001	S8	324.738	-0.262	0.000	0.53	0.0	1770.0	FLOOD RISK
S2.002	S7	319.830	-0.170	0.000	0.67	0.0	2830.8	FLOOD RISK
S3.000	S10a	318.110	-0.390	0.000	0.42	0.0	1968.8	OK
S3.001	S10	316.261	-0.239	0.000	0.57	0.0	2703.6	FLOOD RISK
S2.003	S6	313.801	-0.199	0.000	0.66	0.0	5273.5	FLOOD RISK
S2.004	SN Pond	308.714	1.214	0.000	0.17	0.0	545.6	SURCHARGED*
S1.010	S12	300.403	-0.597	0.000	0.19	0.0	843.1	OK

Ffos y Fran

Summary of flows and volumes from MicroDrainage © for Morlais B using FEH methodology

100 year return period Critical Summary of Results by Maximum Level (Rank 1)

Pipe Number	U/S/BBH Name	Event	U/S/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (m)	Maximum Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
1.000 1a		15 minute 100 year Wint	370.000	369.105	-0.895	0.000	0.02		0.113	0.9	101.1	OK
1.001 1		15 minute 100 year Wint	357.630	357.223	-0.407	0.000	0.33		3.683	1.6	1379.6	OK
1.002 2		15 minute 100 year Wint	347.100	347.062	-0.038	0.000	0.73		17.949	2.2	3298.5	FLOOD RISK
1.003 3		15 minute 100 year Wint	321.700	321.434	-0.266	0.000	0.54		8.557	2.9	3605.8	FLOOD RISK
1.004 4		15 minute 100 year Wint	308.125	308.122	0.022	0.000	0.82		8.951	1.1	4376.5	FLOOD RISK
1.005 4b		30 minute 100 year Wint	306.300	306.105	-0.195	0.000	0.73		281.110	1.1	4294.6	FLOOD RISK*
1.006 4c		30 minute 100 year Wint	305.860	305.896	-0.154	0.000	0.77		179.710	1.0	4260.4	FLOOD RISK*
1.007 4d		30 minute 100 year Wint	305.200	304.862	-0.338	0.000	0.56		101.679	1.3	4294.2	OK
1.008 5		30 minute 100 year Wint	304.100	303.934	-0.166	0.000	0.77		148.140	1.0	4264.6	FLOOD RISK*
1.009 S Pond		720 minute 100 year Wint	305.000	302.649	-1.449	0.000	0.15		10087.489	0.6	301.5	SURCHARGED*
2.000 6		15 minute 100 year Wint	335.000	334.572	-0.428	0.000	0.32		0.641	1.4	1199.5	OK
2.001 8		15 minute 100 year Wint	325.000	324.738	-0.262	0.000	0.53		12.466	1.4	1770.0	FLOOD RISK
2.002 7		15 minute 100 year Wint	320.000	319.830	-0.170	0.000	0.67		19.457	1.9	2830.8	FLOOD RISK
3.000 10a		30 minute 100 year Wint	316.500	316.110	-0.390	0.000	0.42		0.684	0.9	1968.8	OK
3.001 10		30 minute 100 year Wint	316.500	316.261	-0.239	0.000	0.57		102.496	1.0	2793.6	FLOOD RISK
2.003 6		30 minute 100 year Wint	314.000	313.801	-0.199	0.000	0.66		122.778	3.6	5273.5	FLOOD RISK
2.004 N Pond		360 minute 100 year Wint	310.000	308.714	-1.214	0.000	0.17		10066.876	1.0	545.6	SURCHARGED*
1.010 12		480 minute 100 year Wint	302.000	300.403	-0.597	0.000	0.19		14.047	1.5	843.1	OK



Appendix D

Morlais C & D - MicroDrainage Inputs and Results



Ffos y Fran – Additional Morlais C & D Attenuation Estimate

(by NJW 10/12/15)

General:

Total Additional Area = 1.3 ha measured from drawing 35739/LEA/CVD/004

This gives Total Additional Area entering Morlais C = 1.0ha (of which Aimp = 0.60ha assuming PIMP of 60%) and Total Additional Area entering Morlais D = 0.3ha (of which Aimp = 0.18ha assuming PIMP of 60%)

Morlais C Additional Attenuation Calcs

Storage estimate calculation has been undertaken to accommodate an additional 0.60ha of impermeable area from Morlais B catchment (i.e 60% PIMP of total 1.0ha) into the Morlais C catchment assuming that the overall allowable discharge from Morlais C is 29 l/s for this additional area.

The 29 l/s maximum allowable discharge has been calculated from the greenfield runoff calculations summarised in extract 1 and extract 2 below.

Extract 1:

The Institute of Hydrology Report No. 124 method (IH124) method is given by Eq. 3 and the parameters are described in Table 3.2:

$$QBAR_{runoff} = 0.00108(AREA)^{0.39}(SAAR)^{1.17}(SOIL)^{2.17} \quad \text{Eq. 3}$$

Table 3.2 IH124 method parameters

Parameter	Value assigned		Comment
	Nant Morlais	Bradley Gardens (BG) & Goat Mill (GM)	
QBAR_{runoff} (Greenfield runoff rate, l/s)	Calculated	Calculated	Using IH124 method
AREA (total catchment area being drained, ha)	A = 122 B = 60 C = 2 D = 1	On-site = 2.347 Off-site = 5.811	Determined using digital mapping within GIS
SAAR (1961-1990 standard period average rainfall, mm)	1478	1478	From FEH Catchment Descriptors
WRAP (Winter Rainfall Acceptance Potential)	5	5	Soils of wet uplands: (iv) shallow, permeable rocky soils on steep slopes. Based on existing value from the WRAP map for the catchments. Assumes the catchments will be restored with the same soil type. It is noted that this refers to the in-situ pre-development soils and comprises the most conservative estimate. This will be refined during detailed design.
SOIL (index of soils winter rainfall acceptance potential)	0.53	0.53	Based on conversion of WRAP values for use in IH124 method. As above, values represent the upper range of impermeability and thus result in most conservative runoff estimation. This will be refined during detailed design
Hydrometric Growth Region (scales up 2.33yr return period event to longer return period events)	9	9	Taken from FSSR Growth Curve for Wales region.

Extract 2:

Table 3.3 Greenfield (IH124) and Rational Method Runoff analysis results

Catchment	Area (Ha)	Peak Design Runoff (m³/s) for return periods (yrs)					
		Greenfield (IH124 Method)				Reclamation Scheme (Rational Method)	
		2.33	30	100	100+CC	100	100+CC
Morlais A	122	1.464	2.562	3.192	4.149	7.056	9.173
Morlais B	60	0.779	1.362	1.697	2.206	3.128	4.066
Morlais C	2	0.026	0.046	0.058	0.075	0.186	0.242
Morlais D	1	0.013	0.023	0.029	0.038	0.093	0.121
Bradley Gardens Sub	2.347	0.031	0.031	0.054	0.068	0.174	0.227
Goat Mill	5.811	0.077	0.077	0.135	0.168	0.491	0.638

Taking the 58 l/s for the 1 in 100 yr natural greenfield runoff rate for Morlais C catchment and dividing this by 2ha gives 29 l/s/ha. If 29 l/s/ha is now multiplied by the additional area of 1.0ha that needs to be accommodated then this results in an allowable discharge associated with this additional area of 29 l/s. Entering this into MicroDrainage © quick storage estimate gives a required attenuation volume between 206m³ and 384m³. The results are shown below.

The screenshot shows the 'Quick Storage Estimate' dialog box with the 'Variables' tab selected. The 'FEH Rainfall' dropdown is set to 'Cv (Summer)' with a value of 0.750. The 'Return Period (years)' is set to 100. The 'Site Location' is set to 'D3 (km) 0.367'. The 'Infiltration Coefficient (m/h)' is set to 0.00000. The 'Safety Factor' is set to 2.0. The 'Climate Change (%)' is set to 30. The 'Maximum Allowable Discharge (l/s)' is set to 29.0. The 'Enter Area between 0.000 and 999.999' message is displayed at the bottom.

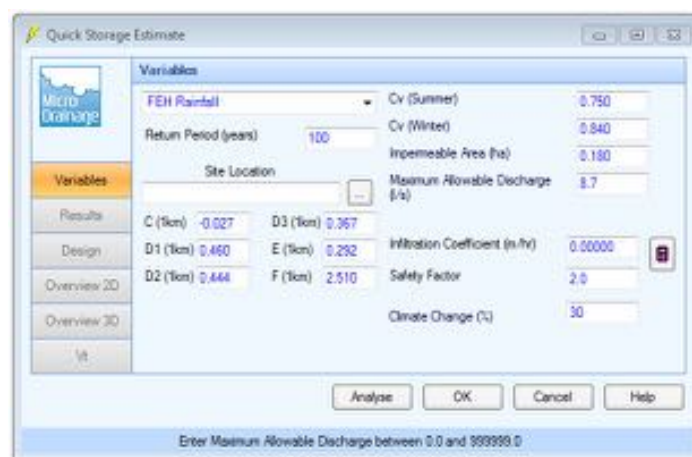
The screenshot shows the 'Quick Storage Estimate' dialog box with the 'Results' tab selected. The 'Global Variables require approximate storage of between 206 m³ and 384 m³.' message is displayed. Below this, it states 'These values are estimates only and should not be used for design purposes.' The 'Enter Area between 0.000 and 999.999' message is displayed at the bottom.

It is assumed that this could be provided by modifying the existing grip in Morlais C to create a wider ditch of 3m² over 128m as one solution

Morlais D Additional Attenuation Calcs

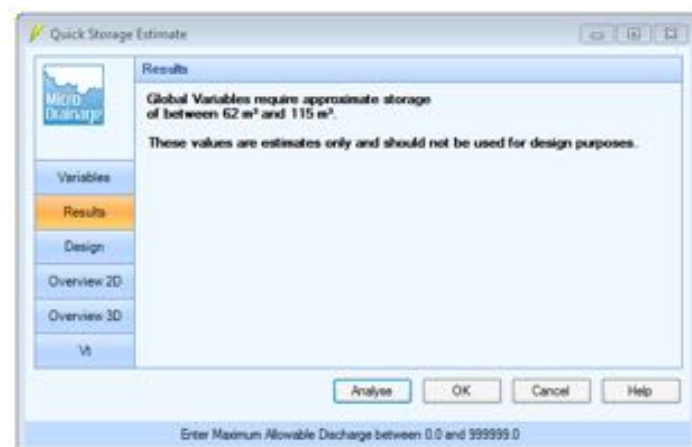
Storage estimate calculation has been undertaken to accommodate an additional 0.180ha of impermeable area from Morlais B catchment (i.e 60% PIMP of total 0.3ha) into the Morlais D catchment assuming that the overall allowable discharge from Morlais D is 8.7 l/s for this additional area.

The 8.7 l/s maximum allowable discharge has been calculated from the greenfield runoff calculations summarised in extract 1 and extract 2 previously. That is to say taking the 29 l/s for the 1 in 100 yr natural greenfield runoff rate for Morlais D catchment and dividing this by 1ha gives 29 l/s/ha. If 29 l/s/ha is now multiplied by the additional area of 0.3ha that needs to be accommodated then this results in an allowable discharge associated with this additional area of 8.7 l/s. Entering this into MicroDrainage © quick storage estimate gives a required attenuation volume between 62m³ and 115m³. The results are shown below.



The screenshot shows the 'Variables' tab of the 'Quick Storage Estimate' software. The interface includes a sidebar with navigation buttons: Variables, Results, Design, Overview 2D, Overview 3D, and Vt. The main area contains input fields for various parameters. The 'Return Period (years)' is set to 100. The 'Maximum Allowable Discharge (l/s)' is set to 8.7. The 'Impermeable Area (ha)' is set to 0.180. The 'Cv (Summer)' is 0.750 and 'Cv (Winter)' is 0.840. The 'Infiltration Coefficient (m/hr)' is 0.00000. The 'Safety Factor' is 2.0. The 'Climate Change (%)' is 30. The 'Site Location' is set to 'C (1km) -0.027'. The 'D3 (1km)' is 0.367. The 'D1 (1km)' is 0.460. The 'E (1km)' is 0.292. The 'D2 (1km)' is 0.444. The 'F (1km)' is 2.510. The 'Analyse' button is highlighted. At the bottom, a status bar reads 'Enter Maximum Allowable Discharge between 0.0 and 999999.0'.

Variable	Value
Return Period (years)	100
Impermeable Area (ha)	0.180
Maximum Allowable Discharge (l/s)	8.7
Cv (Summer)	0.750
Cv (Winter)	0.840
Infiltration Coefficient (m/hr)	0.00000
Safety Factor	2.0
Climate Change (%)	30
C (1km)	-0.027
D1 (1km)	0.460
D2 (1km)	0.444
D3 (1km)	0.367
E (1km)	0.292
F (1km)	2.510



The screenshot shows the 'Results' tab of the 'Quick Storage Estimate' software. The sidebar navigation buttons are the same as in the previous screen. The main area displays the following text: 'Global Variables require approximate storage of between 62 m³ and 115 m³. These values are estimates only and should not be used for design purposes.' The 'Analyse' button is highlighted. At the bottom, a status bar reads 'Enter Maximum Allowable Discharge between 0.0 and 999999.0'.

Global Variables require approximate storage of between 62 m³ and 115 m³.
These values are estimates only and should not be used for design purposes.

It is assumed that this could be provided by installing a ditch in Morlais D of 3m² over 38m as one solution



APPENDIX 5

Availability of Soil Resources

FFOS Y FRAN LAND RECLAMATION SCHEME _ Soil Restoration Requirements and Current Resources in Store @ OCTOBER 2015

Site Soils Balance @ July 2013 (using Restoration Strategy 2007 - Figure 4)																										
Site Soils Balance @ July 2013 (using Restoration Strategy 2007 - Figure 4)								Site Soils Balance @ October 2015 (using Restoration Strategy 2007 - Figure 4)								Remaining Soils Balance @ October 2015 (using Figure 1)										
Soil Unit From Figure RS 8	Total Area to be Restored (ha)	Topsoil Depth Required (mm)	Topsoil Volume Required (m³)	Subsoil Depth Required (mm)	Subsoil Volume Required (m³)	SFM Depth Required (mm)	SFM Volume Required m³	GRAND TOTAL SOILS BALANCE (m³)	Total Area to be Restored (ha)	Topsoil Depth Required (mm)	Topsoil Volume Required (m³)	Subsoil Depth Required (mm)	Subsoil Volume Required (m³)	SFM Depth Required (mm)	SFM Volume Required m³	GRAND TOTAL SOILS BALANCE (m³)	Total Area to be Restored (ha)	Restored Area (ha)	Remaining Area (ha)	Topsoil Depth Required (mm)	Topsoil Volume Required (m³)	Subsoil Depth Required (mm)	Subsoil Volume Required (m³)	SFM Depth Required (mm)	SFM Volume Required (m³) - REVISED SCHEME	GRAND TOTAL SOILS BALANCE (m³)
1	27.5	200	55,000	300	82,500				27.5	200	55,000	300	82,500				27.5	0.0	27.5	200	55,000	300	82,500		0	
2	52.1	165	85,965	165	85,965				52.1	165	85,965	165	85,965				52.1	0.0	52.1	165	85,965	165	85,965		0	
ZAG	55	165	90,750	165	90,750				55	165	90,750	165	90,750				55	0.0	55	165	90,750	165	90,750		0	
ZT	10	250	25,000	250	25,000				10	250	25,000	250	25,000				10	0.0	10	250	25,000	250	25,000		0	
ZWH	5.2	200	10,400	200	10,400				5.2	200	10,400	200	10,400				5.2	0.0	5.2	200	10,400	200	10,400		0	
3	43.3					500	216,500		43.3					500	216,500		43.3	0.0	43.3					500	216,500	
4M	128.5					500	642,500		128.5					500	642,500		125	22.17	102.83					350	359,905	
Attenuation Ponds (4M)	0					0	0		0					0	0		3.5	0.0	3.5					100	3,500	
4N	23.5					650	152,750		23.5					650	152,750		5.2	0.0	5.2					650	33,800	
Development Area (4N)	0					0	0		0					0	0		16.8	0.0	16.8					0	0	
Attenuation Ponds (4N)	0					0	0		0					0	0		1.5	0.0	1.5					100	1,500	
4S	11					650	71,500		11					650	71,500		11	11.0	0					0	0	
TOTAL VOLUMES Required to complete outline Restoration Strategy			267,115		294,615		1,083,250				267,115		294,615		1,083,250						267,115		294,615		615,205	
Total Available Materials in Store			225,588		30,071		921,423				219,308		30,123		881,949						219,308		30,123		881,949	
Volume of SFM placed on interim restoration area							13,579								118,341											
Conservative Estimate of further materials to be recovered from the excavation area							102,000				21,390				31,894						21,390				31,894	
Totals available for Restoration			225,588		30,071		1,037,002				240,698		30,123		1,032,184						240,698		30,123		913,843	
Shortfall/surplus in materials required to complete Restoration Strategy requirements			-41,527		264,544		46,248	-352,319			-26,417		264,492		51,066	-341,975					-26,417		264,492		298,638	7,729

APPENDIX 6

DEFRA Good Practice Guide for Handling Soils Sheet 3
Excavation of Soil Storage Mounds with Excavators and Dump Trucks



GOOD PRACTICE GUIDE FOR HANDLING SOILS

Sheet 3:

Excavation of Soil Storage Mounds with Excavators and Dump Trucks

Issued by the Farming and Rural Conservation Agency, Cambridge

April 2000

MAFF FOREWARD

Standards of restoration of minerals and waste sites have steadily improved in recent years, with operators increasingly aware of their environmental responsibilities. The industry is putting forward more imaginative restoration concepts to a variety of afteruses, and is more aware than ever that it will be judged on the standard of that restoration, and the sustainability of the development.

Sustainable mineral development means balancing economic, environmental and social needs, whilst using resources wisely. The UK Strategy for Sustainable Development recognises the importance of safeguarding agricultural land to meet the needs of future generations, and minimising the loss of soils to new development*.

Improved restoration standards have sometimes enabled planning permission to be given for best and most versatile agricultural land to be worked for minerals, on the basis that it can be restored in a way that safeguards its long-term agricultural potential**. Inherent in these high standards of restoration is the requirement to handle soils in such a way that damage to their structure is minimised. It is the aim of this Guide to provide comprehensive advice on soil handling “Good Practice” to operators, soil moving contractors, consultants and planning authorities.

The Guide is in the form of 15 Sheets giving advice on soil stripping, the forming and taking down of soil storage mounds, and soil replacement operations using excavators, earth scrapers or bulldozers. There are also four Guidance Sheets on remedial works involving the removal of stones and damaging materials, and decompaction during the replacement operations.

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*(DETR, A Better Quality of Life, May 1999, paragraphs 6.66 and 8.50)

**MPG7 (November 1996, paragraph 3).

Acknowledgements

The Guide was written and prepared by Dr R N Humphries of Humphries Rowell Associates, Charnwood House, Loughborough, LE11 3NP, UK. The art work was by R Shenton of H J Banks & Co.

SHEET 3 EXCAVATION OF SOIL STORAGE MOUNDS WITH EXCAVATORS & DUMP TRUCKS

The purpose of this Guidance Sheet is to provide a model method for best practice where excavators and dump trucks are used to excavate soil storage mounds. This Guidance Sheet comprises 4 pages of text, 3 figures and a user response form.

The model may need to be modified according to site conditions or requirements of the Planning Authority. Where this is the case, deviation from the model should be recorded with reasons. The guidance does not specify the type, size or model of equipment, but this should have been agreed as part of the planning conditions or as a reserved matter. The machines should be of a kind which will cause the minimum compaction whilst being operationally efficient (eg wide tracked), and must be well maintained at all times.

Persons involved in the handling of soils, overburden etc., and in the construction or removal of mounds or tips, must comply with the Health and Safety at Work Etc. Act 1974 and its relevant statutory provisions, and in particular those aspects which relate to the construction and removal of tips, mounds and similar structures. This requirement takes preference over any suggested practice in the Sheets.

The user of these guidelines is solely responsible for all liabilities that might arise. No liabilities are accepted for any losses of any kind arising from the use of this guidance.

This soil handling method uses back-acting excavators to load the soil in to dump trucks (articulated or rigid bodied) for transport to the replacement areas.

The soil handling method can affect the agricultural quality of the restoration through severe soil deformation (compression and smearing). This is primarily caused through trafficking, the effects of which increases with increasing soil wetness.

The advantage of this model method, if correctly carried out, is that it should avoid severe deformation of the soil as trafficking is minimised. However, where the soil has been stored in multi-tier mounds there will be a need for decompaction treatment during the excavation operation (see below and Sheet 18).

The key operational points to ensure avoidance of severe soil deformation are as follows:

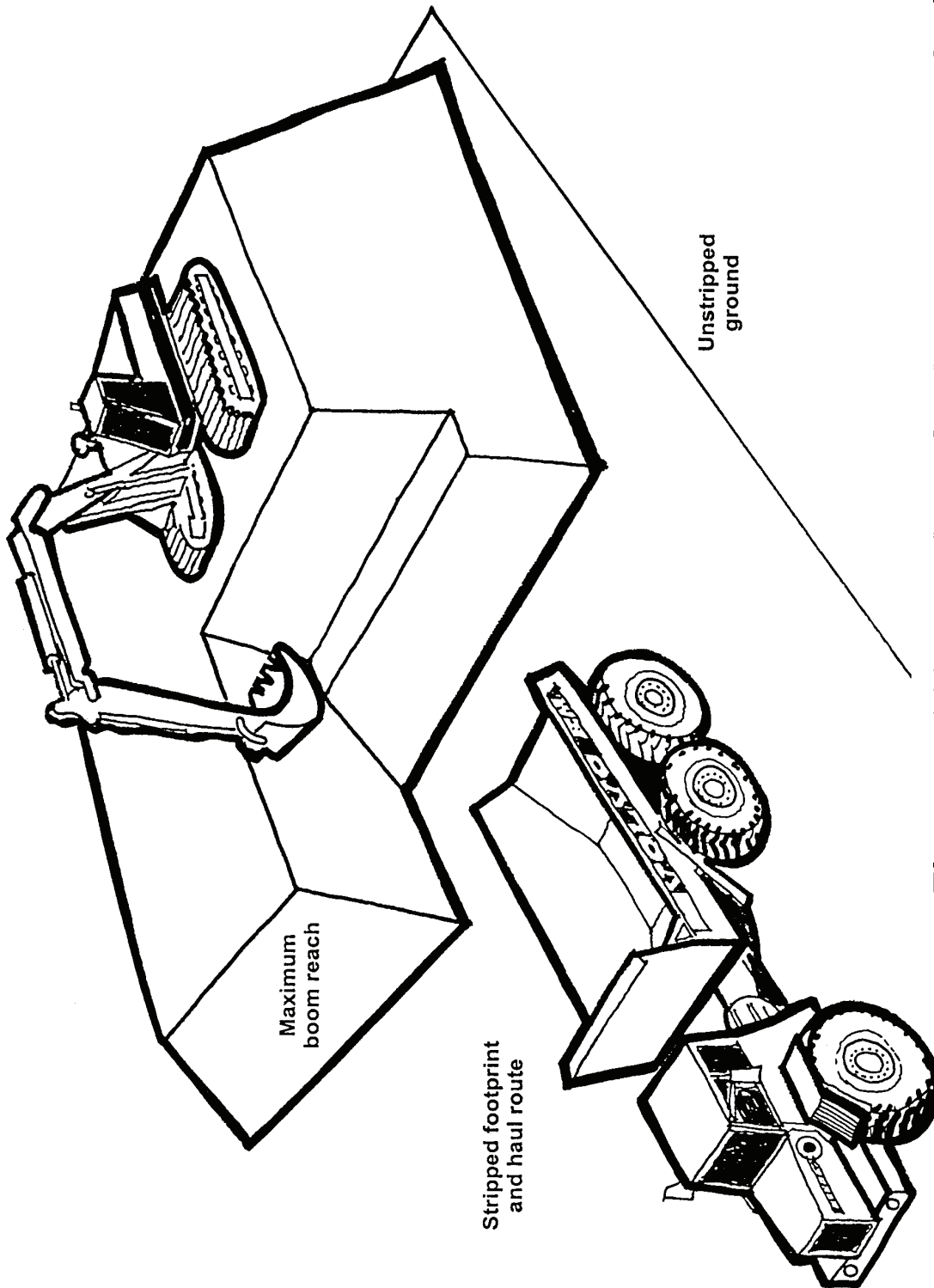
- (i) To minimise compaction:
 - the dump trucks must only operate on the 'basal'/non-soil layer, and their wheels must not on any circumstances run on to the soil in store.
 - the excavator should only operate on the soil mound.
 - the machines are to only work when ground conditions enable their maximum operating efficiency.
 - when excavating the multi-tier mounds, excavate tier by tier starting with the uppermost, trafficking is to be confined to the upper surface of the next tier.
 - if compaction has been caused then measures are required to treat it before it is loaded into the trucks (see below and Sheet 18).
- (ii) To minimise soil wetness and rewetting:
 - the mound should be shaped to shed water before rainfall occurs and whenever replacement is suspended.
 - measures are required to protect the face of the soil layer from ponding of water and maintain the basal layer in a condition capable of supporting dump trucks.

The Excavation Operation

- 3.1 The dump trucks are to travel only on haul routes and in operational area, and both must be maintained. In the case of single tier mounds they must only operate on the basal layer. Detailed daily records should be kept of operations undertaken, and site and soil conditions.
- 3.2 The trucks should enter the storage area and draw alongside the active excavation face. If back-acting excavators are used, they will need to stand on top of the mound to load trucks (Figure 3.1). The mound is to be dug to the base before moving progressively back along its axis.
- 3.3 With multi-tier mounds, the soil should be excavated tier by tier starting with the uppermost tier. This will necessitate the running of the trucks on the stored soil. Excavation should be in the same height of tiers as originally built so that the same surfaces are used for trafficking to minimise further compaction (Figure 3.2). Having removed an upper tier the trafficked layer must be decompacted. This can be achieved by progressively digging the surface as described on Sheet 18 in advance of loading the next layer. It is essential that the digging is effective and this needs to be systematically tested before soil is loaded. The process is repeated for each soil tier.
- 3.4 Any exposed edges/surfaces should be shaped on the onset of rain during the day. All surfaces should be shaped to shed water at the end of each day.
- 3.5 Work should stop in wet conditions with measures undertaken to prevent ponding at the base of the mound and on the basal layer. At the start of each day ensure there is no ponding on the basal layer and operating areas.

Operational Variations

- 3.6 Front loading machines may be used to excavate single tier soil mounds provided that they only operate on the basal layer with the dump trucks (Figure 3.3).
- 3.7 Front loading machines are only to be used for multi-tier mounds if the compacted inter-tier layer has been decompacted at the building stage.



**Figure 3.1 Excavation of soil storage mound with excavators and dump trucks:
Single tier mound**

APPENDIX 7

DEFRA Good Practice Guide for Handling Soils Sheet 15
Soil Replacement with Bulldozers and Dump Trucks



GOOD PRACTICE GUIDE FOR HANDLING SOILS

Sheet 15:

Soil Replacement with Bulldozers and Dump Trucks

Issued by the Farming and Rural Conservation Agency, Cambridge

April 2000

MAFF FOREWARD

Standards of restoration of minerals and waste sites have steadily improved in recent years, with operators increasingly aware of their environmental responsibilities. The industry is putting forward more imaginative restoration concepts to a variety of afteruses, and is more aware than ever that it will be judged on the standard of that restoration, and the sustainability of the development.

Sustainable mineral development means balancing economic, environmental and social needs, whilst using resources wisely. The UK Strategy for Sustainable Development recognises the importance of safeguarding agricultural land to meet the needs of future generations, and minimising the loss of soils to new development*.

Improved restoration standards have sometimes enabled planning permission to be given for best and most versatile agricultural land to be worked for minerals, on the basis that it can be restored in a way that safeguards its long-term agricultural potential**. Inherent in these high standards of restoration is the requirement to handle soils in such a way that damage to their structure is minimised. It is the aim of this Guide to provide comprehensive advice on soil handling “Good Practice” to operators, soil moving contractors, consultants and planning authorities.

The Guide is in the form of 15 Sheets giving advice on soil stripping, the forming and taking down of soil storage mounds, and soil replacement operations using excavators, earth scrapers or bulldozers. There are also four Guidance Sheets on remedial works involving the removal of stones and damaging materials, and decompaction during the replacement operations.

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SHEET 15 SOIL REPLACEMENT WITH BULLDOZER & DUMP TRUCKS

The purpose of this Guidance Sheet is to provide a model method for best practice where the soils are replaced using bulldozers and dump trucks. This Guidance Sheet comprises 6 pages of text, 3 figures and a user response form.

The model may need to be modified according to site conditions or requirements of the Planning Authority. Where this is the case, deviation from the model should be recorded with reasons. The guidance does not specify the type, size or model of equipment, but this should have been agreed as part of the planning conditions or as a reserved matter. The machines should be of a kind which will cause the minimum compaction whilst being operationally efficient (eg wide tracked), and must be well maintained at all times.

Persons involved in the handling of soils, overburden etc., and in the construction or removal of mounds or tips, must comply with the Health and Safety at Work Etc. Act 1974 and its relevant statutory provisions, and in particular those aspects which relate to the construction and removal of tips, mounds and similar structures. This requirement takes preference over any suggested practice in the Sheets.

The user of these guidelines is solely responsible for all liabilities that might arise. No liabilities are accepted for any losses of any kind arising from the use of this guidance.

This soil handling method uses a bulldozer to replace the soils and dump trucks transport it to the replacement area. If the soil is from store an excavator will be required to load the trucks.

The earth scraper soil handling method can significantly affect the agricultural quality of the restoration through severe soil deformation (compression and smearing). This is primarily caused through unavoidable repeated trafficking over the soils during the lifting and the building and excavating mounds, and on replacement; the effects of

which increases with increasing soil wetness. Consequently, for satisfactory restoration there is a need for effective decompaction treatment during the replacement operation (see Sheet 19). Decompaction treatment is an obligate requirement when soils are handled by earth scrapers.

The early installation of under drainage is strongly recommended. Where required this should either be undertaken sequentially during the replacement of the soils or in the early aftercare period. Until drains are installed it is recommended that the restored land is sown and managed as grassland.

There are a number of key operational points to minimise the degree and extent of severe soil deformation and for the effective treatment of the compaction:

- (i) To minimise compaction and optimise decompaction:
 - the dump trucks must only operate on the 'basal'/non-soil layer, and their wheels must not in any circumstances run on to the soil layer(s).
 - the adoption of a bed/strip system minimises the need for the trucks to travel on the soil layers.
 - the machines are to only work when ground conditions enable their maximum operating efficiency.
 - the soils are to be stripped by the bulldozer in as thick layer as possible whilst maintaining their operational efficiency.
 - effective decompaction on soil replacement is a requisite of the bulldozer handling method (see Sheet 19).
 - the soil layers should have a moisture content of 5% or greater below their lower plastic limit*. Moisture content should be assessed by oven drying* of samples taken from representative locations and mid/lower points of each soil horizon. [*Or as required in the planning conditions.]

- (ii) To minimise the re-wetting of the soil and maximising decompaction effectiveness:
- the bed/strip system provides a basis to regulate the exposure of lower soil layers to periods of rain and a means of maintaining soil moisture contents. The soil profile within the active strip should be replaced to the topsoil layer before rainfall occurs and before replacement is suspended.
 - measures are required to protect the face of the soil layer from ponding of water and maintain the basal layer in a condition capable of supporting dump trucks.
 - the area to be stripped is to be protected from in-flow of water, ponding etc. Wet sites should be drained in advance.

The Replacement Operation

15.1 The area to be restored is to be protected from in-flow of water, ponding etc. Wet sites must be drained in advance. Before the operation starts the basal layer should be to level and clean.

15.2 Prior to commencing operations a Meteorological Office forecast should be obtained which gives reasonable confidence of soil replacement proceeding without interruptions from rainfall events. If significant rainfall is forecast or occurs during operations, the replacement must be suspended, and where the soil profile has been started it should be replaced to topsoil level.

Replacement must not restart unless the weather is expected to be dry for at least a full day.

- 15.3 All machines must be in a safe and efficient working condition at all times. The machines are to only work when ground conditions enable their maximum operating efficiency. The operation should only be carried out when the basal layer supports the machinery without ruts or is capable of repair/maintenance. The operation is to be suspended before traction becomes a problem or the integrity of the basal layer and haul routes fails. All haul routes should be maintained.
- 15.4 The operation should follow a detailed replacement plan showing soil units to be replaced, haul routes and the phasing of vehicle movements. The soil units should be defined on the site with information to distinguish types and layers, and thickness. Detailed daily records should be kept of operations undertaken (including the removal of stones and damaging materials, and the results of any assessment of the need for additional decompaction and the effectiveness of decompaction work undertaken), and site and soil conditions.
- 15.5 The dump trucks are only to stand, work and travel on the basal/formation layer. Only the bulldozer is to operate on the soil layers to spread the soil.
- 15.6 The soil layers above the base/formation layer are to be replaced in sequential strips with the subsoil layer(s) to be replaced first, followed by the topsoil layer; each layer being replaced to the specified thickness. The next strip is not to be started until the current strip is completed. This is often referred to as the 'bed system'. The system involves the progressive sequential laying of the materials in strips across the area to be restored (Figure 15.1).
- 15.7 Demarcate the initial strip width (15-20m) and axis, divide strip into 20m long segments. The haul routes should be clearly defined.
- 15.8 Reverse the dump truck to the edge of the current strip and tip the lowest layer (subsoil) soil at the edge of the strip. The bulldozer is used to spread the lower

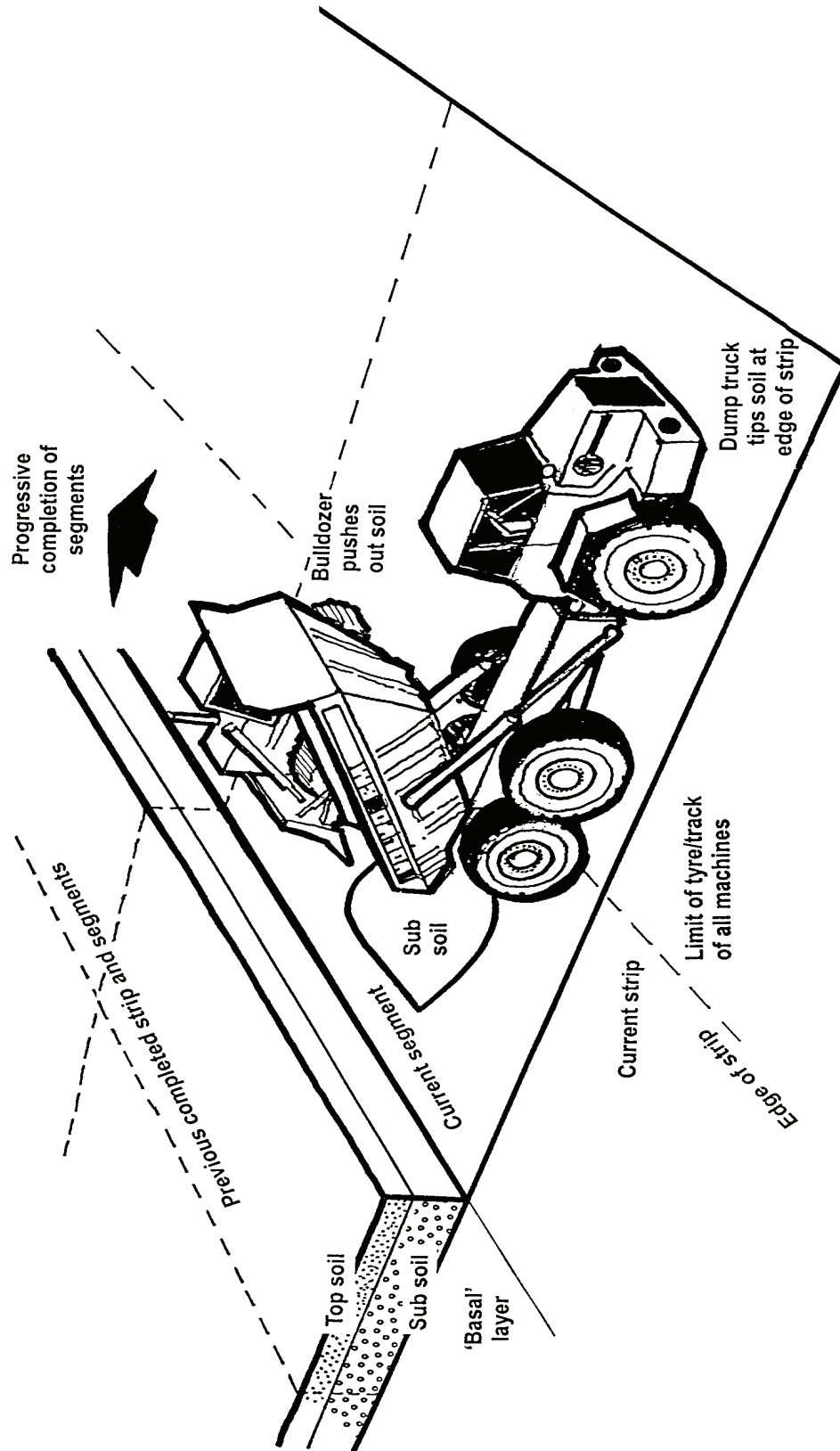
subsoil to full thickness, and in the thickest layers as possible from front to back of strip (Figure 15.2). This is undertaken progressively until the whole segment is complete, and then repeated in each segment until the strip is complete with the full depth of subsoil.

- 15.9 Level boards and soil pits should be used to verify soil thickness in each strip and overall levels. Allowance (ie. bulking factor) should be made for any 'heave' that may take place when the soil is ripped.
- 15.10 The ripping strategy needs to be determined at the planning of operations and must take into account the thickness of soil layers, depth of recompaction and the effective depth of the ripping tool (Sheet 19), and the need for the removal of stones and other damaging materials (Sheet 17). These should be specified in the soil replacement plan. Decompaction and removal of materials should only take place when each specified soil layer is completed along the strip, and the work must be completed before the next layer of soil is placed.
- 15.11 On completion of the lowest layer (subsoil) across the whole strip, repeat the process sequentially spreading the next layers (subsoil/topsoil) (Figure 15.3). If the dump trucks have to rise on the already placed lower layers, this must be limited to the rear wheels only. The above decompaction operations must be arranged to treat the compacted strip margins.
- 15.12 On completion of the topsoil layer the above processes should be repeated for the next strips until the area to be restored is completed. Before the operation starts the basal layer should be to level and clean.
- 15.13 At the end of each day the current strip/segment must be completed if rain is forecast. If during a day it is evident that a full strip cannot be completed, then ensure the current segment is completed.

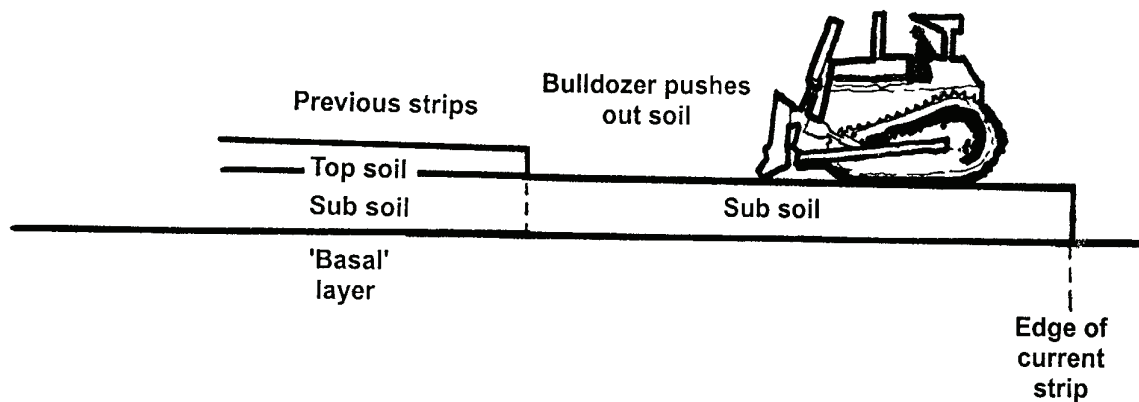
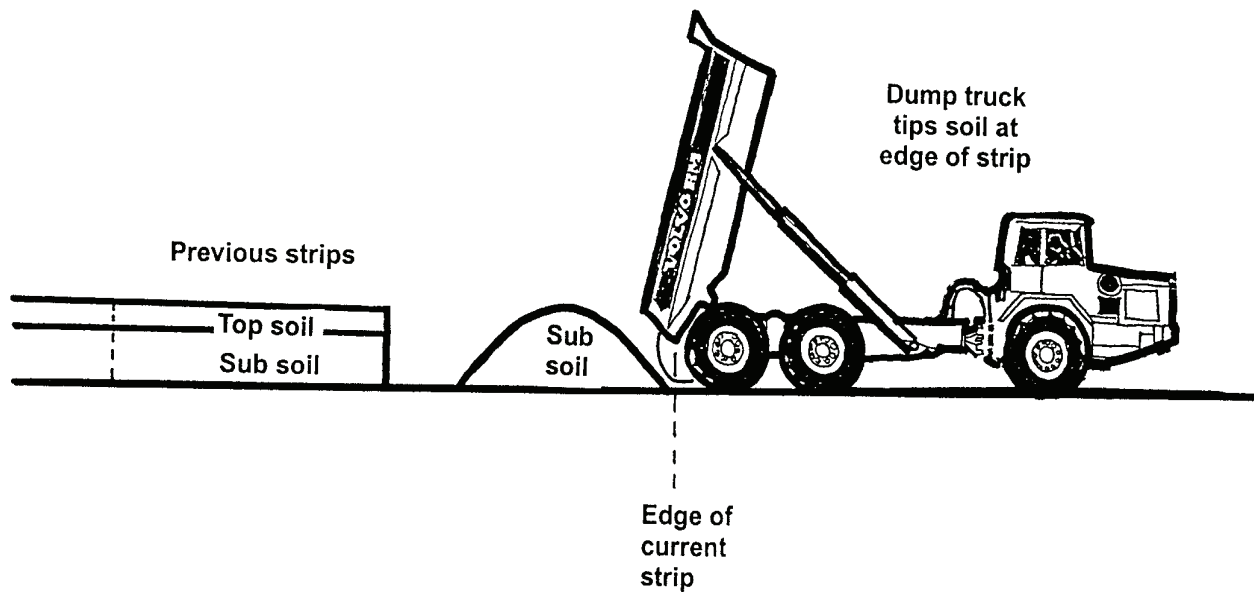
- 15.14 At the end of each day, or during the day if interrupted by rain, make provisions to protect the base of the restored strip from ponding/run-off by sumps and grips, and also clean and level the basal layer. At the start of each day ensure there is no ponding in the current strip or operating areas, and the basal layer is to level with no ruts.

Operational Variation

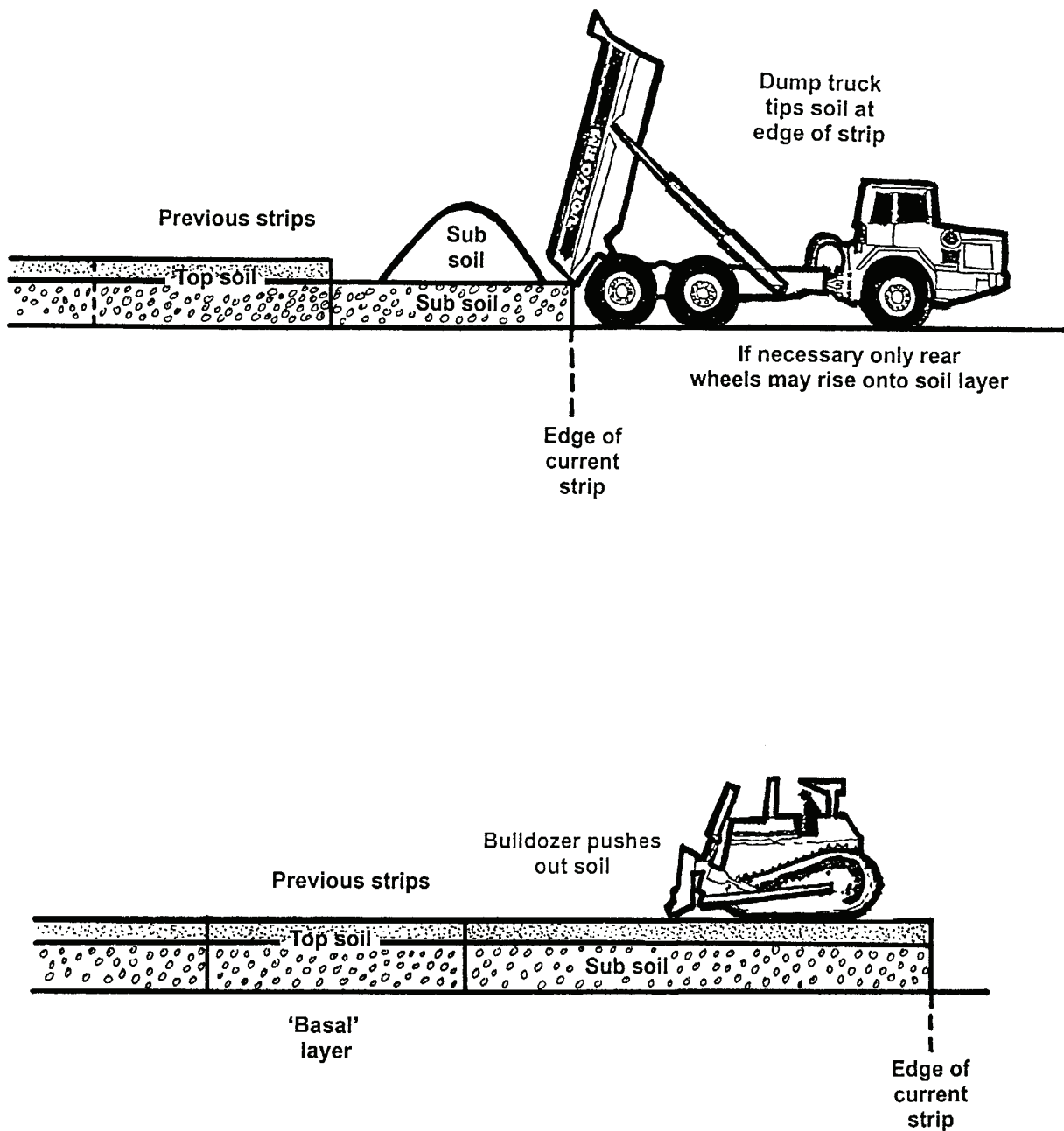
- 15.15 If the basal/formation layer is to be decompacted, before any soil material is placed, each strip is to be firstly decompacted before the subsoil layer is replaced. Decompaction is dealt with in Sheet 19, which covers strategies, equipment and methods of operation. The basal layer must only be decompacted in the strip required for soil replacement, and must be prepared on the day of soil placement. During this process it may be necessary to use Sheet 17 for the removal of stones or damaging materials from the basal layer.



**Figure 15.1 Soil replacement by bulldozers and dump trucks:
Sub soil layer**



**Figure 15.2 Soil replacement by bulldozers and dump trucks:
Sub soil layer**



**Figure 15.3 Soil replacement by bulldozers and dump trucks:
Top soil layer**

APPENDIX 8

DEFRA Good Practice Guide for Handling Soils Sheet 18
Soil Decompaction by Excavator Bucket



GOOD PRACTICE GUIDE FOR HANDLING SOILS

Sheet 18:

Soil Decompaction by Excavator Bucket

Issued by the Farming and Rural Conservation Agency, Cambridge

April 2000

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SHEET 18 SOIL DECOMPACTION BY EXCAVATOR BUCKET

The purpose of this Guidance Sheet is to provide a model method for best practice where an excavator bucket is used to decompact soils and basal/formation layers. Excavators are most likely to be used for this purpose where soils are replaced by either excavator and dump truck or bulldozer and dump truck combinations. This Guidance Sheet comprises 3 pages of text and a user response form.

The model may need to be modified according to site conditions or requirements of the Planning Authority. Where this is the case, deviation from the model should be recorded with reasons. The guidance does not specify the type, size or model of equipment, but this should have been agreed as part of the planning conditions or as a reserved matter. The machines should be of a kind which will cause the minimum compaction whilst being operationally efficient (eg wide tracked), and must be well maintained at all times.

Persons involved in the handling of soils, overburden etc., and in the construction or removal of mounds or tips, must comply with the Health and Safety at Work Etc. Act 1974 and its relevant statutory provisions, and in particular those aspects which relate to the construction and removal of tips, mounds and similar structures. This requirement takes preference over any suggested practice in the Sheets.

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This decompaction method uses an excavator (back-acting type) with a bucket to dig the soil layers to relieve compaction and smearing.

The advantage of this model method, if correctly carried out, is that it should result in the complete lateral decompaction of the soil layer. However the method is limited to relatively shallow depths due to practicalities and bucket size. There is no advantage

of this method over the use of tines (Sheet 19) in respect of soil water content, the soil must be dry enough to shatter.

There are a number of key operational points:

- the excavator is only to stand on and work from the basal/formation layer.
- the moisture content of the soils should be at least 5% below their plastic limit, or greater than this if so advised.

The Decompaction Operation

- 18.1 The excavator is only to stand on and work from the basal/formation layer.
- 18.2 The bucket is to be of a type with teeth.
- 18.3 Where the soil layer to be decompacted is up to about 0.5m thick the following procedure can be adopted. The excavator is to decompact the specified layer by systematically digging along a working face from the back to the front of the strip, working in sections. The digging is to be a cutting action, with the bucket down to the full depth of the layer to be decompacted, and through a scooping motion the soil material is lifted and re-deposited. It is essential each successive bucket 'dig' overlaps with the former both to the back and side of the dig. Finally, the bucket edge can be used to lightly grade the finished surface.
- 18.4 Where the soil layer is deeper than the capability of the bucket (about 0.5m), a 'double-digging' approach is needed. The process is to systematically work its way along the strip, and the next layer of soil is not to be laid until this operation is complete. The method is particularly time consuming and the method described in 18.5 below is recommended.

- 18.5 The alternative for deep profiles to be decompacted by this method is to place the layer in several layers, each up to 0.5m in thickness, and to sequentially decompact each layer as described in 18.3 above. The next layer is to be placed on the decompacted strip, but only when the former layer has been laid and decompacted along the entire length of the strip. The process is repeated until the soil horizon is replaced to the required thickness and has been ‘dug over’.

FIGURES

Legend:

- Extent of Phase 1
- Restoration contours @ 10m Intervals

Watercourses & Waterbodies

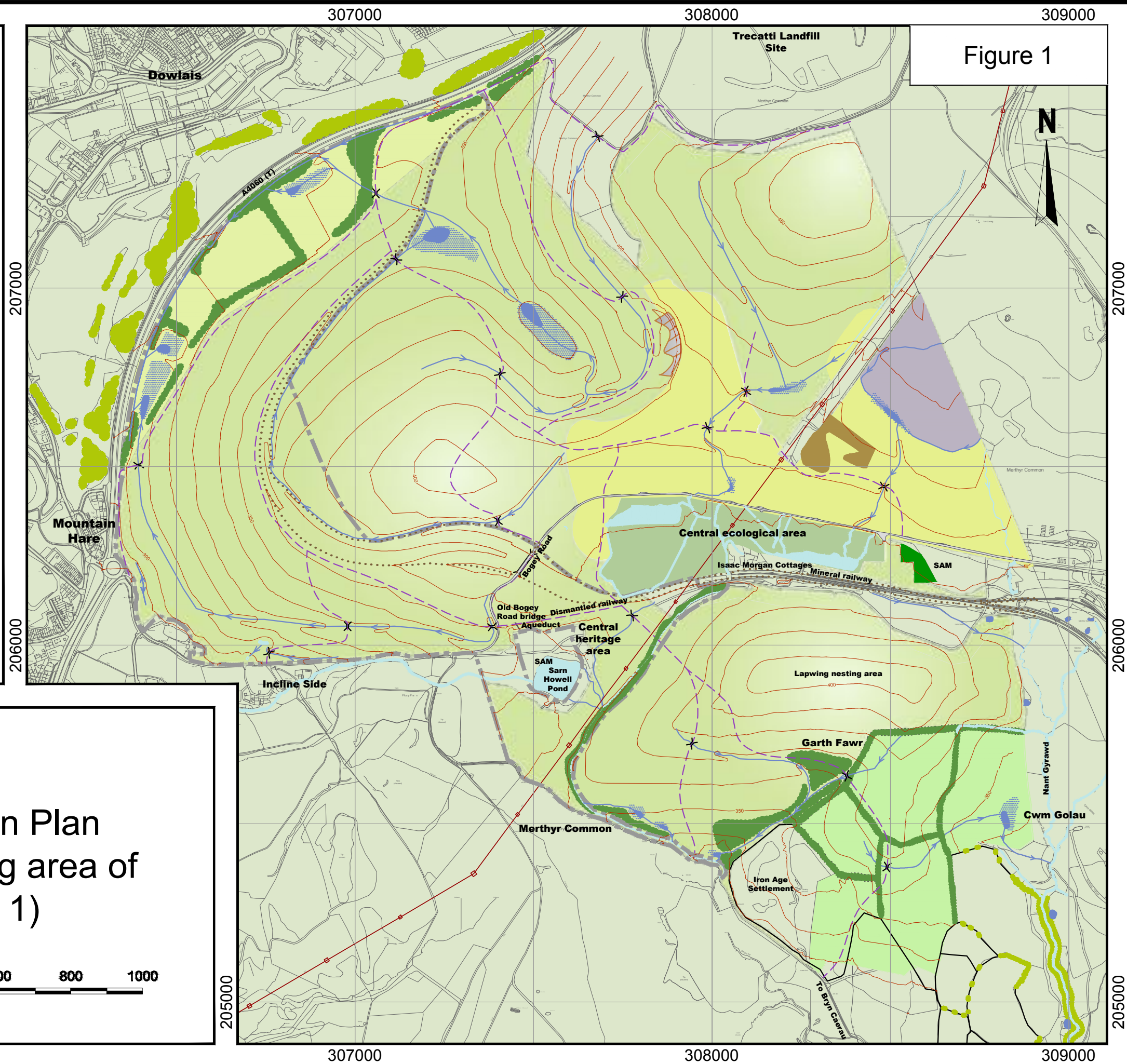
- Streams
- Ponds
- Ponds for Great Crested Newts
- Existing ponds

Vegetation

- Upland grassland
- Improved grassland
- Merthyr Tydfil land; natural regeneration
- Land form terraced to accommodate potential future railway corridor
- Acid grassland
- Wet heath
- Woodland and hedgerows
- Existing woodland and hedgerows
- Coniferous plantation woodland
- Existing field boundaries in Garth Fawr

Other features

- Exposed section of opencast high wall
- Hedgebank or stonewall boundary (if suitable stone is recovered)
- Potential area of 'finger tips' to be carefully re-exposed
- Footpaths
- Pylons and overhead power cables



Restoration Plan (Incorporating area of Phase 1)

Scale

0 200 400 600 800 1000

Metres

Legend:

- Extent of Phase 1
- Restoration contours @ 10m Intervals
- Streams
- Ponds

Soil Types

- 2** 2 - 8.9 Ha
- 4M** 4M - 65.8 Ha
- 4N** 4N - 22.6 Ha
- 4S** 4S - 11 Ha

Restoration Plan (Phase 1) Soil Reinstatement Strategy

Scale

0 200 400 600 800 1000

Metres

