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GAS CONNECTION

Gas Connection Environmental Report

Abergelli Power Project

Abergelli Power Limited

August 2018

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GLOSSARY

Abbreviation	Description
Access Road	An Access Road to the Project Site from the B4489 which lies to the west, formed by upgrading an existing access road between the B4489 junction and the Swansea North Substation (the Substation) and constructing a new section of access road from the Substation to the Generating Equipment Site
AGI	Above Ground Installation
AGI Access	Access for the AGI and Gas Connection Site during operation
AONB	Area of Outstanding Natural Beauty
AOD	Above ordnance datum
APL	Abergelli Power Limited
ATC	Automatic Traffic Count
AURN	Automatic Urban Rural Network
BAI	Bat Activity Index
BGS	British Geological Survey
BOP	Balance of Plant
CCS	City and County of Swansea Council
CEMP	Construction Environment Management Plan
CMS	Continuous Monitoring Stations
CSM	Conceptual Site Model
CSTP	Construction Staff Travel Plan
CTMP	Construction Traffic Management Plan
DAM	Development Advice Map
DCO	Development Consent Order
DEFRA	Department for Environment, Food and Rural Affairs
Drax	Drax Group plc
DVLA	Driver and Vehicle Licensing Agency
Ecological Mitigation Area	Area for ecological enhancement within the Project Site Boundary
EIA	Environmental Impact Assessment
FCA	Flood Consequence Assessment
FRMP	Flood Risk Management Plan
Gas Connection	A gas connection to the proposed Abergelli Power Project Station from the National Gas Transmission System comprised of an AGI and Gas Pipeline.

Abbreviation	Description
Gas Connection Site Boundary	The Boundary of the Gas Connection Site.
Gas Pipeline	Underground gas connection
Generating Equipment	One Gas Turbine Generator with one exhaust gas flue stack and BOP
Generating Equipment Site	The area containing the Generating Equipment
GCN	Great Crested Newt
Ha	Hectares
HDD	Horizontal Directional Drilling
HGV	Heavy Goods Vehicle
HSI	Habitat Suitability Index
HQ	Headquarters
JTC	Junction Turning Count
Km	kilometres
Kv	kilovolt
LAQM	Local Air Quality Monitoring
Laydown Area	A temporary construction compound for the storage of materials, plant and equipment as well as containing site accommodation and welfare facilities, temporary car parking and temporary fencing.
LEMS	Landscape and Ecology Mitigation Strategy
LOAEL	Lowest observable adverse effect level
L_W	Sound Power Levels
M	Metres
Maintenance Compound	A small area within the Laydown Area will be retained permanently.
MBGL	metres below ground level
MOC	Minimum Offtake Connection
MW	Megawatts
NETS	National Grid Electricity Transmission System
NRW	Natural Resource Wales
NSIP	Nationally Significant Infrastructure Project
NSR	Noise Sensitive Receptors
OCGT	Open Cycle Gas Turbine

Abbreviation	Description
OS	Ordnance Survey
PA 2008	The Planning Act 2008
PAH	Polycyclic aromatic hydrocarbons
PCB	Polychlorinated biphenyls
PEA	Preliminary Ecological Assessment
PFRA	Preliminary Flood Risk Assessments
PIC	Personal Injury Collision
PIG	Pipeline Inspection Gauge
Power Generation Plant	Peaking power generating station
PRoW	Public Right of Way
Project Site Boundary	The boundary of the Project Site to contain the 'Project'; The OCGT, Power Generation Plant and new connections to the gas and electricity networks on land adjacent to the Felindre Gas Compressor Station at Abergelli Farm, Felindre, Swansea SA5 7NN..
PTF	Pipeline Trap Facility
RBMP	River Basin Management Plan
SAC	Special Area of Conservation
SEWBReC	South East Wales Biodiversity Records Centre
SINC	Sites of Nature Conservation Interest
SLA	Special Landscape Area
SOAEL	Significant observable adverse effect level
SPA	Special Protection Area
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
Stag Energy	Stag Energy Development Company Ltd
Substation	Swansea North Substation
TCPA 1990	The Town and Country Planning Act 1990
The Project	The OCGT, Power Generation Plant and new connections to the gas and electricity networks on land adjacent to the Felindre Gas Compressor Station at Abergelli Farm, Felindre, Swansea SA5 7NN.
TPH	Total petroleum hydrocarbons
UDP	Unitary Development Plan

Abbreviation	Description
Watt Power	Watt Power Limited
WFD	Water Framework Directive
WSI	Written Scheme of Investigation

1. Introduction

1.1 Overview

1.1.1 This Environmental Report has been prepared on the behalf of Abergelli Power Limited (APL) for the gas connection (hereafter referred to as the "Gas Connection") to the proposed Abergelli Power Station from the National Gas Transmission System. The location of the Gas Connection can be viewed on Figure 1: Site Location Plan.

1.1.2 A screening opinion was submitted pursuant to Regulation 6(1) of the *Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017* (the 'EIA Regulations') (Ref.1.1) to City and County of Swansea Council (CCS) regarding the need for an Environmental Impact Assessment (EIA) for the Gas Connection on the 15th June 2018.

1.1.3 On the 19th July, CCS confirmed that the Gas Connection was not EIA Development, and therefore no EIA is required. This Environmental Report therefore provides the required detailed Environmental Information to support this Planning Application under the Town & Country Planning Act 1990.

1.2 Background

1.2.1 APL proposes to construct and operate an Open Cycle Gas Turbine ("OCGT") peaking power generating station (the "Power Generation Plant") and new connections to the gas and electricity networks on land adjacent to the Felindre Gas Compressor Station at Abergelli Farm, Felindre, Swansea SA5 7NN (the "Project").

1.2.2 APL's project is split into three different elements which are described below, which together form the "Abergelli Power Project". These elements are referred to as the Power Generation Plant, the Gas Connection, and the Electrical Connection.

1.2.3 The three main elements of the Project comprise:

- An OCGT peaking power generating station, fuelled by natural gas and capable of providing a rated electrical output of up to 299 Megawatts (MW). The Power Generation Plant comprises:
    - Generating Equipment including one Gas Turbine Generator with one exhaust gas flue stack and Balance of Plant (BOP) (together referred to as the "Generating Equipment") which are located within the "Generating Equipment Site";
    - An Access Road to the Project Site Boundary from the B4489 which lies to the west, formed by upgrading an existing access road between the B4489 junction and the Swansea North Substation (the "Substation") and constructing a new section of access road from the Substation to the Generating Equipment Site; and
    - A temporary construction compound for the storage of materials, plant and equipment as well as containing site accommodation and welfare facilities, temporary car parking and temporary fencing (the "Laydown Area"). A small area within the Laydown Area will be retained permanently (the "Maintenance Compound").
    - Ecological Mitigation Area – area for ecological enhancement within the Project Site Boundary;

- Permanent parking and drainage to include: a site foul, oily water and surface water drainage system.

- A Gas Connection in the form of a new Above Ground Installation (AGI) and underground gas connection (the "Gas Pipeline") to bring natural gas to the Generating Equipment from the National Gas Transmission System; and
- An Electrical Connection in the form of a new underground electrical cable to export power from the Generating Equipment to the National Grid Electricity Transmission System (NETS).

1.2.4 The Gas Connection is the focus of this Environmental Report.

1.3 Development Consent under the Planning Act 2008

a) Power Generation Plant

1.3.1 The Power Generation Plant described above would have a rated electrical output of up to 299 MW of electricity and is therefore classified as a Nationally Significant Infrastructure Project ("NSIP") under section 15 of the Planning Act 2008 (as amended) ("PA 2008").

1.3.2 As such, APL is applying to the Secretary of State ("SoS") for Business, Energy and Industrial Strategy under section 31 of the PA 2008 for a Development Consent Order ("DCO") for powers to construct, operate and maintain the Power Generation Plant. The DCO Application was submitted on 25th May 2018.

b) Associated Development

1.3.3 The Gas Connection and Electrical Connection comprise development associated with the NSIP ("associated development").

1.3.4 The PA 2008 restricts associated development for which consent can be sought under a DCO in Wales to development that is associated with a generating station with a capacity in excess of 350 MW. As the Power Generation Plant would have rated electrical output of up to 299 MW, associated development to the Power Generation Plant cannot be included in any application for DCO under the PA 2008. The application for a DCO therefore only includes the Power Generation Plant and related mitigation as "authorised development" and does not seek development consent for the Gas Connection or the Electrical Connection.

c) Town and Country Planning Act 1990

1.3.5 APL is seeking for planning permission for the Gas Connection under the Town and Country Planning Act 1990 ("TCPA 1990").

d) The Project Environmental Statement

1.3.6 The Project is a Schedule 1 development as it is a thermal generating station with a heat output of 300 MW or more as listed in Schedule 1, paragraph 2(1) of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009. As such, an EIA has been carried out in respect of the development.

1.3.7 Mitigation has been identified within the EIA carried out for the Project which is applicable to the Gas Connection. This mitigation includes both embedded mitigation (mitigation inherent in to the design of the Project and also specifically to the Gas

Connection), or additional mitigation (which is required to mitigate any residual adverse effects of the Project).

1.4 The Developer

1.4.1 The Applicant is APL, an energy development company established for the Project and owned by Drax Group plc (Drax).

1.4.2 Drax is responsible for generating 6% of the UKs electricity, predominantly via Drax power station in Selby. Drax is one of the UK's largest energy producers and is committed to helping to reduce carbon emissions, displacing more coal off the system and providing additional system support to plug the gaps created by intermittent renewables and boost security of supply.

1.4.3 Drax acquired APL from Watt Power Limited (Watt Power) in 2016. Stag Energy Development Company Ltd (Stag Energy) previously provided management services to Watt Power in relation to APL. Stag Energy continues to provide resources to APL through a management services agreement. Stag Energy was founded in 2002 and the company draws on a depth of experience within a team that has created and delivered over 10,000 MW of power generation and related infrastructure projects across the globe, of which 2,500 MW has been delivered in the UK.

1.4.4 APL is committed to the development of assets to support the UK Government's drive to a low carbon economy. APL recognises the need to balance commercial issues with the environmental benefits and concerns relating to energy projects and believes this balance can be responsibly delivered. The Gas Connection as part of the Project will be designed and developed to high quality, safety and environmental standards.

1.4.5 Further information on the companies referred to above is provided at www.abergellipower.co.uk or www.drax.com.

1.5 Structure of Report

1.5.1 The remainder of this report is structured as follows:

- **Section 2** presents a detailed description of the Gas Connection;
- **Section 3** presents an overview of the planning application and policy that relates to the Gas Connection;
- **Section 4** presents a description of the current land use at the Gas Connection and surrounding area;
- **Section 5** provides an overview of the potential environmental effects associated with the Gas Connection;
- **Section 6** presents a summary of effects; and
- **Section 7** contains the Report conclusions.

1.5.2 An EIA Screening Request and Screening Matrix have been completed for the Gas Connection and are included in Appendix 1 of this Report. A Mitigation Register has been prepared that outlines all the embedded and additional mitigation which has been identified to avoid, reduce or remedy any significant residual effects from the Project as a whole, but specifically for the Gas Connection. The Mitigation Register is included in Appendix 2.1 of this Report and has been abbreviated from the wider Project Mitigation Register for the mitigation, to include mitigation required for the Gas Connection only.

The Gas Connection Mitigation Register is cross-referenced throughout this Report for consistency and ease of reference.

1.5.3 This Report summarises the environmental assessments conducted as part of the Project ES and provides technical conclusions based on those assessments in relation to the likely significant effects of the Gas Connection.

2. Project Description

2.1.1 The Gas Connection will be in the form of a new AGI and Gas Pipeline. This is to bring natural gas to the Project from the National Gas Transmission System. Gas will be transported at a suitable rate and pressure to produce up to 299 MW when the Power Station is in use. The AGI will comprise a Minimum Offtake Connection (MOC) facility, which will be owned by National Grid; and a Pipeline Inspection Gauge (PIG) Trap Facility (PTF), which will be owned by APL.

2.1.2 The AGI (both the MOC and PTF) will be located on the southern side of the Rhyd-y-pandy Road leading to Felindre. Once complete, maintenance access for the AGI will be from the Rhyd-y-pandy Road via a short, purpose built tarmacadam access track. The Gas Connection will then follow a route corridor shown on Figure 2: Site Layout Plan, running in southerly direction to the Abergelli Power Station. It will be approximately 1.4 kilometres (km) in length. It will cross the National Gas Transmission System in two locations, a Public Right of Way (PRoW LC35B) in one location, two private farm tracks and one ditch (field drain). Termination of the Gas Connection will be at a second PTF located at the Abergelli Power Station.

Table 2-1: Maximum Parameters of Gas Connection Above-Ground Structures

Structure	Maximum Height (m)	Maximum Length (m)	Maximum Width (m)
Above ground installation (AGI)	3	85	35
Minimum offtake connection (MOC)	3	35	35
Gas Pipeline inspection gauge facility	3	35	35

2.2 Construction

2.2.1 The Gas Connection includes both the Gas Pipeline together with its connection with the AGI. The route for the actual Gas Pipeline will be marked out, topsoil stripped and moved to one side and the trench excavated. The exact construction method for the Gas Pipeline will be subject to further survey and dependant on the National Gas Transmission System depth and ground conditions.

2.2.2 Construction of the Gas Pipeline would likely take place within a temporary fenced strip of land called the ‘working width’. The working width is required to facilitate safe construction and the protection of off-site receptors.

2.2.3 It is likely that the working width would be 30 metres (m) along the length of the Gas Pipeline route, although it may be necessary to increase / decrease the working width at specific points. For example, adjacent to road and water crossings it may be necessary to increase the working width to provide additional working areas and storage for materials or special plant. Alternatively, adjacent to areas of conservation or existing services it may be necessary to decrease the working width to reduce potential impacts.

2.2.4 Aside from the special crossings, for example, water and road crossings, where trenchless techniques (e.g. Horizontal Directional Drilling, HDD) may be used to reduce impact on sensitive areas, it is expected that the Gas Pipeline would be constructed using standard open-cut cross-country pipeline construction techniques.

2.2.5 The Gas Pipeline will be delivered in spools and laid out along the route before welding into a string. The sections of pipe would then be lowered into the trench using side arm booms and backfilled for testing. Where the Gas Pipeline route crosses the National Gas Transmission System, an appropriate method of crossing will be undertaken which affords the appropriate level of protection to the National Gas Transmission System at its existing depth. This may include open cut techniques or a trenchless crossing such as HDD.

2.2.6 After the Gas Pipeline is laid, the excavated material and topsoil will be returned to its original position. The surface will then be seeded to restore it to its original state.

2.2.7 Gas systems skids will be placed and piping connected before commissioning the Gas Pipeline, pressure regulators and metering.

2.2.8 The Gas Connection will cross an existing PRoW LC35B. During construction, temporary closure(s) of all or part of the footpath and restriction of the use of the footpath may be required in order to ensure user safety. Details of how these temporary arrangements will be managed will be supplied in supporting management plans. It is not envisaged that the PRoW will be stopped up.

2.3 Operation and Maintenance

2.3.1 The Gas Connection would remain operational for the entire lifetime of the Project. No parts of the Gas Connection would be manned. Telemetry apparatus (both within the Gas Pipeline trench and at the AGI) would report back any issues to a central control room. Should any issues be identified, the Gas Pipeline would be isolated and the supply switched off, pending investigation of any faults. Access to the AGI during maintenance / repair would be via a new permanent access off Rhyd-y-pandy Road.

2.3.2 The primary maintenance and inspection activities would be as follows:

- Visual checks;
- In-line inspection;
- Cathodic protection checks; and
- Valve operation checks.

2.4 Decommissioning

2.4.1 It is assumed that the Gas Connection would be decommissioned after 25 years, which is the design life of the Power Generation Plant. However, it is important to note that elements of the Connection would be owned and operated by a third party. In accordance with its statutory duties, National Grid may use these assets in the future as part of its wider network.

2.4.2 As such, though the date of decommissioning of some elements of the Gas Connection cannot be certain, a 25 year working assumption has been used to allow for a reasonable assessment of decommissioning effects in this Report.

2.4.3 Finally, it is assumed that elements of the Gas Connection may be left in situ at the point of decommissioning, as this approach is likely to cause less environmental effects than removal. Any potential effects linked to decommissioning of the AGI and other ancillary elements are considered to be either less than or comparable with the construction phase, and are therefore not discussed separately.

2.5 Embedded Mitigation

2.5.1 Mitigation that is either implicit in the design of the Gas Connection or its construction and operation through standard control measures routinely used, such as working within best practice guidance during construction, is known as embedded mitigation. The embedded mitigation implemented in relation to the Gas Connection is summarised as follows but is outlined in greater detail within the Mitigation Register in Appendix 2.1 (the notation provided is for ease of reference):

- Production of an Outline Construction Environment Management Plan (CEMP) (GEN01) which includes waste management (OE01) (Appendix 2.2);
- Production of an Outline Landscape & Ecology Mitigation Strategy (LEMS) (GEN02) (Appendix 2.3);
- Management of dust and air quality mitigation (AQ01 – AQ04);
- Management of noise, noise generation and vibration management (N01 – N08);
- Protection of sensitive habitats, sensitive ecological features, protected species and designated sites (E01 – E03);
- Production of an Outline Surface Water Management Plan (WQ01) (Appendix 2.3), surface water management (WQ04) and drainage (WQ06 and WQ09);
- Protection of groundwater and hydrogeology features, peat management, identification and management of unexpected contamination(G01 – G03);
- Landscape and visual mitigation from PRoW and other amenity viewpoints (LV01);
- Production of a Construction Traffic Management Plan (CTMP) (Appendix 2.5) (including safety, severance and traffic management such as speed restrictions) in addition to a Construction Staff Travel Plan (CSTP) (T03 – T05) (Appendix 2.6); and
- Archaeological investigation including a Written Scheme of Investigation (WSI) (CH01 and CH02).

2.5.2 This embedded mitigation applies to the Gas Connection and has been assumed for this Environmental Report to be in place from the outset. The assessments included in this Report therefore consider the likely significant effects of the Gas Connection including embedded mitigation.

2.5.3 Any required additional mitigation is set out within the relevant assessment in Section 5 of this Report and cross referenced within the Mitigation Register in Appendix 2.1. The management plans committed to as embedded mitigation are also referenced where relevant.

3. Site Description

3.1 Gas Connection Location

3.1.1 The Gas Connection (see Figure 1) is located on open agricultural land approximately 2 km north of Junction 46 on the M4, approximately 3 km to the north of the city of Swansea, 1 km southeast of Felindre and 1.4 km north of Llangyfelach.

3.1.2 The current land use is improved grazing for sheep and horses on poor quality agricultural land (Agricultural Land Classification Grade 4). There are no residential dwellings located within the Gas Connection Site.

3.1.3 Ground levels vary from approximately 145 m above ordnance datum (AOD) at the highest point in the north-west corner at Rhyd-y-pandy Road to approximately 86 m AOD along the southern perimeter, with ground levels generally falling in a southerly and south easterly direction. The CCS Unitary Development Plan (UDP) Proposals Map (Ref.1.1) identifies mineral deposits along the Gas Connection including coal and sand and aggregates. There is a groundwater body below the Gas Connection of poor current and projected *Water Framework Directive* (Ref.4.2) status.

3.1.4 Two hedgerows are situated along the Gas Pipeline route that depict field boundaries that could have medieval origins. The first is located in the northern extent of the Gas Pipeline, running north-south along the field boundary that marks the edge of the western boundary of the Gas Connection. The second crosses perpendicular to the Gas Connection approximately half way along the Gas Pipeline length.

3.1.5 The Gas Pipeline route crosses one field drain that discharges into the Afon Llan. The Afon Llan links with the Afon Lliw and the River Loughor, which discharges into Carmarthen Bay through Bury Inlet, 7 km west of the Gas Connection. Carmarthen bay and its estuaries is designated as a Special Area for Conservation (SAC) and Bury Inlet is designated as a Special Protection Area (SPA), Site of Special Scientific Interest (SSSI) and as a wetland of international importance under the Ramsar Convention. There are no Main Rivers within the Gas Connection working width.

3.2 Surrounding Area

3.2.1 The area surrounding the Gas Connection is, at present, predominantly rural in character, although there is the Felindre Park and Share facility to the south and a substantial amount of utility infrastructure in the area, some of which the Gas Connection will cross.

3.2.2 The National Gas Transmission System, a Water Main and a decommissioned Oil Pipeline are all located in the area around the Gas Connection. To the west of the Gas Connection there is the Substation and Felindre Gas Compressor Station. There is also a network of electricity pylons, underground utilities and overhead lines which lead to and from the Substation. The Felindre Water Treatment Works is located to the northwest, while the Cefn Betingau Solar Park and Abergelli Solar Farm are located to the east of Gas Connection. A further three solar parks are built in the vicinity; Lletty-Morfil Solar Farm, Brynwhilach Solar Park and Gelliwern Isaf Solar Park.

3.2.3 Other features of the area include public footpaths, bridleways and tracks located in and around the Gas Connection, linking it to the wider area. Of particular note is the

LC35B PRoW, which crosses the Gas Connection. There are a number of residential properties between 600 m and 875 m from the Gas Connection. These include Cefn-betingau to the east, Feline Wen Farm and Llwynhelig to the south east, Maes-eglwys to the south, and Lletty-Morfil Farm and Abergelli Farm to the west.

3.2.4 There is a paintball activity centre located to the west of the Gas Connection off the B4889. Other tourist attractions and resources include the Cwm Clydach Nature Reserve woodland and nature reserve at Clydach, 3 km east of the Gas Connection and the National Cycle Route 43, which passes through Clydach on route to Swansea from Builth Wells.

3.2.5 There are a number of Sites of Nature Conservation Interest (SINCs) adjacent to the Gas Connection including:

- The Lletty-Morfil SINC (no. 106) to the east;
- The Rhos Fawr SINC (no.316) to the north across the Rhyd-Y-Pandy road from the Gas Connection.
- The Rhyd-Y-Pandy SINC (no. 315) is 71 m to the east; and
- Waun Garn Wen SINC (no. 105) 135 m to the west.

3.2.6 There is an area of Ancient Woodland that partially coincides with the Lletty-Morfil SINC and surrounds the Substation and the Gas Compressor Station to the west of the Gas Connection. There is also an area of Ancient Woodland to the east and a Wildlife Trust Reserve (Coed Barcud) to the north east. The Mawr Uplands Special Landscape Area (SLA) is located within 5 km of the Gas Connection, extending from the north-west round to the east.

4. Potential Environmental Effects

4.1.1 The following sections describe the potential effects from the construction, operation and decommissioning of the Gas Connection. Throughout the topic specific sections, reference will be made to both the Gas Connection Site and the wider Project Site Boundary; the former is the subject of this Environmental Report but where surveys or data collection has been made on the Project Site Boundary, this has been made clear.

4.1.2 In addition, reference will also be made to study areas. These may change in size and proximity to the Gas Connection, and in some topics, relate to the Project Site Boundary. Where relevant, this has been clearly set out.

4.1.3 In the interests of aiding the reader, these definitions are repeated for ease of reference:

- AGI - Above Ground Installation;
- Gas Connection - A gas connection to the proposed Abergelli Power Project Station from the National Gas Transmission System comprised of an AGI and Gas Pipeline;
- Gas Connection Site Boundary - The boundary of the Gas Connection Site;
- Gas Pipeline - Underground gas connection;
- Project Site Boundary - The boundary of the Project Site to contain the 'Project'; and
- The OCGT, Power Generation Plant and new connections to the gas and electricity networks on land adjacent to the Felindre Gas Compressor Station at Abergelli Farm, Felindre, Swansea SA5 7NN.

4.2 Ecology

a) Baseline Conditions

4.2.1 Previous ecological surveys have been undertaken by BSG Ecology in 2014 and have been repeated by AECOM in 2017/2018. These baseline reports are contained within the Appendices referred to throughout this section. Given the time between initial 2014 surveys and submission of the DCO Application for the Project, ecology surveys have been repeated to provide more recent ecological survey information to support the Project.

4.2.2 It should be noted that the Gas Connection fits entirely within the Project Site Boundary (for AECOM reports dated 2017/2018). The 2014 survey areas (BSG Ecology and Parsons Brinckerhoff reports) are more extensive than the 2017/2018 survey extents as the Project Site Boundary was larger in 2014. The Project Site Boundary has since been further refined to that shown on Figure 1 and Figure 2, and the survey areas reduced as required.

4.2.3 The survey extents for both 2014 and 2017/2018 surveys are shown on Figure 4.1, and therefore references to survey areas and any associated buffer zones or extents required for species specific surveys should be understood in the context of these boundaries.

4.2.4 A summary of the baseline conditions has been provided in the following sections using the surveys undertaken by BSG Ecology and AECOM. Detailed information such as survey data has been provided for each element in Appendices 3.1 – 3.19.

- Appendix 3.1: Preliminary Ecological Appraisal Report, 2017 (See section 5.1.6);
- Appendix 3.2: NVC Survey Report, 2014;
- Appendix 3.3: Invertebrate Survey Report, 2017 (See section 5.1.10);
- Appendix 3.4: Great Crested Newt Survey Report, 2017 (See section 5.1.16);
- Appendix 3.5: Reptile Survey Report, 2017 (See section 5.1.20);
- Appendix 3.6a: Breeding Bird Survey, 2017 Report (See section 5.1.27);
- Appendix 3.6b: Breeding Bird Survey, 2018 UPDATE Report (See section 5.1.32);
- Appendix 3.7a: Bat Roost and Walked Activity Transect Survey Report, 2017 (See section 5.1.33);
- Appendix 3.7b: Bat Roost and Walked Activity Transect Survey, 2018 UPDATE Report (See section 4.2.36);
- Appendix 3.8: Bat Survey Report, 2014 (See section 5.1.33);
- Appendix 3.9: Dormouse Survey Report, 2017 (See section 5.1.81);
- Appendix 3.10: Otter and Water Vole Survey Report, 2017 (See section 5.1.82);
- Appendix 3.11: Badger Survey Report, 2017 (Confidential) (See section 5.1.89);
- Appendix 3.12: Arboricutural Survey Report, 2014;
- Appendix 3.13: Preliminary Ecological Appraisal, 2014;
- Appendix 3.14: Otter and Water Vole Survey Report, 2014 (See section 5.1.82);
- Appendix 3.15: Final Dormouse Survey Report, 2014 (See section 5.1.81);
- Appendix 3.16: Breeding Bird Survey Report, 2014 (See section 5.1.27);
- Appendix 3.17: Great Crested Newt Survey Report, 2014 (See section 5.1.16);
- Appendix 3.18: Reptile Survey Report, 2014 (See section 5.1.20); and
- Appendix 3.19: Invasive Plant Species Survey Report, 2014 (See section 5.1.8).

i. Statutory Designated Sites

4.2.5 Using the MAGIC website three internationally designated sites were identified within 10 km and one nationally designated site within 2 km of the Gas Connection Site Boundary. The details of the sites are presented below in Table 4-1. The location of these sites in relation to the Gas Connection Site Boundary is shown on Figure 4.2 and 4.3.

Table 4-1: Statutory Designated Sites

Site and Statutory Designation and approximate distance/direction at nearest point	Summary Designating Features
Crymlyn Bog SAC and Ramsar 6.9 km south-east	**SAC** Annex I habitats that are a primary reason for selection of this site: Transition mires and quaking bogs; and, Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*. Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site: Alluvial forests with Alnus glutinosa *and Fraxinus excelsior* (Alno-Padion, *Alnion incanae*, *Salicion albae*). **Ramsar** Designated under Ramsar Criterion 1: Largest example of valley floodplain topogenous mire in South Wales, and one of the largest surviving fens in the west of Britain. Very few other sites are known to support a comparable complexity and diversity of vegetation. Designated under Ramsar Criterion 2: Supports a substantial population of the nationally-rare slender cotton-grass *Eriophorum gracile*, and a rich invertebrate fauna including many rare and highly localised species. Designated under Ramsar Criterion 3: The site supports 199 vascular plant species including 17 regionally-uncommon and one nationally rare.
Carmarthen Bay SAC 6.7 km west	A component part of the Carmarthen Bay and Estuaries/Bae Caerfyrddin ac Aberoedd European Marine Site. Partially overlaps Burry Port SPA and Ramsar. Annex I habitats that are a primary reason for selection of this site: Sandbanks which are slightly covered by sea water all the time; Estuaries; Mudflats and sandflats not covered by seawater at low tide; Large shallow inlets and bays; Salicornia and other annuals colonizing mud and sand; and, Atlantic salt meadows (Glauco-Puccinellietalia maritimae).

Site and Statutory Designation and approximate distance/direction at nearest point	Summary Designating Features
	Annex II species that are a primary reason for selection of this site: Twaite shad Alosa fallax. Annex II species present as a qualifying feature, but not a primary reason for site selection: Sea lamprey Petromyzon marinus; River lamprey Lampetra fluviatilis; Allis shad *Alosa alosa*; and, Otter.
Burry Inlet SPA and Ramsar 7.8 km south-west	A component site of the Carmarthen Bay and Estuaries/Bae Caerfyrddin ac Aberoedd European Marine Site. Partially overlaps the Carmarthen Bay SAC. Burry Inlet is a large estuarine complex located between the Gower Peninsula and Llanelli in South Wales. It includes extensive areas of intertidal sand- and mud-flats, together with large sand dune systems at the mouth of the estuary. The site contains the largest continuous area of saltmarsh in Wales (2,200 ha). The estuary experiences large tidal fluctuations (about 8 m), which has the consequence of exposing a large extent of intertidal sediments on a regular basis. These are mostly sandy, but muddy substrates are to be found in more sheltered areas. The Burry Inlet regularly supports large numbers of overwintering wildfowl and waders that feed in the saltmarshes and on the intertidal areas. **SPA** This site qualifies under Article 4.2 of the Birds Directive (2009/147/EC) by supporting populations of European importance of the following migratory species: <u>Over winter</u>: Oystercatcher *Haematopus ostralegus*, 13,590 individuals representing at least 1.5% of the wintering Europe& Northern/Western Africa population (5 year peak mean 1991/2 - 1995/6); and, Pintail *Anas acuta*, 1,772 individuals representing at least 3.0% of the wintering Northwestern Europe population (5 year peak mean 1991/2 - 1995/6). <u>Assemblage qualification: A wetland of international importance.</u> The area qualifies under Article 4.2 of the Directive (2009/147/EC) by regularly supporting at least 20,000 waterfowl.

Site and Statutory Designation and approximate distance/direction at nearest point	Summary Designating Features
	Over winter, the area regularly supports 34,962 individual waterfowl (5 year peak mean 1991/2 – 1995/6) including: curlew *Numenius arquata*, black-tailed godwit *Limosa limosa islandica*, dunlin *Calidris alpina alpina*, knot *Calidris canutus*, shoveler *Anas clypeata*, shelduck *Tadorna tadorna*, oystercatcher *Haematopus ostralegus*, pintail *Anas acuta*, whimbrel *Numenius phaeopus*. **Ramsar** Designated under Ramsar Criterion 5: *Assemblages of international importance.* Species with peak counts in winter: 41,655 waterfowl (5 year peak mean 1998/99-2002/2003). Designated under Ramsar Criterion 6: *Species/populations occurring at levels of international importance.* Qualifying Species/populations (as identified at designation): Species with peak counts in spring/autumn: Common redshank, *Tringa totanus*, 857 individuals, representing an average of 0.7% of the GB population (5 year peak mean 1998/9 – 2002/3). Species with peak counts in winter: Northern pintail, *Anas acuta*, NW Europe 2,687 individuals, representing an average of 4.4% of the population (5 year peak mean 1998/9 – 2002/3); Eurasian oystercatcher, *Haematopus ostralegus*, Europe & NW Africa – wintering 14,861 individuals, representing an average of 1.4% of the population (5 year peak mean 1998/9 – 2002/3); and, Red knot, *Calidris canutus islandica*, W & Southern Africa (wintering) 3618 individuals, representing an average of 1.2% of the GB population (5 year peak mean 1998/9 – 2002/3). Species/populations identified subsequent to designation for possible future consideration under Criterion 6. Species with peak counts in winter: Northern shoveler, *Anas clypeata*, NW & C Europe 467 individuals, representing an average of

Site and Statutory Designation and approximate distance/direction at nearest point	Summary Designating Features
	1.1% of the population (5 year peak mean 1998/9 – 2002/3).
Nant Y Crimp SSSI 1.75 km west	Nant y Crimp is of special interest for its wet pastures, species-rich neutral grasslands and semi-natural woodland as well as associated scrub, which are host to several uncommon plant species. Notable plant species recorded at the site include petty whin Genista anglica, cranberry Vaccinium oxycoccos, narrow buckler fern Dryopteris carthusiana and whorled caraway Carum verticillatum, the latter an Atlantic species characteristic of unimproved pastures in the South Wales coalfield. In addition, there is also a colony of the marsh fritillary butterfly Euphydryas aurinia at the site. This is a declining species confined, in South Wales to wet agriculturally unimproved pastures where its food plant, devil's bit scabious Succisa pratensis, grows in profusion.

ii. Non-Statutory Designated Sites

4.2.6 The desk study identified 12 non-statutory designated sites within 2 km of the Gas Connection Site Boundary, one is a Wildlife Trust Reserve and 11 are SINCs. Details of the sites are presented below in Table 4-2. The location of these sites in relation to the Gas Connection Site is shown on Figures 4.2 – 4.3.

Table 4-2: Non-statutory Designated Sites

Site and Statutory Designation and approximate distance/direction at nearest point from boundary	Distance and direction from the Gas Connection	Summary Designating Features
Lletty-Morfil SINC	Immediately adjacent south-west	Supporting the habitats: native wet woodland, ancient woodland, structurally-diverse and species-rich scrub, and purple moor-grass and rush pasture; and the Section 7 listed butterfly, wall *Lasiommata megera*.
Coed Barcud Wildlife Trust Reserve	Immediately adjacent north-east	A previously improved grassland field, planted up to become future woodland. Within the boundary of Rhoas Fawr SINC.
Rhos Fawr SINC	Immediately adjacent north	Supporting the habitats: woodland containing ancient woodland indicator species, structurally-diverse and species-rich scrub, species-rich neutral

Site and Statutory Designation and approximate distance/direction at nearest point from boundary	Distance and direction from the Gas Connection	Summary Designating Features
		grassland, purple moor-grass and rush pasture, and watercourse with exposure/erosion features; and a number of Section 7 listed bird species.
Felindre Grasslands SINC	1.5 km south-west	Native wet woodland, lowland mixed deciduous woodland, structurally-diverse and species-rich gorse scrub, and purple moor-grass and rush pasture; and a number of Section 7 listed invertebrate and bird species, and the Schedule 1 listed birds barn owl *Tyto alba* and Northern goshawk *Accipiter gentilis*.
Middle Llan SINC	473 m south	Supporting the habitats: Continuous semi-natural linear vegetation and watercourse with exposure/erosion features.
Rhyd-Y-Pandy Valley and Grasslands SINC	71 m east	Supporting the habitats: native wet woodland, woodland containing ancient woodland indicator species, gorse stands, lowland meadow, species-rich neutral grassland, structurally-diverse and species-rich scrub, purple moor-grass and rush pasture, reedbeds, and watercourse with exposure/erosion features; and a number of Section 7 listed invertebrate and bird species, and the Schedule 1 listed birds barn owl and red kite *Milvus milvus*.
Waun Garn Wen SINC	135 m west	Supporting the habitats: native wet woodland, structurally-diverse and species-rich scrub, purple moor-grass and rush pasture, and watercourse with exposure/erosion features; and a number of Section 7 listed invertebrate and bird species.
Pant Lasau SINC	611 m south	Supporting the habitats: native wet woodland, lowland mixed deciduous woodland, gorse stands, lowland fen, structurally-diverse and species-rich scrub, purple moor-grass and rush pasture, and watercourse with exposure/erosion features; and a number of Section 7 listed invertebrate and bird species.
Lower Lliw Resivoir SINC	458 m north	Supporting the habitats: woodland containing ancient woodland indicator species, gorse stands, species-rich bracken, structurally-diverse and species-rich scrub, purple moor-grass and rush pasture, and watercourse with exposure/erosion features; and a number of Section 7 listed invertebrate and bird species, and the Schedule 1 listed birds kingfisher

Site and Statutory Designation and approximate distance/direction at nearest point from boundary	Distance and direction from the Gas Connection	Summary Designating Features
		Alcedo atthis, merlin *Falco columbarius* and red kite.
Cefn Forest Stream SINC	1.2 km south-west	Supporting the habitats: woodland containing ancient woodland indicator species, upland mixed ash woodland, native wet woodland, lowland mixed deciduous woodland, lowland meadow, species-rich neutral grassland, structurally-diverse and species-rich scrub, degraded lowland heath, lowland fen, purple moor-grass and rush pasture, ponds, and watercourse with exposure/erosion features; and a number of Section 7 listed invertebrate and bird species, and the Schedule 1 listed barn owl.
Cilfaen SINC	759 m west	Supporting the habitats: wet woodland, woodland containing ancient woodland indicator species, and purple moor-grass and rush pasture.
Middle Lliw SINC	673 m west	Supporting the habitats: ancient semi-natural woodland, woodland containing ancient woodland indicator species, structurally-diverse and species-rich scrub, gorse stands, species-rich neutral grassland, semi-improved lowland dry acid grassland, acid grassland with anthills, purple moor-grass and rush pasture, watercourse with exposure/erosion features, and species-rich bracken; and a number of Section 7 listed invertebrate species.
Ancient Woodland 1	Immediately adjacent east	Ancient Semi Natural Woodland.
Ancient Woodland 2	58 m west	Ancient Woodland Site of Unknown Category.
Ancient Woodland 3	68 m west	Restored Ancient Woodland Site.
Ancient Woodland 4	635 m south	Restored Ancient Woodland Site.
Ancient Woodland 5	541 m south-west	Restored Ancient Woodland Site.
Ancient Woodland 6	698 m south-west	Restored Ancient Woodland Site.
Ancient Woodland 7	466 m south-west	Ancient Semi Natural Woodland.
Ancient Woodland 8	578 m south-west	Ancient Semi Natural Woodland.

Site and Statutory Designation and approximate distance/direction at nearest point from boundary	Distance and direction from the Gas Connection	Summary Designating Features
Ancient Woodland 9	803 m south-west	Restored Ancient Woodland Site.
Ancient Woodland 10	749 m east	Ancient Semi Natural Woodland.
Ancient Woodland 11	201 m north	Ancient Semi Natural Woodland.
Ancient Woodland 12	1 km south-west	Plantation on Ancient Woodland Site.
Ancient Woodland 13	809 m east	Ancient Semi Natural Woodland.
Ancient Woodland 14	958 m west	Ancient Semi Natural Woodland.
Ancient Woodland 15	970 m east	Ancient Semi Natural Woodland.
Ancient Woodland 16	1.8 km south-east	Ancient Semi Natural Woodland.
Ancient Woodland 17	1.4 km west	Ancient Semi Natural Woodland.
Ancient Woodland 18	1.1 km east	Restored Ancient Woodland Site.
Ancient Woodland 19	721 m north	Ancient Semi Natural Woodland.
Ancient Woodland 20	2.1 km south-east	Ancient Semi Natural Woodland.
Ancient Woodland 21	1.1 km east	Ancient Semi Natural Woodland.
Ancient Woodland 22	963 m north	Ancient Semi Natural Woodland.

iii. Protected Species Records

4.2.7 A wide range of historical records of protected and/or notable species were received from SEWBReC. Relevant records are reported in the Preliminary Ecological Assessment and corresponding technical baseline reports (Appendices 3.1 – 3.19). Historic records and survey results are considered together in the evaluation of ecological features below.

Phase 1 Habitat Survey

4.2.8 The land within the Gas Connection Site Boundary supports rows of trees, standalone trees, dense and scattered scrub, semi-improved grassland, marshy grassland, standing water and hedgerows.

4.2.9 A summary of data collected during the Phase 1 Habitat survey is presented in Table 4-3.

Table 4-3: Phase 1 Habitats within the Gas Connection Site Boundary

Habitat Type	Description	Extent
Dense/Continuous Scrub	There are several areas of dense scrub.	0.02 ha
Rows of Trees – Broadleaved	Rows of trees are predominantly located in between grassland fields and along road edges.	350 m
Standalone Trees	There are two standalone oak trees within the Gas Connection Site Boundary.	4
Semi-Improved Neutral Grassland	There is semi-improved neutral grassland present on road and track sides both within and adjacent to the Gas Connection Site Boundary. There are several semi-improved grassland fields within the centre of the Gas Connection Site Boundary.	1.02 ha
Marshy Grassland	There are a few areas of marshy grassland.	0.01 ha
Standing Water	There is one pond within the Gas Connection Site Boundary.	1
Hedgerows	There is 180m of species-poor hedgerow within the Gas Connection Site Boundary.	180 m

Invasive Plant Species

4.2.10 During the 2014 survey, BSG Ecology identified five invasive species within the Project Site Boundary subject to legal controls: Japanese knotweed; Himalayan balsam; rhododendron; floating pennywort *Hydrocotyle ranunculoides*; and montbretia *Crocosmia* × *crocosmiiflora*. Two of these species; Japanese knotweed and Himalayan balsam were found within the Gas Connection Site Boundary.

4.2.11 During the 2017 Phase 1 Habitat survey, three invasive species subject to legal controls were identified within the Gas Connection Site Boundary – Rhododendron *Rhododendron ponticum*, Japanese knotweed and Himalayan balsam, and one within the Gas Connection Site boundary - Japanese knotweed, on the northern perimeter, east of the AGI Access.

Invertebrates

4.2.12 Several records of notable moths and the protected marsh fritillary butterfly *Euphydryas aurinia* were returned from the local records centre.

4.2.13 Invertebrate surveys were carried out by BSG Ecology in 2014 for moths, beetles, and aquatic macroinvertebrates (in ponds and watercourses). There is no habitat with the potential to support marsh fritillary within the Gas Connection Site Boundary and they are considered to be absent from the survey area.

4.2.14 The watercourses were sampled and samples were analysed to at least family level as required to obtain a score for water quality for the watercourse sections sampled; where possible, species were also recorded for completeness and so that any rare species collected would be identified. Watercourse 4 is the only watercourse within the Gas Connection Site. The report did not highlight any rare species and concluded the watercourses were of generally good quality.

4.2.15 Notable or Priority beetle, butterfly and moths species identified during the survey are given in 4-4 below. Thirteen Section 7 species of moth were recorded during the survey. Their habitat requirements fit with the habitats present within the Gas Connection Site Boundary, and as such it is likely they are present.

Table 4-4: Notable and Priority beetle, butterfly and moth species from within the Survey Site

Species	Status	Notes
Nitulid beetle *Epuraea distincta*	Nationally Scarce	This saproxylic species is associated with fungi (notably bracket fungi) on trees, especially in wet woodland. Samples were taken from two pitfall traps in the woodland in the east of the Gas Connection Site.
Melandryid beetle *Orchesia micans*	Nationally Scarce	This saproxylic species was found on the remnants of fungus on a single birch tree in the woodland in the east of the Gas Connection Site.
Small heath butterfly *Coenonympha pamphilus*	Section 7 species	Widespread and common, and found in a fairly wide variety of habitats with its main food plants being grasses. Specific location not given, although majority of butterflies were recorded in a narrow strip of flower-rich habitat in the southern-most part of the area that was surveyed.
Dusky brocade moth *Apamea remissa*	Section 7 species	The moth is associated with grasses, and there are patches of tall grassland along tracks, roads and on waste ground within the Survey Site.
Garden tiger moth *Arctia caja*	Section 7 species	This species has become scarce in eastern Glamorgan, but remains common in the south and west.
Latticed heath moth *Chiasmia clathrata*	Section 7 species	Common and widespread in southern Glamorgan.
Broom moth *Melanchra pisi*	Section 7 species	Locally, the favoured larval food plant is bracken.
Shoulder-striped wainscot moth *Mythimna comma*	Section 7 species	The larvae feed on a range of grasses.
White ermine moth *Spilosoma*	Section 7 species	The larvae feed on a range of herbaceous plants.

Species	Status	Notes
lubricipeda		
Buff ermine moth *Spilosoma luteum*	Section 7 species	The larvae have wide ranging feeding preferences.
Blood vein moth *Timandra comae*	Section 7 species	Common across England and Wales. The moth is associated with a variety of herbaceous plants, but docks in particular, so it would have been well suited to the field margins and woodland within the Gas Connection Site Boundary.
Cinnabar moth *Tyria jacobaeae*	Section 7 species	The moth is almost exclusively associated with common ragwort (*Jacobaea vulgaris*) and there are some small patches of this plant within the Survey Site, many of which support larvae of this species.
Ear moth agg. moth *Amphipoea oculea*	Section 7 species	The three ear moths that have been recorded in Glamorgan are all either uncommon or rare in the county.
Small phoenix moth *Ecliptopera silaceata*	Section 7 species	Common, widespread resident in Glamorgan, and found in a range of habitats.
Dusky thorn moth *Ennomos fuscantaria*	Section 7 species	Occurs wherever the food plant, ash is found.
Rosy rustic moth *Hydraecia micacea*	Section 7 species	Occurs in a wide range of habitats including gardens, waste ground, pasture, fens, marshes and woodland rides.

Amphibians

4.2.16 Records of common toad *Bufo bufo*, palmate newt *Lissotriton helveticus* and common frog *Rana temporaria* were returned from the local records centre.

4.2.17 Twenty-six ponds were subject to a Habitat Suitability Index (HSI) assessment to assess suitability for support breeding Great Crested Newt (GCN). From the results of the HSI assessment and where access allowed seven ponds were subject to further surveys for GCN including eDNA analysis.

4.2.18 No GCNs were recorded during the 2014 and 2017 surveys, and the eDNA analysis returned negative results for each of the ponds for GCN within the Gas Connection Site Boundary.

4.2.19 Ponds 22 and 23 are located within the Gas Connection Site Boundary and may require removal. Pond 22 currently supports palmate newts and is likely to support other amphibians including frogs and toads as well as a range of generalist aquatic invertebrates. Pond 23 could not be assessed but if it contains water has the potential to support generalist aquatic invertebrates and common amphibians.

4.2.20 The majority of the habitat suitable for supporting common amphibians is present south of the Gas Connection Site. The dominance of improved grassland fields with fenced boundaries in the north limits the suitability of the area for supporting amphibians.

4.2.21 It is considered unlikely that GCN will be present within any of the ponds that were not surveyed or within 500 m of these ponds in surrounding habitat given the absence of GCN from all nearby ponds surveyed. The Gas Connection will require the removal of Pond 23. Pond 23 could not be assessed but, if it contains water, it has the potential to support common amphibians.

Reptiles

4.2.22 The desk study confirmed the presence of slow-worm *Anguis fragilis*, grass snake *Natrix helvetica helvetica*, adder *Vipera berus* and common lizard *Zootoca vivipara* within 2 km, and the presence of grass snake and common lizard within the Gas Connection Site Boundary.

4.2.23 During the 2017 reptile survey (survey area as shown on Figure 2 of Appendix 3.5), a total of 51 adult and juvenile common lizard observations were recorded within the Project Site Boundary, with a peak count of six adults recorded on one survey visit. Observations of common lizard were recorded from across the reptile survey area. The majority of records were from the verges either side of the grassy track running through the centre of the Gas Connection Site and from the semi-improved neutral grassland present around the National Grid site.

4.2.24 During the course of the reptile survey, male, female, and juvenile common lizards were recorded, which confirmed that there was a breeding population present within the Project Site Boundary.

4.2.25 Based on the survey results and the criteria laid out in Froglife Advice Sheet 10 (Ref.5.1), the Site supports a ‘Good population’ of common lizard.

4.2.26 The Gas Connection Site does not meet the criteria for a ‘Key Reptile Site’.

4.2.27 The survey areas for grass snake remain the same in both the 2014 and 2017 surveys (survey area as shown on Figure 2 of Appendix 3.5). No grass snakes were identified within the 2017 reptile survey area including the area with the highest abundance during the 2014 surveys. However, there is the potential for grass snake to be present within the Gas Connection Site Boundary and to have gone unrecorded since grass snakes are wide ranging.

4.2.28 As such, it should be assumed grass snake is likely to be present at low densities within the Gas Connection Site Boundary and surrounding habitat.

Breeding Birds

4.2.29 Breeding bird surveys were undertaken in 2014 (BSG Ecology report, Appendix 3.16) and in 2017/2018 (AECOM, Appendix 3.6a and Appendix 3.6b). The survey area is more extensive in 2014 as the Project Site Boundary was larger. The 2017/2018 surveys were undertaken on a refined Project Site Boundary but covered the same core areas which make up the Project.

4.2.30 The BSG Ecology surveys identified nine Section 7 bird species (previously referred to as species of principal importance for nature conservation in S42 of the NERC Act 2006, now repealed by Environment (Wales) Act 2016) comprising cuckoo *Cuculus canorus*, grasshopper warbler *Locustella naevia*, dunnock *Prunella modularis*, house sparrow *Passer domesticus*, linnet *Carduelis cannabina*, lesser redpoll *Acanthis*

cabaret, skylark *Alauda arvensis*, song thrush *Turdus philomelos*, and tree pipit *Anthus trivialis* were considered likely to breed on-site.

4.2.31 All nine Section 7 species recorded are also red-listed species of conservation concern in Wales, with the exception of dunnock (which is amber-listed). An additional seven amber-listed species, bullfinch *Pyrrhula pyrrhula*, mistle thrush *Turdus viscivorus*, meadow pipit *Anthus pratensis*, reed bunting *Emberiza schoeniclus*, common redstart *Phoenicurus phoenicurus*, whitethroat *Sylvia communis* and willow warbler *Phylloscopus trochilis* were also considered to have bred.

4.2.32 No territories of species listed under Schedule 1 Part 1 of the Wildlife & Countryside Act 1981 (as amended) (Schedule 1 species) were recorded, although two Schedule 1 species were recorded during the surveys, as follows. A pair of red kite was recorded mobbing a peregrine falcon *Falco peregrinus* in May. A pair of red kite was also recorded flying over the breeding bird survey area on the same survey day. Given the timing of the records, and that at least one pair were recorded during survey it is likely that red kite breed locally but that the single record of peregrine referred to a transient bird. No evidence was found to suggest breeding of either species occurred within the breeding bird survey area during 2014.

4.2.33 The single breeding bird survey undertaken in 2017 revealed the same nine Section 7 bird species as recorded during the 2014 survey (cuckoo, grasshopper warbler, dunnock, house sparrow, linnet, lesser redpoll, skylark, song thrush and tree pipit). Nine further species listed on the Amber List were also recorded (bullfinch, common redstart, meadow pipit, mistle thrush, meadow pipit, reed bunting, stock dove, whitethroat and willow warbler) although no species listed on Schedule 1 were recorded within the Project Site Boundary. The survey results from 2017 are largely found to be in line with what was identified in 2014 and there is no significant difference in species breeding within the Project Site Boundary between the two surveys.

4.2.34 A survey for goshawk was undertaken in February 2018 of habitats suitable for supporting the species and with the potential to be impacted by the Project. During the survey there were no observations of goshawk.

4.2.35 Four further breeding bird surveys were conducted between April and May 2018. The 2018 surveys recorded similar species assemblages as for 2014 and 2017, but the numbers of birds were due to a targeted survey with a reduced survey area.

Bats

4.2.1 All of the distances specified in this section are relative to the wider Project Site Boundary not just the Gas Connection Site. In addition, bat features are explained in the wider context of the Project Site Boundary where relevant due to the connectivity of features for commuting, foraging and roost, and therefore may be outside the Gas Connection Site Boundary.

4.2.2 Bat surveys were undertaken by BGS in 2014 (Appendix 3.8), AECOM in 2017 (Appendix 3.7a) and completion of remaining surveys in 2018 to provide an updated report (Appendix 3.7b).

4.2.3 The desk study identified no sites designated for bats within 10 km of the Project Site Boundary. The desk study confirmed the presence of the following species from within 2 km of the Project Site Boundary: Daubenton's *Myotis daubentonii*, Natterer's *Myotis*

nattereri, Noctule *Nyctalus noctule*, pipistrelle species *Pipistrellus sp*., common pipistrelle *Pipistrellus pipistrellus,* soprano pipistrelle *Pipistrellus pygmaeus,* long-eared species *Plecotus sp.,* brown long-eared *Plecotus auritus* and generic records of bat species *Chiroptera*. None of these records of bats were from within the Project Site.

4.2.4 The desk study identified the following records of known roost sites within 2 km of the Project Site:

- A noctule tree roost approximately 1 km north-west of the Project Site Boundary;
- Common pipistrelle roost approximately 1.3 km east of the Project Site Boundary;
- A common pipistrelle roost approximately 1.8 km south-east of the Project Site Boundary;
- A common pipistrelle roost approximately 1 km southeast of the Project Site Boundary;
- A common pipistrelle roost approximately 1 km north-west of the Project Site Boundary;
- A soprano pipistrelle roost approximately 2 km south-west of the Project Site Boundary;
- A soprano pipistrelle roost approximately 2 km north-west of the Project Site Boundary;
- A long-eared bat and brown-long-eared bat roost approximately 1.6 km east of the Project Site Boundary; and,
- A long-eared bat and brown long-eared bat roost approximately 1.1 km north-west of the Project Site Boundary.

4.2.5 The specific locations of the bat roosts are confidential.

Bat Roosts

4.2.6 There are no buildings suitable for supporting bats within the Gas Connection Site, or the within the wider Project Site Boundary.

4.2.7 Buildings adjacent to the Project Site Boundary were assessed, and summarised below. Building locations can be found in Appendix 3.7b, Figure 2.

- AECOM Building 1: Unknown Roost Status. Not surveyed by AECOM or BSG Ecology, Building is approximately 125m from the Project Site Boundary;
- AECOM Building 2: Confirmed as a long-eared and pipistrelle roost by BSG in 2014 (Appendix 3.8). Not surveyed by AECOM. It is approximately 120 m outside of the Project Site Boundary;
- AECOM Building 3: No Roost;
- AECOM Building 4: No Roost;
- AECOM Building 5: No Roost;
- AECOM Building 6: No Roost;
- AECOM Building 7: Confirmed as a lesser horseshoe, long-eared and pipistrelle roost by BSG Ecology in 2014 (Appendix 3.8). Surveyed by AECOM in 2018 (Appendix 3.7b) and confirmed summer, non-maternity roost for at least two lone roosting common pipistrelle bats, a summer roost, possibly maternity, for at least 8 long-eared bats and a suspected roost for at least one Myotis sp.
- AECOM Building 8: BSG Ecology internal inspection did not find evidence of bats but not all areas were accessible (Appendix 3.8). Due to the bat roost features identified by BSG Ecology an internal inspection only is not sufficient to determine if this building is being used as a bat roost. Therefore it was surveyed in 2018 by AECOM (Appendix 3.7b) and confirmed as a summer non-maternity roost for at least two lone roosting common pipistrelle bats.

4.2.8 Tree 19 is a lone male or non-breeding female common pipistrelle summer roost. No other trees were identified as bat roosts. A photograph of Tree 19 is shown in Appendix 3.7b, Plate 1.1.

4.2.9 A trial shaft (mining feature) and a mine adit are located within the Project Site Boundary. A safety investigation confirmed that the trial shaft has been filled in. The respective landowner has confirmed that the mine adit, located next to Building 4, is an underground feature that has been capped and is now covered by grass. Therefore, there is no likelihood of hibernating bats or any suitable bat habitat being present in either of the mine related features within the Project Site Boundary.

Bat Activity – Walked Transects

4.2.10 At least 13 species of bat were recorded foraging and/or commuting in close proximity of and within the Project Site Boundary. The following species have been identified during bat surveys at the Project Site Boundary during the bat surveys undertaken in 2017/2018:

- Greater horseshoe;
- Lesser horseshoe;
- Common pipistrelle;
- Soprano pipistrelle;
- Nathusius' pipistrelle;
- Daubenton's;
- Natterer's;
- Mytois species; (including calls with characteristics of Bechstein's, Brandt's Myotis brandtii and Whiskered Myotis mystacinus);
- Noctule;
- Serotine;
- Leisler's;
- Long-eared species; and,
- Indeterminate species.

4.2.11 Common and soprano pipistrelles were the most commonly recorded species in the Project Site (Appendix 3.7b). Overall pipistrelle species comprised 87.3% of all passes recorded on the walked transect surveys and 93.8% of the static detector surveys. They were also the most commonly recorded species during the emergence/re-entry surveys. Pipistrelle species comprised of 89.9% of the passes recorded on the North Transect and 85.6% of the passes recorded on the South Transect.

4.2.12 Similarly, pipistrelle species were the most commonly recorded species during the BSG 2014 transect and static detector surveys (Appendix 3.8).

4.2.13 Two passes of Nathusius' pipistrelle were recorded during the July 2017 transect surveys, one record from the South Transect and one record from the North Transect, making up 0.2% of total bat passes.

4.2.14 Overall Myotis species comprised 9.5% of the total calls recorded on the transect surveys. Myotis species comprised 7.7% of the passes recorded on the North Transect and 10.8% of the calls recorded on the South Transect.

4.2.15 Activity levels for Myotis species during the transect surveys were comparable with the activity levels recorded during the BSG 2014 transect surveys (Appendix 3.8).

4.2.16 Noctule, serotine and Leisler's (N/S/L) bats comprised 1.8% of the passes recorded on walked transect surveys. N/S/L bats comprised of 1.6% of the passes recorded on the North Transect and 2.0% of the passes recorded on the South Transect. The percentages by species within Appendix 3.7a and 3.7b are not comparable to 2014 surveys as the species were not split by species (Appendix 3.8).

4.2.17 Long-eared and possible long-eared bat comprised a total of 0.4% of the passes recorded on the North Transect and 0.4% recorded on the South Transect surveys. BSG Ecology did not breakdown these species into percentages but figures are comparable between years (Appendix 3.8).

4.2.18 There was a single lesser horseshoe bat pass, recorded on the South Transect, equating to 0.2% of the total passes for the South Transect and 0.1% of the total passes for the Project Site Boundary. This was recorded in August 2017 (Appendix 3.7a). BSG Ecology also recorded a single pass of lesser horseshoe on the South Transect (Appendix 3.8).

4.2.19 Higher levels of activity were recorded in the Southern Transect (713 bat passes; 15.4 Bat Activity Index (BAI)), compared to the Northern Transect (555 bat passes, 12.3 BAI). The bat activity levels across the Project Site Boundary however are broadly similar.

4.2.20 Bat activity was recorded across the Project Site (Appendix 3.7a.b, Figure 5.1). Vegetated stream or wet ditch corridors appear to be important for bats within the Project Site Boundary. The distribution of bat calls suggests the following general patterns of activity. This is a qualitative assessment only:

- Pipistrelle bats were recorded across the Project Site;
- Myotis species showed some association with mature tree lines and/or areas near water;
- Noctule, serotine and Leisler bats were primarily recorded at height over open fields across the Project Site;
- Long-eared bats showed some association with mature tree lines and are focused more towards the centre and south-east of the Project Site. The passes recorded are within approximately 315m to 700m of the confirmed long-eared roost in Building 7 and approximately 270m and 850m of the BSG confirmed long-eared roost in Building 2;
- The single lesser horseshoe was recorded on the South Transect along a mature tree line approximately 900m south of the closest known lesser horseshoe roost in Building 2.

4.2.21 Bat activity was recorded at the Project Site between June and October 2017 and April and May 2018 (Appendix 3.7a,b).

4.2.22 August had the highest BAI for both transects. The North Transect had a BAI of 17.2 and the South Transect had a BAI of 24.9.

4.2.23 May had the second highest BAI for both transects. The North Transect had a BAI of 15.1 and the South Transect had a BAI of 20.4.

4.2.24 For the static detector surveys, July had the highest BAI of 456.8; the second highest BAI was 428.3 in May and third highest BAI was 423.0 in August.

4.2.25 As seen in Plate 1.4 the month of August has a greater level of species richness than April and September. This was a statistically significant result as seen in Appendix 3.7b, Appendix 4A: Tables 2.3 and 2.4.

4.2.26 The statistical analysis of the first night of static detector data showed that there is no significant difference between the bat activity in each month sampled (Appendix 3.7b, Plate 1.2 and Appendix 4A: Table 2.2) as there was not statistically significant results between any of the months.

4.2.27 Young bats are typically born in June and July and during August the young are starting to leave the roosts to fly and feed. October is part of the bat mating period and a time when bats are extensively foraging for food as they are looking to store fat for the winter hibernation period. The general ecology of bat species is likely to influence the temporal activity for the Project Site.

Bat Activity – Static Detectors

4.2.28 Static detector locations are presented in Appendix 3.7b, Figure 3.4.

4.2.29 In total 83,329 bat passes were recorded during the static detector surveys. Appendix 3.7b, Table 1.22 gives the bat activity by the Static Detector Location Groups. Higher levels of activity were recorded in the Southern Static Detector Locations (20,470 total bat passes; 264.1 BAI), compared to the Northern Static Detector Locations (21,492 total bat passes, 231.1 BAI), reflecting the pattern of the walked transect.

4.2.30 Using the first night data from static detector surveys, the species richness recorded across different locations was not statistically significant (Appendix 3.7b, Appendix 4A: Table 2.3), i.e. one location did not support a significantly different diversity of bats than any other location.

4.2.31 The distribution of bat echolocation calls detected during the static detector surveys suggests the following general patterns of activity. This is a qualitative assessment only:

- Pipistrelle bats were recorded across the Project Site;
- Myotis species were recorded across the Project Site;
- Noctule, Serotine and Leisler bats were recorded across the Project Site;
- Long-eared bats were recorded across the Project Site, with highest numbers recorded at Lane 3, followed by South 3 and North 2;
- Greater horseshoe bats were recorded across the Project Site, with the South having the highest number of passes; and,
- Lesser horseshoe bats were recorded across the Project Site within the highest number recorded in the south and south-west of the Project Site at South 2, South 3, Lane 1 and Lane 2.

4.2.32 The highest level of activity was recorded in the Lane Static Detector Locations (41,367 total bat passes, 537.23 BAI). The Lane Static Detector Locations (even with the equipment malfunctions, see Limitations) had higher levels of activity compared to both the North and South Static Detector Locations combined. This may be because the Lane is likely used for foraging, along the sheltered woodland edge, and detectors may have been recording multiple passes by the same bats up and down the Lane.

Dormouse

4.2.33 No records of dormouse were returned from the local records centre. No evidence of dormouse was identified during the field surveys.

Water Vole

4.2.34 No records of water vole were returned during the desk study.

4.2.35 No watercourses that had potential for supporting water vole were recorded within the Gas Connection Site Boundary.

Otter

4.2.36 There were no watercourses found within the Gas Connection Site Boundary suitable for supporting foraging otter, holt and couch creation. Water course 6 is suitable, which is immediately adjacent to the eastern boundary of Gas Connection Site.

4.2.37 Within the Project Site Boundary (as located in Appendix 3.10, Figure 1.1) a total of thirteen watercourses were found suitable for supporting commuting otter and two watercourses were suitable for supporting foraging otter, holt and couch creation. One potential couch was identified with a trampled vegetation track leading to it which suggested occasional use by a mammal. Two mammal tracks were identified; these may have been fox or another mammal. No spraints, holts, footprints, anal jelly or other signs were identified during the otter surveys.

4.2.38 Due to the confirmed presence of otter upstream from the Project Site in 2015, the presence of spraints and a footprint from a nearby pond in May 2017 and the presence of a couch, slide pathway, feeding remains and a spraint from a watercourse it can be concluded that otters are still active in the locality. As such it is likely that otters use the suitable watercourses within the otter survey area for occasional forging, commuting, resting and holt creation; although no evidence of holts was identified during the survey.

Brown Hare

4.2.39 No records of brown hare Lepus europaeus were returned from the local records centre.

4.2.40 Sightings of brown hare were made during surveys for other species. A targeted survey for brown hare was not undertaken.

4.2.41 Scrub, trees and grassland habitat present throughout the Gas Connection Site are suitable for supporting the species.

Badger

4.2.42 The badger survey area (as located in Appendix 3.11, Figure 1) contains suitable habitat for supporting badgers. The scrub, woodland edge and grassland habitat present throughout the badger survey area are suitable for supporting the species. A total of five badger setts were recorded during the survey (two of which were within 100 m of the Gas Connection Site Boundary and the other three were well outside of the Gas Connection Site Boundary).

4.2.43 The survey identified signs of badger actively using the Gas Connection Site. Badger signs recorded included dung pits and mammal paths. It is therefore likely that badger

use the Gas Connection Site on a regular basis for foraging and to commute between foraging areas within the wider landscape.

b) Potential Environmental Effects

i. Construction

4.2.44 Table 4-5 presents a summary of the likely ecological effects from the Gas Connection during construction. They identify the receptor/s likely to be affected and include the additional mitigation proposed, as detailed within the LEMS (Appendix 2.1, (GEN02)) and illustrated in the Landscape and Ecology Mitigation Plan in Figure 4.4 with the Project Site Boundary.

Table 4-5: Ecology Summary of Effects Arising During Construction Phase for the Gas Connection

Receptor	Description of Effect	Additional Mitigation
Dense/Continuous Scrub	Habitat loss – there will be a temporary loss of 0.02 ha	None
Rows of Trees – Broadleaved	Habitat loss – there will be a temporary loss of 350 m.	Temporarily removed habitats will be reinstated. Mature trees will be replaced by standards of the same species or transplanted to a suitable location elsewhere within the Gas Connection Site.
Standalone Trees	Loss of up to two trees.	None
Semi-Improved Neutral Grassland	Habitat loss – there will be a temporary loss of 1.02 ha of semi-improved neutral grassland.	None
Marshy Grassland	Habitat loss – there will be a temporary loss of 0.01 ha of marshy grassland.	Temporarily removed habitats will be reinstated.
Standing Water	Habitat loss – temporary removal of Pond 23.	Mitigation for the loss of standing water habitat will include the provision of replacement habitat. Provisionally, it has been suggested that a wildlife pond will be provided at the AGI.
Hedgerows	Habitat loss – there will be a temporary loss 180 m of species-poor hedgerow.	Temporarily removed habitats will be reinstated.
Invertebrates	Loss of habitat - temporary removal of habitat suitable for supporting the Section 7 listed butterfly, common species, and Section 7 species of moth and butterfly.	Habitats will be reinstated after works are complete.
Amphibians	Temporary loss of suitable breeding, foraging and sheltering habitat including a pond (may be possible to avoid), scrub, semi-improved neutral grassland, marshy grassland, rows of trees and species-poor hedgerows.	Habitats will be reinstated once works are complete including the pond located at the AGI.
	Potential for injuring or killing of amphibians during habitat removal, trampling and vehicular movements.	A Method Statement will be finalised pre-construction.
Reptiles	Temporary loss of suitable breeding, foraging and sheltering habitat including scrub, semi-improved neutral grassland, marshy grassland and species-poor hedgerows.	Habitats will be reinstated once works are complete.

Receptor	Description of Effect	Additional Mitigation
	Although the works are temporary in this area, the loss of standing water (may be possible to avoid) and mature rows of trees must be considered permanent due to the time required for mature trees to grow and the change in ground conditions making it unlikely for the pond to reform without human intervention.	Mature trees will be replaced by standards of the same species or transplanted to a suitable location elsewhere within the Gas Connection Site. A new pond is located at the AGI.
	Potential for injuring or killing of reptiles during habitat removal, trampling and vehicular movements.	Due to the 'Good' population of common lizard within the survey area a trapping and translocation programme including exclusion fencing will be undertaken to help protect any reptiles from being injured or killed. All works will proceed under a Method Statement (outline included in the LEMS (Appendix 2.3)) to be agreed with the Local Biodiversity Officer/Country Ecologist prior to works commencing.
Breeding Birds	Temporary removal of habitat with the potential to support breeding birds (trees, woodland, hedgerows and scrub).	Habitats will be reinstated once works are complete.
	Localised disturbance from night time illumination in winter months.	None
	Noise generated during construction. Birds generally adapt to localised construction noise.	None
Bats	Disturbance, injury or killing of bats in newly formed roosts in trees previously confirmed as not supporting roosting bats during felling.	Pre-construction checks will be undertaken on trees scheduled for removal for their current bat roost potential with consideration of the seasonal survey timings. Results will be used to inform any further mitigation to seek to avoid impacts on roosting bats.
	Severance of linear features used by bats roosting in Buildings 7 & 8.	Building assessments and further bat surveys will be undertaken on Buildings 7 and 8. Results will be used to inform any further mitigation to seek to avoid impacts on bats from the roost commuting and foraging across the Project Site Boundary.
	Loss of foraging habitat.	None
	Severance of habitat connectivity through removal of hedgerows and tree lines.	Maintain connectivity of foraging and commuting habitats by the retention of trees and hedgerows wherever possible and utilising

Receptor	Description of Effect	Additional Mitigation
		'brown hedgerows' of brash, to maintain connectivity during construction. For linear features identified as key forging or commuting habitat, where possible the Gas Connection should be installed using drilling to retain feature and connectivity across the Project Site.
	Localised disturbance from night time illumination in winter months are limited due to the embedded mitigation in the lighting plan.	None
Otter	There is the potential harm or kill individual otters during construction within 10 m of Watercourse 6.	A pre-construction check for otter holts/couches and activity of will be undertaken where construction is present within 100 m of watercourses as identified as suitable for supporting the species during the 2017 field surveys. Further mitigation measures may be required if activity is found. Habitat management will be undertaken to help reduce the quality of the habitats for holt/couch creation for the period leading up to and for the duration of construction in that area. Additional mitigation may be required as a result of the survey.
Brown Hare	There is the potential cause disturbance of, harm or kill individual brown hares during construction.	None
Badger	There is the potential harm or kill individual badger during construction within 30 m of a sett.	A pre-construction check for badger setts and activity will be undertaken where construction works are within 30 m of suitable habitats for badger sett creation. Additional mitigation may be required as a result of the survey.
	Trapping of badgers in open excavations and obstructing the movement of badger across the Project Site.	Sloping escape ramps for badgers should be created by edge profiling trenches/excavations and/or excavations should be fitted with a scaffolding board ramp to allow any trapped animals to exit. Crossing places will be provided across open excavations for the duration of the works on the sections where known badger paths have been identified. Open pipework greater than 150 mm diameter that is left over night will be made secure by either filling

Receptor	Description of Effect	Additional Mitigation
		in the end of the pipe or covering the end with a solid timber panel or similar.
Invasive Species	Potential for the construction of the Project to cause the spread of invasive species will be reduced due to the embedded mitigation to implement measures contained in relevant best practice guidance on the control and removal of invasive weed species.	Recommend management plan is produced to control and eradicate the invasive species within the Project Site Boundary. An updated invasive species survey will be undertaken to accurately assess invasive species and extents within the Project Site Boundary prior to the implementation of control measures.

ii. Operation

4.2.45 No effects are anticipated through the operation phase of the Gas Connection.

4.3 Flood Risk and Water Quality

a) Baseline Conditions

4.3.1 This section is supported by the assessment demonstrated in

- Appendix 4.1: Flood Consequence Assessment (FCA); and
- Appendix 4.2: Water Framework Directive (WFD) Screening Assessment.

4.3.2 A 1km study area, taken from the Project Site Boundary, has been utilised and is shown on the corresponding Figures.

i. Topography and land use

4.3.3 The topography of the Gas Connection Site is reasonably elevated and steeply sloping. Ground levels across the Gas Connection Site vary from approximately 145 m AOD in the north to 86 m AOD in the south.

4.3.4 The land within the Gas Connection Site is currently used for sheep and horse grazing. The area surrounding the Gas Connection is, at present, predominantly rural, although there is Felindre Park and Share to the south and a substantial amount of utility infrastructure in the area. Some springs and drainage channels/ditches drain the land and discharge into the Afon Llan River. The current land uses are considered “Less vulnerable” to flooding according to the TAN15 classifications.

ii. Ground conditions and hydrogeology

4.3.5 The British Geological Survey (BGS), online mapping data, provides details of both the regional and local geology of the Gas Connection Site. The data indicates that the Gas Connection Site is underlain by bedrock of the Grovesend Formation, comprising mudstone, siltstone and sandstone (Figure 4.5). Superficial deposits across the Gas Connection Site are quite variable. However, they primarily comprise till and glaciofluvial deposits (sands and gravels) with a smaller area of peat in the southeastern corner Gas Connection Site Boundary (Figure 4.6). The thickness of the superficial deposits beneath the Gas Connection Site is currently unknown. Groundwater occurs in both the superficial and bedrock beneath the Gas Connection Site.

4.3.6 Natural Resource Wales (NRW) has designated the bedrock geology beneath the Gas Connection Site as a Secondary A aquifer with the superficial deposits designated a mixture of Secondary A aquifer and unproductive strata. Secondary A aquifers are permeable layers capable of supporting water supplies at a local rather than strategic scale and, in some cases, can form a vital source of base flow to rivers. Unproductive strata are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow. Soils within the Gas Connection Site are variable, designated to have high, intermediate and low leachate potential.

4.3.7 Groundwater movement within the underlying geology is likely to be limited considering the aquifer designations as discussed above. Although the Gas Connection Site is elevated, shallow or perched groundwater within the superficial deposits is expected to be reasonably close to the surface and in hydraulic connectivity with the surface watercourses present within the Gas Connection Site and immediate surroundings.

4.3.8 The objectives of the WFD have been used to assess the groundwater quality in the Gas Connection Site. The Carmarthen Carboniferous Coal Measures (Waterbody ID GB41002G200600) and Swansea Carboniferous Coal Measures (Waterbody ID GB410002G201000) are two WFD groundwater bodies within the study area (as illustrated in Figure 4.7). Information on their status regarding water quality is available from NRW Rivers and Waterbodies website (accessed October 2017). According to the NRW website, the current quantitative water quality for both the Carmarthen and Swansea water bodies is good and predicted to remain so beyond 2015, based on the most recent available data from 2015.

4.3.9 However, the overall 2015 Cycle 2 Status and current chemical quality for both Carmarthen Carboniferous Coal Measures and Swansea Carboniferous Coal Measures groundwater bodies are reported to be poor and are expected to remain so beyond 2015. There are no identified designated groundwater SPZs or drinking water Safeguard Zones with regards to agricultural activities within 1 km of the Gas Connection Site. Furthermore, information on the status of the Carmarthen and Swansea Carboniferous WFD groundwater bodies shows that they are not targeted for improvement within the Western Wales River Basin Management Plan (RBMP).

4.3.10 The Landmark Envirocheck report (Appendix 8.1) has identified no groundwater abstraction licences associated with the Gas Connection Site. The Landmark report identified only one licence located within 100 m of the Gas Connection Site, recorded 56 m to the north-east for a well at Abergelli Farm, licence number 22/59/4/0027 dated February 1993, for general farming and domestic use. Recent data (received on 9 October 2017) on private groundwater and abstraction licences received from CCS and NRW respectively did not identify this licence or any other licences within the 4 km of the Gas Connection Site.

iii. Contaminated land

4.3.11 No intrusive site investigation has been completed to inform this assessment. However, as the majority of the Gas Connection Site is undeveloped, it is unlikely to have experienced significant potentially contaminative activities. Figure 4.8 shows current or historical potential pollution point/aerial sources within 1 km of the Gas Connection Site. It also includes historic landfill and industrial land use activities that have a higher potential for ground contamination such as the disused (inert) landfill site located approximately 100 m west of the Gas Connection, a coal mine north of Abergelli Farm and the Substation.

4.3.12 A mine spoil dump covered approximately three-quarters of the landfill area from the former Abergelli Colliery (Figure 4.8). This mine waste largely was removed leaving a layer of well compacted mine waste over the majority of the landfill area. Part of the ground that was covered by mine spoil was formerly used for drying out of water treatment sludge (aluminium sulphate) though this ceased when the landfill became operational. No further information regarding potential impacts to the water environment from this operation is known.

iv. Surface water and groundwater features

4.3.13 There are both designated "ordinary" and "main" surface water bodies within the study area (as shown in Figures B2 and B3, Appendix B of FCA provided in Appendix 4.1). Within the Gas Connection Site, there are springs and spring-drainage rivulets and

drainage ditches that drain the Project Site into the Afon Llan River. The Afon Llan River catchment includes all of the Gas Connection Site.

4.3.14 There are three WFD classified surface water bodies (Figure 4.9) within the study area: the Afon Llan (Water body ID GB110058032070 to the south of the Gas Connection Site), the Afon Lliw (Water body ID GB110059032100 to the north of the Gas Connection Site) and the Loughor Estuary (Burry Inlet Inner) (Water body ID GB531005913500 located approximately 7 km south of the Gas Connection Site) into which these water bodies discharges.

4.3.15 The Afon Llan River is the closest WFD designated surface watercourse that traverses the immediate vicinity of the Gas Connection Site. It flows in a south-westerly direction and is designated as a Main River by NRW. The Afon Llan links with the Afon Lliw and the River Loughor, which discharges into Carmarthen Bay. The rivers will not be directly altered by the Gas Connection.

4.3.16 There is one WFD groundwater body (i.e. the Carmarthen Carboniferous Coal Measures Water body ID GB41002G200600) in the vicinity of the Gas Connection Site. This WFD water body is not targeted for improvements within the Western Wales RBMP.

4.3.17 Information about the current and predicted status of the Afon Llan River and the other designated WFD water bodies within the study area are available from NRW Cycle 2 River and Waterbodies websites1 (accessed May 2017 and updated in June 2018) and is summarised in Table 4-6. Details of groundwater bodies are provided in Table 4-7.

Table 4-6: Surface water bodies WFD Cycle 2 status WFD status of Afon Llan, Afon Lliw and Loughor Estuary

Status			
Water Body	**Afon Llan**	**Afon Lliw**	**Loughor Estuary (Burry Inlet Inner)**
Overall Status	Good	Moderate	Poor
Chemical Status	Good	Fail	Good
Ecological Status	Good	Good	Poor
Driving Ecological Quality Elements	Fish, Invertebrates, Macrophytes and Phytobenthos Combined	Fish, invertebrates	Phytoplankton blooms
Mitigation Measures by NRW	Not yet applied	Not yet applied	Not yet applied
Typology	Low, Small, Siliceous	Low, Small, Siliceous	Mixed, Macro, Extensive

[1] https://nrw.maps.arcgis.com/apps/wegappviewer/index.html?id=2176397a06d64731af8b21fd69a143f6

Table 4-7: Groundwater body WFD Cycle 2 status

Status	
Water Body	**Carmarthen Carboniferous Coal Measures**
Overall 2015 Cycle 2 Status	Poor
2015 Cycle 2 Quantitative Status	Good
2015 Cycle 2 Chemical Status	Poor

4.3.18 The Afon Lliw is located approximately 1.3 km north of the Gas Connection Site and has been assessed under the WFD.

4.3.19 There are other smaller watercourses in the vicinity of the Gas Connection Site that drain to the Afon Llan, along with some springs and small ponds.

4.3.20 Both the Afon Llan and Afon Lliw discharge to the Loughor Estuary west of Swansea, approximately 7 km from the Gas Connection Site. The Gas Connection Site lies outside of the Afon Lliw topographic catchment and therefore it is expected that any direct hydraulic connectivity will be limited. The Afon Llan does, however, join with the Afon Lliw approximately 9 km downstream of the Gas Connection Site. There may also be some potential for the cross-transfer of shallow groundwater flows between the two catchments. The Loughor Estuary has been assessed under the WFD. NRW has identified that the Loughor Estuary contains designated Shellfisheries.

4.3.21 No surface water abstraction points have been identified within the Gas Connection Site. The closest surface water abstractions, assumed to be from a tributary of the Afon Llan, have been identified approximately 1.6 km northeast and upstream of the Gas Connection Site. Accordingly, no impact to this receptor is envisaged and it is not considered further in this assessment.

4.3.22 There are also a number of small drainage ditches and land drains which output into the ordinary watercourses and then the Afon Llan.

v. Flood risk

4.3.23 There are no flood defence structures in the study area or Gas Connection Site.

4.3.24 The Gas Connection Site is outside the Development Advice Map (DAM) Zones and considered to be at very low risk of flooding i.e. DAM Zone A. Figure D1 in Appendix 4.1 displays the flood zones and Project Site Boundary.

4.3.25 During the site visit, the area immediately south of the Gas Connection Site was notably saturated. It is assumed that this area and the lower lying area to the south may be susceptible to groundwater or surface water flooding. This is consistent with BGS groundwater flooding susceptibility mapping showing the area to the south of the Gas Connection Site as potential groundwater flooding at surface.

4.3.26 The literature review has not identified any historic incidents of flooding affecting the Gas Connection Site from any source.

4.3.27 The CCS Preliminary Flood Risk Assessments (PFRA) (2011) (Ref.5.2), Level 1 (2010) and Level 2 (2012) Strategic Flood Consequence Assessment (SFCA's) do not report

any recorded flood events from groundwater sources within the CCS region. The Flood Risk Management Plan (FRMP) (2015) indicates that there is a low risk of groundwater flooding across the CCS region (Ref.5.3).

4.3.28 NRW online maps show that reservoir flooding is not predicted to affect the Gas Connection Site. This is relevant with respect to the upstream Lliw Reservoir.

vi. Drainage

4.3.29 Most of the Gas Connection Site is undeveloped and surface water run-off flows overland and through field drains discharging into the Afon Llan. These field drains and drainage ditches can be seen to cross the Gas Connection Site and flow to the ordinary watercourses. The largest ordinary watercourse flows south along the east perimeter of the Gas Connection Site before discharging to the Afon Llan.

4.3.30 It has been identified that there are no foul sewers within the Gas Connection Site, and therefore assumed that the foul effluent from the nearby farm and residential properties discharge to cess pits and septic tanks.

b) Potential Environmental Effects

i. Construction

4.3.31 No effects for flooding have been identified during the construction phase for the Gas Connection.

4.3.32 From water quality and resources perspective, it is envisaged that the Gas Pipeline will not give rise to an increase in impermeable area within the Gas Connection Site and impact upon the surface water run-off regime for the Gas Connection.

4.3.33 Good practice management measures for the reduction and control of water pollution including works near water will be set out in the Surface Water Management Plan (WQ01) and Drainage Strategy - WQ02 and WQ03 of the Mitigation Register (Appendix 2.1). No additional mitigation measures have been proposed.

ii. Operation

4.3.34 The only permanent structure constructed for the Gas Connection is the AGI at the connection to the National Gas Transmission System, which will change the infiltration capacity of the ground.

4.3.35 The total size of the AGI, including access spur road is approximately 0.3 hectares (ha). The installation will have exposed plant on reinforced foundations with gravel surfacing in between. It is anticipated that infrastructure will be identified to appropriately attenuate surface water runoff in order to maintain the equivalent greenfield runoff. No additional mitigation is proposed.

4.4 Air Quality

a) Baseline Conditions

i. CCS Air Quality Monitoring and Reporting

4.4.1 A review of existing baseline air quality has been undertaken using information presented within the CCS Progress Report 2016 (Ref.5.4), information published on an

official CCS Air Quality website (Ref.5.5) and Department for Environment, Food and Rural Affairs (DEFRA) website (Ref.5.6).

4.4.2 There are a number of Continuous Monitoring Stations (CMS) in the administrative area of CCS. A summary of the monitoring stations and last five years of monitoring data from each, are presented in Table 4-8 to Table 4.11.

Table 4-8: CMS Site Details

CMS name	Type	Location		Distance to Gas Connection Site
		X	Y	
Swansea Automatic Urban Rural Network (AURN)	Roadside	265299	194470	5.5 km south
Morriston Groundhog	Roadside	267210	197674	4 km south
Cwm Level Park	Urban Background	265912	195890	5 km south

Table 4-9: CMS Monitored NO2 Concentrations (µg/m3)

CMS name	Annual Mean NO_2 Concentration (µg/m^3) / Number of Daily Means > 200 µg/m^3 in Parentheses				
	2012	2013	2014	2015	2016
Swansea AURN	26.0 (0)	26.8 (0)	25.0 (0)	23.0 (0)	26.3 (0)
Morriston Groundhog	23.4 (0)	23.2 (0)	21.1 (0)	20.5 (0)	26.6 (0)
Cwm Level Park	19.6 (0)	18.5 (0)	17.1 (0)	14.8 (0)	14.5 (0)

Table 4-10: CMS Monitored PM10 Concentrations (µg/m3)

CMS name	Annual Mean PM_{10} Concentration (µg/m^3) / Number of Daily Means > 50 µg/m^3 in Parentheses				
	2012	2013	2014	2015	2016
Swansea AURN	17.8 (4)	19.0 (2)	20.3 (2)	20.2 (2)	20.3
Morriston Groundhog	13.9 (0)	15.3 (0)	13.2 (1)	-	-

Table 4-11: CMS Monitored PM2.5 Concentrations (µg/m3)CMS name	Annual Mean $PM_{2.5}$ Concentration (µg/m^3)				
	2012	2013	2014	2015	2016
Swansea AURN	11.5	11.9	12.8	12.8	16.0

4.4.3 Additionally CCS managed a network of diffusion tube monitoring sites focused on roadside locations mainly at busy junctions and along narrow and congested roads. The Gas Connection Site is at a rural location and therefore monitoring data from the NO_2 diffusion tube network are not considered relevant to inform the air quality baseline at the Gas Connection Site.

ii. Defra Mapped Background Data

4.4.4 Defra has produced maps of background pollutant concentrations covering the whole of the UK for use by local authorities and consultants in the completion of Local Air Quality Monitoring (LAQM) reports and Air Quality Assessments where local background monitoring is unavailable or inappropriate for use. The current maps are based on a background year of 2015 and provide background pollutant concentrations for NO_2, PM_{10} and $PM_{2.5}$ for each 1 km grid square within the UK for all years between 2015 and 2030. Defra also provides historic mapped estimates from 2001 for CO. The mapped Defra NO_2, PM_{10} and $PM_{2.5}$ concentrations at the Gas Connection Site are presented in Table 4-12 for 2016.

Table 4-12: Defra Mapped Annual Background Pollutant Concentrations (µg/m³) at the Gas Connection Site in 2016

Pollutant	Mapped Grid Square		Annual Mean Concentrations (µg/m³)
	X	Y	
NO_2	265500	201500	6.8
PM_{10}			10.8
$PM_{2.5}$			7.2
CO			220

4.4.5 Table 4-13 presents a comparison of measured concentrations at the CCS Cwm Level Park urban background CMS site, presented in Table 4-9, versus Defra mapped background concentration for the corresponding grid square.

Table 4-13: 2016 Mapped vs Monitored Annual Mean Background NO2 Concentrations (µg/m3)

Monitoring Site	Monitored NO_2 Concentration (µg/m^3)	Mapped Grid Square		Mapped NO_2 Concentration (µg/m^3)
		X	Y	
Cwm Level Park	14.5	265500	195500	12.5

Note: The DEFRA background concentrations were downloaded in November 2017 from the 2015 reference year background maps.

b) Potential Environmental Effects

i. Construction

4.4.6 The dust emission potential for construction of the Gas Connection is assessed as being large during earthworks due to the size of the corridor affected, which is approximately 1,400 m long and a maximum of 50 m wide, the number of earth moving machines that may be required and the volume of material that will be excavated to form the trench into which the Gas Pipeline will be laid. Construction emissions are classed as small which is considered to be conservative given the prefabricated nature of installing the Gas Pipeline. Emissions from trackout have a large dust potential due to the number of vehicles operating. There is no demolition associated with this phase of the works.

4.4.7 Table 4-14 sets out the assessment of dust emission class from demolition activities, earthworks, construction and trackout as a function of the works associated with the Gas Connection.

Table 4-14: Summary Assessment of Dust Emissions Class

Phase	Magnitude	Dust Risk		
		Nuisance (Low Receptor Sensitivity)	Human Health (Low Receptor Sensitivity)	Ecology (Low Receptor Sensitivity)
Demolition	N/A	N/A	N/A	N/A
Earthworks	Large	Low	Low	Low
Construction	Small	Negligible	Negligible	Negligible
Trackout	Large	Low	Low	Low

4.4.8 Table 4-14 shows the risk of effects with no mitigation is negligible or low in terms of human health, nuisance and ecological impacts.

4.4.9 Good practice dust management will be set out within the Outline CEMP, GEN01 and AQ01 – AQ04 Mitigation Register (Appendix 2.1). No additional mitigation is therefore proposed.

ii. Operation

4.4.10 No effects on air quality are expected during the operation phase.

4.5 Noise

a) Baseline Conditions

4.5.1 This section describes the baseline environmental characteristics for the Gas Connection and surrounding areas with specific reference to noise and vibration. The baseline sound levels presented within this report were measured by AECOM in February 2018 (Appendix 5: Noise Survey) and summarised Table 4.15.

4.5.2 Representative *background and ambient sound levels* are summarised below in Table 4.15 for each of the four Noise Sensitive Receptors (NSRs) located in Figure 4.10.

Table 4-15: Representative Background and Ambient Sound Levels

NSR	Observations of baseline sound environment	Day time *background sound level* L_{AF90}	Day time ambient (residual) sound level L_{Aeq}	Night time *background sound level* L_{AF90}	Night time ambient (residual) sound level L_{Aeq}
NSR1	Distant rotary engine noise and M4 motorway traffic noise, low but audible. Bird noise and cattle noises heard from the nearby area. On collection there was additional noise from farm activities as well as a low frequency plant hum which started up around 10:00. At night, low level plant hum heard, road traffic was audible to both the south and east. Very quiet site.	40	46	34	40
NSR4	M4 motorway traffic noise and rotary engine noise low but audible. On collection dogs were barking at the nearby property. At night, low level plant hum and distant M4 traffic noise, low but audible. Very quiet site.	36	43	35	38
NSR5	On site hen noise and dogs barking. Wind rustle in the trees. Distant M4 traffic and rotary engine noises heard, low but audible. On collection a low level plant hum could be heard. At night, low level plant hum and distant M4 traffic noise, low but audible. Very quiet site.	43	54	38	40
NSR6	Wind rustle and birds heard in nearby trees, dogs barking in the distance. Distant M4 traffic and rotary engine noises heard, low but audible. Rotary engine noise, advised to be a drone, low but audible. At night, low level plant hum and distant road traffic noise heard. Very quiet site.	40	47	36	39

b) Potential Environmental Effects

i. Construction

4.5.3 This section sets out the preliminary assessment of the potential noise and vibration effects on sensitive receptors arising during the construction period.

4.5.4 Noise levels experienced by local receptors during such works depend upon a number of variables, the most significant of which are:

- The noise generated by plant or equipment used on-site, generally expressed as Sound Power Levels (L_w) or the vibration generated by the plant;
- The periods of use of the plant on-site, known as its on-time;
- The distance between the noise/vibration source and the receptor;
- The noise attenuation due to ground absorption, air absorption and barrier effects;
- In some instances, the reflection of noise due to the presence of hard surfaces such as the sides of buildings; and
- The time of day or night the works are undertaken.

4.5.5 The predicted levels are given in Table 4-16 below.

Table 4-16: Predicted Construction Sound Levels LAeq,T

Location	Distance from Gas Connection	NSR	Gas Connection Construction Sound Levels (LAeq,T)
Cefn-betingau	600m east	NSR1	45
Felin Wen Farm	750m southeast	NSR2	42
Llwynhelig	700m southeast	NSR3	43
Maes-eglwys	600m south	NSR4	46
Lletty Morfil Farm	600m southwest	NSR5	48
Abergelli Farm	60m west	NSR6	66

4.5.6 The predicted indicative construction noise levels for the Gas Connection were below the lowest observable adverse effect level (LOAEL) level, apart from at NSR6 where a level just exceeding the LOAEL during the day time but significantly below the significant observable adverse effect level (SOAEL) is predicted.

4.5.7 No additional mitigation is proposed however good practice noise management is considered within N01- N09 Mitigation Register (Appendix 2.1) and Outline CEMP, GEN01.

ii. Operation

4.5.8 No effects are anticipated during operation due to the nature of development.

4.6 Landscape and Visual

a) Baseline

i. Landform

4.6.1 The Gas Connection Site is located within a valley with ground rising to the north, east and west which provides visual containment. Ground levels vary across the Gas Connection Site from approximately 145 m AOD in the north-west corner to 86 m AOD along the southern perimeter. Ground levels generally fall in a southerly and south easterly direction.

ii. Movement and Connectivity

4.6.2 Junction 46 on the M4 lies approximately 2 km to the south of the Gas Connection Site providing immediate access to the strategic road network between London and South Wales. To the immediate north of Junction 46 lies the Felindre Park and Share at Brynwhilhach adjacent to the un-developed Felindre Business Park. A network of minor roads dissects the 5 km study area, connecting settlements and farmsteads. These are typically surrounded by earthbanks with hedgerow and tree planting which contains views along them and successfully integrates them into the wider landscape. The study area is well served with Public Rights of Way (PRoW) although not all are easily accessible nor do they appear to be regularly used. A section of the Gower Way, a long distance footpath through the Afon Lliw valley passes within approximately 2 km at its closest point to the northern boundary of the Gas Connection Site.

iii. Land Use and Built Form

4.6.3 The Gas Connection Site is predominantly covered with pasture which is currently used for sheep and horse grazing, and broadleaf woodland which is classified in part as Ancient Woodland lies to the east of the Gas Connection Site. Fields across the Gas Connection Site are subdivided by ditches, remnant hedgerows and are interspersed with scrub vegetation.

4.6.4 Pastoral land and woodland are the predominant land uses within the wider valley, including Penllergaer Forest and other smaller broadleaved woodlands that are scattered throughout the valley. Combined with the network of hedgerows and hedgerow tree planting which define many of the small and irregular shaped fields as well as the network of minor roads, the landscape displays a well vegetated character. This character of woodland, rolling topography and visual containment helps integrate developments in the rural fabric.

4.6.5 To the southwest of the Gas Connection Site Boundary, there is the Access Road, National Grid Car Park, Substation and the Felindre Gas Compressor Station. Both the Substation and the Felindre Gas Compressor Station comprise large scale power infrastructure facilities characterised by tall industrial structures enclosed by security fencing and set within woodland planting. Pylons are prominent across the landscape and converge at the Substation.

4.6.6 A number of solar farms lie around the Gas Connection Site particularly to the north-east and east as well as to the north-west. The Felindre Business Park adjacent to the Park and Share at Brynwhilhach has been partially constructed with service

infrastructure in place along with an outline landscape structure including stone walls and planting.

4.6.7 The main settlement in the 5 km study area is Swansea, with the northern edges of the city forming notable built form in the south and south eastern parts of the study area, approximately 2 km from the Gas Connection Site. The Driver and Vehicle Licensing Agency (DVLA) office block forms a prominent tall building and local landmark in many views that look south. Morriston hospital complex at Pant-lasau lies to the south-east of the Gas Connection Site with the settlement of Clydach extending to the east. Settlement locally is dispersed comprising small villages such as Felindre to the north-west or scattered properties and farmsteads.

iv. Landscape Designations

4.6.8 Landscapes can be given international, national, regional or local designations in recognition of their importance, outstanding scenic interest or attractiveness. The Brecon Beacons National Park lies 12.8 km to the northern edge of the Gas Connection Site at its closest point. There is no theoretical visibility between the Gas Connection and the National Park and as such the Brecon Beacons National Park as a landscape receptor due to the distance and topography and is therefore is not considered further.

4.6.9 The Gower Area of Outstanding Natural Beauty (AONB) lies 9.1 km to the south-west of the Gas Connection Site. The Gower AONB was designated in 1956 for its classic limestone coast and the variety of natural habitats. The Gower's scenery ranges from dune and salt marsh in the north to dramatic limestone cliffs along the south coast, interspersed by sandy beaches. Inland the hills of Cefn Bryn and Rhossili Down dominate the landscape of traditional small fields, wooded valleys and open commons. There is no theoretical visibility between the Gas Connection and the National Park and as such the Brecon Beacons National Park as a landscape receptor is not considered further.

4.6.10 SLAs are identified in the draft UDP within Policy ER 5: Landscape Protection and are identified on Figure 4.11. The Policy state states that priority will be given to protecting, managing and enhancing the character and quality of the three SLAs:

- Mawr Uplands;
- Lower Loughor Valley and Estuary and Southern part of the Burry Inlet; and
- North East Gower and Cockett Valley.

4.6.11 Within the SLAs, development will only be permitted where proposals include measures to protect, manage and enhance the character and quality of the particular landscape features for which the SLA has been designated. The aim of the Policy is to ensure that the character and quality of the County's most valued landscapes are protected from inappropriate development and to encourage the management, enhancement and creation of key landscape features where possible.

4.6.12 There are four Country Parks within the wider landscape but all lie beyond the 15 km study area and do not experience any theoretical visibility.

b) Potential Environmental Effects

i. Construction

4.6.13 The construction of the Gas Connection would result in temporary adverse effects as a result of the construction plant and activity involved in constructing the AGI along with an access road into it off the Rhyd-y-pandy road and the Gas Pipeline. The open trench method of constructing the Gas Pipeline would result in the temporary removal of grazing land and the permanent removal of sections of field boundary hedgerow and trees.

4.6.14 The temporary presence of construction plant, activities and lighting would introduce noticeable features uncharacteristic of the landscape at present.

4.6.15 No additional mitigation is proposed, but good practice landscape and visual management measures will be will be included within the Outline CEMP (GEN01) (Appendix 2.2) and LEMS (GEN02) (Appendix 2.3) of the Mitigation Register (Appendix 2.1).

ii. Operation

4.6.16 Post-construction, structure planting and reinstatement boundary vegetation will be planted around the AGI to assist in assimilating it within the immediate landscape pattern. Planting will extend up to existing field boundaries in order to retain the field pattern and avoid land severance.

4.6.17 Once the structure planting around the AGI establishes it will assist in providing some additional structure to the landscape which alongside the reinstatement of hedgerow planting and fields returned to grazing along the route of the Gas Pipeline, will assist in integrating the Gas Connection into the local landscape.

4.6.18 As a result of the embedded mitigation outlined above and further described in the Outline Landscape & Ecology Mitigation Strategy (LEMS) (GEN02) (Appendix 2.3) and LEMP, Figure 4.4, there would be no significant effects on the landscape character as a result of the Gas Connection.

4.7 Historic environment

a) Baseline Conditions

4.7.1 The following sections describe the archaeological and historical context of the 1 km and 5 km Study Areas from the Project Site Boundary and the known sites within it. Full details are contained in the cultural heritage gazetteer (Appendix 6) and the assets are shown on Figures 4.12 and 4.13.

4.7.2 Table 4-17 summarises the number of historic assets within the Project Site Boundary, and within the 1 km and 5 km Study Areas.

Table 4-17: Summary of Historic Assets

Historic Asset	Project Site	1 km Study Area	5 km Study Area
Scheduled Monument	0	0	11
Listed building (Grade I)	0	0	1
Listed building (Grade II*)	0	0	5
Listed Building (Grade II)	0	0	41
Listed building (all grades)	0	0	47
Non-designated asset	2	17	N/A
Conservation area	0	0	2
Registered Historic Parks and Gardens	0	0	3
Registered historic landscape	0	0	0

i. Palaeolithic and Mesolithic (1,000,000 – 4000 BC)

4.7.3 Evidence for human activity during the Palaeolithic period is extremely sparse across Wales as a whole, with the principal find sites being concentrated on the Carboniferous Limestone zone of the south-west coast and north-east Wales. The known settlement sites in South Wales have been discovered within caves, with no open sites yet recognised. The coast of Gower has yielded several very significant sites, but there is nothing known closer to the Study Area, nor have any stray finds been recovered locally. Although the Mesolithic period is somewhat better represented across Wales as a whole, known sites in South East Wales are once again concentrated in coastal areas, with few discoveries made in inland locations. No Mesolithic sites or finds are known within the Study Areas (Ref.5.7).

ii. Neolithic and Bronze Age (4000 – 700 BC)

4.7.4 The Neolithic period in Britain is differentiated from the preceding Mesolithic by the onset of a series of profound social, technological, and economic changes. The period coincides with the first domestication of animals and of cereal cultivation, and is accompanied by changes in material culture, including the development of ceramics and new lithic typologies. It was also a time when long-distance connections developed across Britain, Ireland and mainland Europe, alongside mechanisms of long-distance exchange, principally of lithic artefacts (Ref.5.8 and Ref.5.9). From this period the evidence for human activity increases significantly across Wales, and it becomes possible to discuss the Study Areas specifically, as opposed to merely the broader regional pattern.

4.7.5 Neolithic communities were the first to leave their mark prominently on the landscape through the construction of monuments, which have traditionally dominated interpretations of the period. The emergence of monumental architecture provides evidence for new forms of social organisation and complexity, including ritualised mortuary activity involving formal burial deposition, ceremonial practices and the construction of social and cultural identities. The range of monument types present in South Wales is narrower than in areas such as Wessex, but its uplands are characterised by numerous, highly visible Neolithic and Bronze Age funerary and ritual

monuments – principally but not exclusively in the form of cairns (Ref.5.10). The majority of cairns were funerary monuments, although some may have served as memorials or have marked territorial boundaries. Very many appear to have been located for dramatic effect, often on ridge crests or on the saddle of hills close to well-travelled paths (Ref.5.11 and Ref.5.12). Others had utilitarian origins, having been formed by field clearance for agriculture: however, dating these latter features is difficult and some could plausibly relate to more recent times.

4.7.6 Within the Study Areas there are five cairns of presumed Neolithic to Bronze Age date that are designated as Scheduled Monuments. All are shown on Figure 4.13. These comprise a ring cairn on Craig Fawr (SM GM380), Pant-y-Ffa Round Cairn (SM GM201), Mynydd Pysgodlyn Round Barrow (SM GM202), Garn Goch Round Barrow (SM GM199), and a ring cairn on Tor Clawdd (SM GM353). The visual interrelationship of such monuments is a well-established theory as a key to understanding their positioning within the landscape. A study of a stone alignment at Bancbryn, located approximately 3 km north of Tor Clawdd (8 km from Project Site Boundary; not illustrated), posits (but cannot prove) that the inter-visibility between those stones and Hartland Point, on the north Devon Coast, is significant. Incorporated into this alignment is Tor Clawdd, which is framed to the left side of the Hartland Point (Ref.5.13).

4.7.7 There is no evidence for contemporary settlement within the Study Areas.

iii. Iron Age (700 BC – AD 43)

4.7.8 The society that emerged in the Late Bronze Age and Iron Age was markedly different from its predecessor. The emergence of the hillfort points to a changing emphasis in the settlement pattern and to a radically altered social dynamic.

4.7.9 Although hillforts are the dominant monument of the period within the modern landscape, they are known to have existed in conjunction with wider undefended rural settlement, of which traces are mostly ephemeral and easily destroyed by cultivation. As Lynch et al. comment, ‘though overshadowed by the hillforts, the lightly enclosed or open farmstead must have shared a close relationship with their more impressive counterparts’ (Ref.5.11). Given this situation, it is reasonable to assume some level of settlement in the area, although its character and location remains unknown.

4.7.10 A probable Iron Age site is located within the 1 km Study Areas, located 1.5 km to the west of the Project Site Boundary, as shown in Figure 4.12 and 4.13. This is Scheduled Monument (SM GM308), which comprises an oval enclosure measuring c. 90 m x 60 m, defined by a wide earthen bank that stands up to 1 m high in places. Its date is unproven but its morphology suggests it belongs to the Iron Age, with either a defensive and/or settlement function. The monument, now standing within woodland, is well preserved and retains considerable archaeological potential.

iv. Roman (AD 43 – AD 410)

4.7.11 The Study Areas are removed from the main framework of Roman forts and roads in the region, which developed during the conquest of South Wales between 47 and 77 AD (Ref.5.14 and Ref.5.15). Forts were established at Coelbren, Neath, Loughor and Carmarthen, connected by a road network that can, in part, still be traced in the modern landscape (Ref.5.16). The remains of two Roman practice camps are known

within the 5 km Study Area, 4.6 km south of the Project Site Boundary, on Mynydd Carn Goch (SM GM269).

4.7.12 A re-analysis of the rural evidence may challenge the widely held belief that the indigenous population was largely untouched by the Romans (Ref.5.17). However, identifiably Roman sites are entirely absent from the 1 km Study Area, although a continuity of native occupation must be assumed throughout this period and into the immediate post-Roman era.

v. Medieval (AD 410 – AD 1540)

4.7.13 The early medieval period in South Wales is broadly characterised by the emergence of distinct regional kingdoms, and of Christianity, with the possibility of some level of Viking depredation (Ref.5.14). Archaeologically, the period is very poorly evidenced, and no settlement sites of this era are known within the Study Areas – although it is possible that some Anglo-Norman and medieval Welsh sites may have earlier origins. One possible monument belonging to this period is the base of a stone cross within Llangyfelach churchyard, 1.7 km south of the Project Site Boundary (SM GM299). Though not precisely dated, stylistically it would appear to belong to the early medieval period.

4.7.14 Evidence from the later medieval period in South Wales (i.e. after the Norman Conquest of the region) is far more abundant. No certain medieval sites are known within the Gas Connection Site or 1 km Study Area, but Pen y Fedw (PRN 01525w) is suggested to have its origins in the 14th century (Ref.5.18), although the evidence supporting this assertion is unclear. Assuming some degree of continuity, some of the other post-medieval farms in the district could reasonably be assumed to have earlier origins.

4.7.15 Within the 5 km Study Area, the scheduled earthwork known as Cae Castell is probably medieval in date and, on the basis of its place-name, quite possibly defensive in character (SM GM439). Meanwhile, the tower of the St David's church, Llangyfelach, is the likely standing remains of a former 14th-century church that stood within the curtilage of the present churchyard (LB 26236).

4.7.16 The present-day agricultural field pattern was largely established by the beginning of the 18th century, as evidenced by the 2":1 mile map of Glamorgan and Monmouthshire (1812-14; Ref.5.19). Of particular interest on this map are the hedgerows identified in this assessment as AB03 and AB04, both of which are within the Gas Connection Site. The date at which the field pattern as a whole began to develop is not known, but it is possible that some parts may have medieval origins.

vi. Post-medieval (AD 1540 – AD 1901)

4.7.17 Within the 1 km Study Area, the earliest forms of post-medieval remains appear to be predominately of domestic and agricultural purpose. One example (albeit immediately outside the 1 km Study Area) is Cynghordy Fawr (PRN 02750w), which is located in the north-east of the Study Area. This building is fairly typical of the architectural style of this period, comprising a 17th-century longhouse with a courtyard and further ranges including a stable block and granary.

4.7.18 George Yates' Map of Glamorgan, dated 1799 (Ref.5.20), shows 'Abergelly Fach' (AB02) as an isolated farm building, disconnected from a north/south aligned lane that

cuts across the north-western corner of the Project Site Boundary. A map of Glamorganshire (1812-14, Ref.5.19) depicts the same farm as comprising two north-east/south-west aligned rectangular buildings set within their own grounds, and connected to the existing north/south aligned lane via a short driveway. To the east of AB02 is the farmstead of 'Abergelly-fawr' (AB01), featuring at least two buildings and an associated connecting lane to the north. The remaining land is shown as an enclosed field system, which includes boundaries AB03 and AB04, located immediately north of Abergelly-fach.

4.7.19 By the time of the surveying of the Llangyfelach Tithe Map of 1838 (Ref.5.21), new field boundaries had been created and the fields made smaller and more irregular in shape. Boundaries AB03 and AB04 remained intact, forming the southern boundary of three irregular fields to the east of 'Abergelly fach' (AB01). The field systems depicted on the tithe map can also been seen on Ordnance Survey (OS) map of 1883-1884 (Ref.5.22). By this time 'Abergelli-fach' (AB02) had expanded, comprising a farmstead of at least six buildings. The most significant development is the establishment of a large plantation in the south-east of the Project Site Boundary. The subsequent OS edition of 1897 (Ref.5.23) names the plantation as 'Abergelli-fach Plantation'. A quarry (PRN 01349w) is depicted for the first time, and is labelled as a 'gravel pit' immediately south-west of AB02.

4.7.20 In the early post-medieval period the population of the larger Swansea area began to decline as the administrative centre for the region moved to Cardiff (Ref.5.24). This decline reversed in the early 18th century as the transport of materials for use in industry such as coal and metals along the River Tawe became essential. The River Tawe was a vital trade route during the 18th and 19th centuries at the time when Swansea became renowned as a copper smelting centre with such works as the Hafod Copperworks (PRN 05956w) and the Landore Copperworks (PRN 01586w). Swansea's copper industry rose to prominence in the 18th century. Llangyfelach Copperworks (NPRN 34094), established in 1717, was the first of the major Swansea copperworks; its site is located beyond the 5 km Study Area, at the junction of Cwm Level Road and Neath Road to the north of Landore viaduct (Ref.5.25).

4.7.21 No copper-working sites are known within the 1 km Study Area, but several sites attest to the supporting coal-mining industries which grew up in Swansea's hinterland. Collieries established during this period within the Study Area include Bryn Whilach Colliery (PRN 01340w) and an unnamed colliery at Mawr (PRN 01345w).

4.7.22 Industrial transport networks are also evidenced. In 1798, the Swansea Canal was opened, serving to increase the industrial capacity of the area, such that at one stage in the 19th century, three quarters of the world's copper ore was being transported to Swansea for processing (Ref.5.25). The century following the canal's construction saw the city's population grow from approximately 10,000 people to 95,000 people. Transport routes were established over land not only to supply the copperworks with raw materials but also to link the mines and collieries with the works and ports. Within the 1 km Study Area these include a tramroad (PRN 05950.0w) linking Bryn-whilach and Pen-rhiwfelen coal pits to Clydach Road, a mineral railway (PRN 03017.0w) situated within the community of Llangyfelach, and now a dismantled railway (PRN 02916.0w) serving Felindre Pit on the east side of the Lliw Valley.

vii. Modern (1901-present)

4.7.23 Due to the availability of cheaper copper and coal from overseas, the industrial prosperity of the South Wales region began to decline in the early 20th century (Ref.5.25). Throughout this period Swansea still remained a centre of industry within South Wales, with a population at the time of the outbreak of World War II of 167,000 people (Ref.5.27). The Velindre works (PRN 02905w; 0.8 km south of the Project Site Boundary) was built as part of a post-war development programme begun after the Steel Company of Wales was formed in 1947. In 1952 the company started work on the construction of a cold reduction and electrolytic tinning plant at the site near Llangyfelach. The Velindre works began production in October 1956. The main building, the Mill Bay, was of very significant size: 1440 ft long, 100 ft wide and 66 ft high. It was closed down in September 1989 and its buildings were subsequently demolished.

4.7.24 One historic asset immediately to the west of the Project Site Boundary originates in this period: Abergelli Colliery (NPRN 80607). When first shown on the OS map of 1931 (Ref.5.28), it comprised a water tank, engine houses, a slant (slanted shaft), and a tramway or railway following a course from the slant to a slag heap at the north end of the colliery site. The colliery worked the Four Feet and Graigola (also known as the Brynwhilach) coal seams and was a registered colliery from 1926 to 1960 The owner, up to nationalisation, was the Graigola Merthyr Co. Ltd and it was worked in association with Clydach Merthyr Colliery located at Craig Cefn Parc, approximately 2.5 km north-east of the Project Site Boundary (Ref.5.29).

4.7.25 Aerial photographs of the area taken in 1970 (Ref.5.30) show the addition of an electrical substation to the south-west of Abergelli Farm. The next significant changes to the Project Site are shown on aerial photographs taken in 2008; these reflect the construction of the Felindre Gas Compressor Station. The photographs show that the works included the installation of the Oil Pipeline from the road to the north of Abergelli farm, traversing the fields to the east and south of the farm, to the Substation, which extends over much of the Abergelli fach Plantation. As a part of this development, a section of historic field boundary AB03 was removed for Oil Pipeline easement.

4.7.26 Aerial photographs of 2010 show this complex being extended southwards. By 2015, much of the land to the east of the farm had been utilised for solar panels (Ref.5.30).

viii. Historic landscape characterisation

4.7.27 The Gas Connection Site area lies in Landmap Historic Landscape Aspect Area H27 (Gower Supraboscus Agricultural). This is characterised by an irregular fieldscape with hedgerows and hedgebanks, reflecting a history of gradual and piecemeal enclosure in the valleys and foothills throughout the medieval and post-medieval periods. There is some evidence for enclosure in the pre-Norman period, and the process continued into the second half of the 19th century. Some unenclosed land and woodland remains. Limited industrial activity (mainly mining) also took place here in the 19th century and has left residual traces in the landscape. The settlement pattern is predominantly of dispersed character, but ribbon developments occur in areas of former industrial activity.

ix. Previous Investigations

4.7.28 A watching brief was undertaken by Cambrian Archaeological Projects (Ref.5.31) during groundworks associated with the construction of a high pressure gas pipeline between Felindre and Brecon. The watching brief was carried out within part of the Gas Connection Site through the fields to the east of Abergelli Farm. A single pit was noted and revealed evidence of *in situ* burning, which was potentially the remains of a hearth or furnace. It measured 1.5 m in diameter and was 0.2 m in depth. No date was ascertained for this feature. The site of this feature was located to the south of Abergelli farm at NGR SN 65136 01433, approximately 100 m outside of the Gas Connection Site.

4.7.29 Archaeological watching briefs undertaken by Cotswold Archaeology during the construction of the Oil Pipeline in the northern extent of the Gas Connection Site revealed two undated charcoal spreads. Elsewhere, two pits with charcoal and burnt stone were exposed, and were associated with a spread of burnt material containing two worked, undated, flints. An evaluation at Waun y Garnwen, forming part of the same scheme of works, recorded four probable former field boundaries (Ref.5.32).

4.7.30 A geophysical survey in the area immediately to the east of the Gas Connection Site was undertaken in advance of the installation of a solar energy farm. The works identified probable soil-filled features in most of the survey areas, and concluded that although some of the anomalies were weak or diffuse, most have potential to reflect the remains of archaeological features (Ref.5.33).

4.7.31 On the south-east fringe of the 1 km Study Area, a watching brief was undertaken by Oxford Archaeology within the grounds of Morriston Hospital prior to the development of new parking facilities. A linear field boundary and ornamental features relating to the garden of the former Maes y Gwernen Hall were recorded (Ref.5.34).

b) Potential Environmental Effects

i. Construction

4.7.32 Construction of the Gas Connection will not have a significant physical impact on any known historic asset.

4.7.33 The Gas Pipeline will cross the line of historic boundary AB03, necessitating the removal of a portion of this feature for the construction working width of the Gas Pipeline. However, only a small percentage of this feature is affected – and this was substantially altered when the preceding Oil Pipeline was installed, with little of the original historic fabric remaining.

4.7.34 The construction working width of the Gas Pipeline will also run parallel to historic boundary AB04, which coincides with the western limit of the Project Site boundary. However, this feature is 25 m from the Gas Pipeline centreline, and thus beyond the limits of the pipe easement. There will be no effect upon this feature. No additional mitigation is proposed.

4.7.35 Archaeological investigation including a Written Scheme of Investigation (WSI) (CH01 and CH02) will be undertaken which is included as embedded mitigation. No additional mitigation is proposed.

ii. Operation

4.7.36 Operation of the Gas Connection will not have an impact upon any known historic asset, therefore no mitigation is required.

4.8 Traffic, Transport and Access

a) Baseline Conditions

4.8.1 In order to determine the baseline conditions in the study area, data was collected from numerous sources, as summarised in Table 4-18.

Table 4-18: Data Collection

Subject Area	Source
Local Highway Network	Site visit (21/11/2017) / OS mapping / online desktop review.
Highway Operational Conditions	Traffic surveys undertaken by Sky High (now Tracsis) in 2014. AGI Access traffic counts (June 2018)
Walking, Cycling and Public Transport	Site visit (21/11/2017)/ online desktop review (PRoW mapping obtained from the CCS, public transport timetables).
Road Safety	Personal Injury Collision (PIC) data obtained from the CCS.

4.8.2 The data was used to determine the:

- Weekday AM and PM peak hours for use in the assessment;
- Locations of concern in terms of highway operation;
- Collision history within the study area; and
- Opportunities for sustainable travel.

i. Access Locations

4.8.3 There will be two access points for the Project Site which are both described below, and located in Figure 2:

1. A privately maintained 'Access Road' from the B4489. This will serve the Project Site during the construction and operation phase. The Access Road comprises of an existing road from the B4489 to the Swansea North Substation, which will be upgraded as required, and a new section of Access Road from the Substation to the Generating Equipment Site. This Access Road is being consented separately as part of the DCO Application; and
2. The 'AGI Access' will connect the AGI to the Rhyd-y-Pandy Road by upgrading an existing double gated agricultural access point. The AGI Access will be used only for maintenance access to the AGI during operation. The AGI Access is included in this TCPA application.

ii. Local Highway Network

4.8.4 The local highway network is presented in Figure 4.14. The existing section of Access Road between the B4489 and Substation is unlit. The width of the Access Road varies along its length between 3.5 m and 7.5 m, and is generally bordered by trees and intermittent hedgerows. The Access Road connects to the B4489 via a simple priority junction. This is characterised by large radii on the minor arm (the Access Road) to accommodate Heavy Goods Vehicle (HGV) movements.

4.8.5 The B4489 routes between the village of Felindre to the north (approximately 2.3 km from the Access Road) and the M4 Junction 46 to the south (approximately 1.8 km from the Access Road). The B4489 is subject to a 40 mph speed limit at its junction with the Access Road. At this location, the road has a 5.5 m wide carriageway and is unlit. Approximately 330 m to the north of the Access Road, the B4489 becomes subject to the national speed limit. The B4489 continues a further 1.7 km north where it connects to Rhyd-y-Pandy Road at a priority junction. This section of the B4489 is unlit and ranges in width between 4.5 m and 5.5 m, with numerous passing places. The junction with Rhyd-y-Pandy Road and its approaches are subject to a 30 mph speed limit. Rhyd-y-Pandy Road routes east for 1.6 km where it passes the northern extent of the Project Boundary. This section of Rhyd-y-Pandy Road is unlit and ranges in width between 4.5 m and 5.5 m, with numerous passing places. It is subject to a 30 mph speed limit, increasing to the national speed limit around 900 m east of its junction with the B4489. It also serves the Felindre Water Treatment Works.

4.8.6 Approximately 475 m to the south of the Access Road, the B4489 is street lit. A further 75 m south from this point, the B4489 forms a three-arm roundabout with the access to the Felindre Park and Share.

4.8.7 The B4489 forms a dumbbell roundabout with the M4 Junction 46. The northern dumbbell roundabout junction comprises three arms; the B4489 and the eastbound on/off-slips of the M4. The southern dumbbell roundabout junction comprises six arms; the A48 (three arms), the B4489 Swansea Road, and the westbound on/off-slips of the M4. The south-eastern arm of the A48 forms a mini-roundabout junction with Pant Lasau Road approximately 90 m southeast of the southern dumbbell roundabout. These junctions are subject to a 40 mph speed limit and are lit.

iii. Highway Operational Conditions

4.8.8 An Automatic Traffic Count (ATC) survey was undertaken on the B4489 between the Access Road and the roundabout junction with the Felindre Park and Share. The survey was undertaken between Thursday 16th October 2014 and Wednesday 22nd October 2014. The traffic flow information for an average weekday is summarised in Table 4-19. Growth factors have been applied to the 2014 data to represent conditions in 2017.

Table 4-19: Summary Traffic Flow Information – B4489

Time Period	Direction	Total Vehicles	Number of HGVs	HGV%
Weekday AM Peak Hour (07:45-08:45)	Northbound	44	1	2%
	Southbound	88	2	2%
	Two-Way	132	2	2%
Weekday PM Peak Hour (16:30-17:30)	Northbound	55	0	0%
	Southbound	30	0	0%
	Two-Way	85	0	0%
Weekday 24-Hour	Northbound	476	4	1%
	Southbound	510	8	2%
	Two-Way	987	12	1%

Note: Summation errors due to rounding.

4.8.9 Table 4-19 shows that, on an average weekday, the B4489 carries approximately 130 vehicles during the AM peak hour, 90 vehicles during the PM peak hour, and 1,000 vehicles over the 24-hour period. HGVs account for no more than 2% of total traffic.

4.8.10 Junction Turning Count (JTC) surveys were also undertaken on Thursday 16th October 2014 at the following junctions in the study area network:

- M4 Junction 46 Northern Dumbell Roundabout;
- M4 Junction 46 Southern Dumbell Roundabout; and
- A48/Pant Lasau Road Mini-Roundabout.

4.8.11 The traffic survey data is reproduced in Appendix 7.1. The 2014 traffic flows at the surveyed locations during the weekday AM and PM peak hours are shown on Figures 4.15 and 4.16 respectively. Growth factors have been applied to represent traffic flows in 2017, as shown on Figures 4.17 and 4.18 respectively.

4.8.12 The surveyed junctions have been modelled using the TRL software program 'Junctions 9'. They have been modelled as a linked network in view of their proximity to each other. This has required the use of the lane simulation tool, which only provides outputs for queuing and delay. The capacity assessment results for 2017 during the weekday AM and PM peak hours are summarised in

4.8.13 Table 4-20.

4.8.14 These are shown for the entry arms to the network (listed clockwise from the northern arm of the B4489) and exclude the internal links. The capacity assessment output reports are reproduced in Appendix 7.2.

Table 4-20: 2017 Capacity Assessment Results

Entry Arm	Weekday AM Peak Hour		Weekday PM Peak Hour	
	Queue (Vehicles)	Delay (Secs/ Vehicle)	Queue (Vehicles)	Delay (Secs/ Vehicle)
B4489 (North)	2	34	1	6
M4 WB Off-Slip	211	884	2	6
Pant Lasau Road	6	43	25	134
A48 (Southeast)	3	17	75	372
B4489 (South)	36	171	2	8
A48 (Southwest)	59	638	1	6
M4 EB Off-Slip	113	823	1	6

4.8.15 Table 4-20 shows that, during the AM peak hour, the highest levels of queuing and delay are experienced on the M4 eastbound and westbound off-slips, followed by the A48 (Southwest) and B4489 (South). During the PM peak hour, levels of queuing and delay are significantly lower across the junction, with Pant Lasau Road and the A48 (Southeast) experiencing the highest levels of queuing and delay.

4.8.16 On-site observations carried out by AECOM during the AM peak hour on Tuesday 21st November 2017 suggests that the M4 Junction 46 is operating well within capacity. At the time of the observational visit, it was apparent that the queues reported by the modelling were not present at that time. This is particularly the case for the M4 off-slips,

which appeared to be free flowing or with minimal queuing. The modelling is therefore considered to represent a 'worst-case' of existing conditions at the junctions.

4.8.17 The analyses was carried out as part of this section will be based upon the previously observed traffic flows and queues and will therefore be a robust assessment of this part of the network.

iv. Road Safety

4.8.18 A review of PIC data has been undertaken to determine whether there are any locations on the local highway network with poor collision records.

4.8.19 The data was obtained from CCS for the three-year period from 1st October 2014 to 30th September 2017 (the most recent three-year period for which data was available). The reports for each of the PICs recorded in the study area together with a plan showing the location of each PIC (these are not included in this ES for data protection reasons).

4.8.20 A total of 25 PICs were recorded in study area over the three-year period, of which three were 'serious'. The remaining 22 PICs were all 'slight'. No 'fatal' PICs were recorded in the study area. For ease of analysis the PICs have been separated into those occurring at junctions and on links in the study area. The following account of the events which led to a PIC was taken from the records provided.

PICs at Junctions

4.8.21 One 'slight' PIC was recorded at the M4 Junction 46 Northern Dumbbell Roundabout. This involved a collision between a vehicle entering the roundabout and a vehicle already on the roundabout.

4.8.22 Four 'slight' PICs were recorded at the A48/Pant Lasau Road Mini-Roundabout. These all involved a collision between a vehicle entering the mini-roundabout and a vehicle already on the roundabout. These types of collisions are not uncommon on mini-roundabouts, due to the limited separation between entry arms. Further analysis has been undertaken of the listed causation factors for the PICs (these cannot be explicitly stated here for data protection reasons); this has not identified any highway defects contributing to these PICs.

4.8.23 One 'serious' PIC was recorded at the M4 Junction 46 Southern Dumbbell Roundabout. This involved a vehicle on the M4 westbound off-slip losing control and colliding with a tree on the central roundabout island.

PICs Recorded on Links

4.8.24 One 'slight' PIC was recorded on the B4489, south of its junction with Rhyd-y-pandy Road. This involved a collision between two vehicles on a bend; one vehicle was travelling northbound, and the other vehicle was travelling southbound.

4.8.25 Three 'slight' PICs were recorded on the M4 eastbound, between the off and on slips of the M4 Junction 46. Two of these PICs involved vehicles losing control, and the remaining PIC involved a rear-end shunt collision.

4.8.26 Two 'slight' PICs were recorded on the M4 eastbound, east of the M4 Junction 46, both of which involved rear-end shunt collisions.

4.8.27 Two ‘slight’ PICs were recorded on the M4 westbound, east of the M4 Junction 46. These involved a rear-end shunt collision, and a collision between two vehicles as one vehicle was changing lanes.

4.8.28 One ‘slight’ PIC was recorded on the M4 westbound off-slip. This involved a vehicle losing control and leaving the carriageway.

4.8.29 Three ‘PICs’ were recorded on the M4 westbound, between the off and on slips of the M4 Junction 46. The ‘serious’ PIC involved a vehicle losing control after entering the drainage system. The ‘slight’ PICs involved a rear-end shunt collision, and a vehicle losing control and colliding with the central barrier.

4.8.30 One ‘slight’ PIC was recorded on the M4 eastbound, west of the M4 Junction 46. This involved a rear-end shunt collision.

4.8.31 Two ‘slight’ PICs were recorded on the M4 eastbound off-slip. One of the PICs involved a vehicle losing control, colliding with the barrier and overturning. No description was provided for the remaining PIC.

4.8.32 One ‘slight’ PIC was recorded on the A48 between the M4 Junction 46 Southern Dumbbell Roundabout and the A48/Pant Lasau Road Mini-Roundabout. This involved a vehicle travelling southeast-bound entering the opposite side of the carriageway and colliding with an oncoming vehicle.

4.8.33 One ‘serious’ PIC was recorded on Pant Lasau Road, northeast of the A48/Pant Lasau Road Mini-Roundabout. This involved a collision between a vehicle and a pedestrian that had entered the carriageway.

4.8.34 One ‘slight’ PIC was recorded on the A48, southeast of the A48/Pant Lasau Road Mini-Roundabout. This involved a collision between a vehicle performing a u-turn and another vehicle.

4.8.35 One ‘slight’ PIC was recorded on the A48, southwest of the M4 Junction 46. This involved a collision between a vehicle pulling off from the side of the carriageway and a vehicle travelling southwest-bound.

Summary

4.8.36 Overall, the analysis of the PIC data and listed causation factors has not identified any existing highway safety issues in the study area. Where PICs have been recorded, these have been identified as being as a result of causation factors relating to driver/road user error and weather conditions. No causation factors relating to highway defects have been reported in the PIC data.

v. Walking and Cycling

4.8.37 The walking and cycling facilities and PRoW are shown on Figure 4.19.

4.8.38 There are no footways that serve the Project Site. The nearest footways are on the B4489, approximately 475m south of the Access Road (on the approach to the junction with the Felindre Park and Share. This footway continues to the M4 Junction 46. The 500 m section of the footway to the north of the M4 Junction 46 is separated from the carriageway edge by a barrier. At the M4 Junction 46 the footways continues south along the east side of the carriageway, serving the southern arms of the southern dumbbell roundabout, with dropped kerbs and tactile paving to facilitate crossing movements across entry arms.

4.8.39 There are no formal cycling routes in the vicinity of the Project Site. Part of the B4489 is identified as an 'advisory cycling route' on the CCS's cycle map. This covers the section of the B4489 that routes north from the Access Road to Felindre and to a point approximately 475 m south of the Access Road.

4.8.40 There are numerous PRoW crossing/in the vicinity of the Project Site. Footpaths LC34 and LC117 cross the Access Road (and the new section of Access Road) at points approximately 350 m and 1.3 km from the B4489. Footpath LC35B passes through the Gas Connection Site, connecting to Rhyd-y-Pandy Road in the vicinity of the AGI Access.

vi. Public Transport

4.8.41 The nearest bus stop to the Project Site is the 'Lliw Reservoirs' stop located on Rhyd-y-pandy Road. This is situated to the east of Felindre and approximately 500 m to the northwest of the northern extent of the Project Site boundary. There is no footway between the Project Site and this bus stop. It provides access to Service 142, which routes between Morriston and Garnswllt. This service is operated Community Transport for the Dulais, Afan, Neath, Swansea and Amman Valley areas. There are three to four services per day in each direction, although these can generally only be pre-booked.

4.8.42 Service 141 passes to the south of the Project Site, routeing between Gorseinon and Morriston. The nearest stop that provides access to this service is the 'Pant Lasau Cross' stop located on Mynydd Gelli Wastad Road. It is situated approximately 750 m to the southeast of the southern extent of the Project Site boundary and can be accessed via Footpath LC117.

4.8.43 There are no railway stations in the vicinity of the Project Site. Llansamlet railway station is situated approximately 5.5 km southeast of the Project Site, accessible by car via the A48 (from M4 Junction 44 and 46). Swansea railway station is a further 7 km from the Project Site; this is a key local transport hub and is more easily accessible by public transport. Swansea railway station is managed by Arriva Trains Wales. There are four services daily from Swansea to Shrewsbury; an hourly service from Swansea to Manchester Piccadilly, which calls at Cardiff Central; and a total of two to three services hourly from Swansea to Cardiff Central. Great Western Railway also provides services from Swansea to London Paddington, calling at Bristol Parkway.

4.8.44 Overall, the opportunities to access the Project Site by public transport are limited, and it is therefore considered that, for the purposes of this assessment, no trips by construction, maintenance and permanent staff will be undertaken by these modes.

vii. Parking

4.8.45 Felindre Park and Share is accessed from the B4489, approximately 550 m south of the Access Road. It is located on the site of the proposed Felindre Business Park. It has capacity for 480 spaces and its use is encouraged for employees of the Driver and Vehicle Licensing Agency (DVLA) Headquarters (HQ) in Clase. A shuttle bus service runs between the Felindre Park and Share and the DVLA. There are no other parking facilities in the study area. The Felindre Park and Share is understood to be managed by the DVLA and will not be available for use by the Project.

AGI Access

4.8.46 An Automatic Traffic Count (ATC) survey was undertaken between Thursday 14th June 2018 and Wednesday 20th June on the road passing the AGI Access (Rhyd-y-Pandy Road. The results of the survey are shown in the table below:

Table 4-21: Summary Weekday AGI Access Traffic Information

Time Period	Direction	Total Vehicles	No. of HGVs	HGV%
Average Weekday (24-Hour)	Eastbound	105	1	1%
	Westbound	114	1	1%
	Two-Way	**219**	**2**	**1%**

4.8.47 Table 4-21 effectively shows that Rhyd-y-Pandy Road carries 219 vehicles per day at this location, of which HGVs account for 1%.

b) Potential Environmental Effects

i. Construction

Traffic Generation

4.8.48 The peaks in construction staff traffic and HGV traffic are shown for the weekday AM and PM peak hours and 24-hour period in Table 4-22. This includes traffic associated with the construction of the AGI.

Table 4-22: Gas Connection Peak Traffic Generation

Time Period	Vehicle Type	Arrivals	Departures	Total
Weekday AM Peak Hour (07:45-08:45)	Light Vehicles (Staff)	5	0	5
	HGVs	1	0	1
	Total	**6**	**0**	**6**
Weekday PM Peak Hour (16:30-17:30)	Light Vehicles (Staff)	0	5	5
	HGVs	0	1	1
	Total	**0**	**6**	**6**
Weekday 24-Hour	Light Vehicles (Staff)	10	10	20
	HGVs	2	2	4
	Total	**12**	**12**	**24**

Severance, Pedestrian Delay, Pedestrian Amenity, Fear and Intimidation – Traffic Flows

4.8.49 Table 4-23 and Table 4-24 show the two-way total link flows (all vehicles) during the weekday AM and PM peak hours respectively for the '2022 Baseline' and '2022 Baseline + Gas Connection Construction Traffic' scenarios, the difference between the two and the percentage change.

Table 4-23: 2022 Two-Way Total (All Vehicle) Traffic Flows (Gas Connection) – Weekday AM Peak Hour (07:45-08:45)

Link No.	2022 Baseline	2022 Baseline + Gas Connection Construction Traffic	Difference	% Change
1	-	-	+6	-
2	140	147	+6	+4%
3	140	147	+6	+4%
4	382	388	+6	+2%
5	415	415	+0	+0%
6	1,223	1,227	+5	+0%
7	876	877	+1	+0%
8	2,334	2,335	+2	+0%
9	1,365	1,366	+1	+0%
10	1,239	1,240	+1	+0%
11	1,112	1,114	+2	+0%
12	938	938	+0	+0%

Table 4-24: 2022 Two-Way Total Traffic Flows (All Vehicle) (Gas Connection) – Weekday PM Peak Hour (16:30-17:30)

Link No.	2022 Baseline	2022 Baseline + Gas Connection Construction Traffic	Difference	% Change
1	-	-	+6	-
2	90	96	+6	+7%
3	90	96	+6	+7%
4	242	248	+6	+3%
5	842	844	+3	+0%
6	1,239	1,242	+3	+0%
7	606	606	+0	+0%
8	2,023	2,025	+2	+0%
9	950	951	+1	+0%
10	1,221	1,222	+1	+0%
11	1,124	1,125	+1	+0%
12	948	948	+0	+0%

4.8.50 Table 4-25 shows the two-way HGV link flows during the weekday 24-hour period in 2022 both without and with the Gas Connection construction traffic, the difference between the two and the percentage change.

Table 4-25: 2022 Two-Way HGV Traffic Flows (Gas Connection) – Weekday 24-Hour

Link No.	2022 Baseline	2022 Baseline + Gas Connection Construction Traffic	Difference	% Change
2	13	17	+4	+31%
3	13	17	+4	+31%
4	154	158	+4	+3%

4.8.51 The level of increase in HGV traffic associated with the Gas Connection on the pedestrian experience on these links is not significant. Minimal pedestrian movement has been observed at these locations, which is typical given the nature of the strategic access junction. It is also likely that any pedestrians at these locations will already be accustomed to the levels of general traffic and HGVs.

4.8.52 No additional mitigation is proposed however traffic management will be covered within a CTMP and CSTP, T01 – T05 of the Mitigation Register (Appendix 2.1).

Driver Delay

4.8.53 Table 4-26 and Table 4-27 show the driver delay at the junction network during the weekday AM and PM peak hours respectively in 2022 both without and with the Gas Connection construction traffic.

Table 4-26: Capacity Assessment Results (Gas Connection) – Weekday AM Peak Hour (07:45-08:45)

Entry Arm	Delay (Seconds/Vehicle)			% Change
	2022 Baseline	2022 Baseline + Gas Connection Construction Traffic	Difference	
A - B4489 (North)	38	36	-2	-5%
B - M4 WB Off-Slip	1,040	1,049	+9	+1%
C - Pant Lasau Road	54	65	+9	+17%
D - A48 (Southeast).	20	21	+1	+5%
E - B4489 (South).	287	276	-11	-4%
F -A48 (Southwest	859	861	+2	+0%
G - M4 EB Off-Slip.	1,030	1,021	-9	-1%

Table 4-27: Capacity Assessment Results (Gas Connection) – Weekday PM Peak Hour (16:30-17:30)

Entry Arm	Delay (Seconds/Vehicle)			% Change
	2022 Baseline	2022 Baseline + Gas Connection Construction Traffic	Difference	
A - B4489 (North)	6	6	+0	+0%
B - M4 WB Off-Slip	7	7	+0	+0%
C Pant Lasau Road	220	230	+10	+5%
D - A48 (Southeast).	552	564	+12	+2%
E - B4489 (South).	9	9	+0	+0%
F -A48 (Southwest)	6	6	+0	+0%
G - M4 EB Off-Slip.	7	7	+0	+0%

4.8.54 Table 4-26 shows that, during the AM peak hour, the entry arms of the M4 westbound off-slip and Pant Lasau Road will experience a change of up to 17% which is not considered significant. The B4489 (North and South) and the M4 eastbound off-slip will experience a beneficial effects; this is as a result of changes in the balance of traffic flows at the junction, which will result in more gaps for traffic exiting from this arm as priorities are changed. This will result in a reduction in the level of delay of the arm benefitting from traffic flow balancing and an increase in arms which are forced to concede priority more than before flows were balanced.

4.8.55 Table 4-27 shows that, during the PM peak hour, all entry arms will experience a change of up to 5% which is not considered significant. This effect will be temporary in nature, and only experienced during the peak of construction traffic movements.

4.8.56 No additional mitigation is proposed, but management measures to minimise driver delay will be included within a CTMP and CSTP, T01 – T05 of the Mitigation Register (Appendix 2.1).

ii. Operation

4.8.57 For maintenance activities during the operation phase, vehicles will use the AGI Access. The traffic generation is expected to be minimal (approximately 2 vehicles per month), therefore no embedded mitigation is required, or additional mitigation.

4.9 Geology and Ground Conditions

a) Baseline Conditions

4.9.1 This section describes the baseline environmental characteristics for the Gas Connection Site and surrounding areas with specific reference to geology, ground

conditions and hydrogeology. The study area for this section is the Project Site Boundary.

4.9.2 This assessment has been undertaken using desk based information currently available including the Landmark Envirocheck Report (dated October 2017 and presented in Appendix 8.1) and the Preliminary Geo-Environmental Risk Assessment for Abergelli Power Project (Appendix 8.2), and a site walkover undertaken in July 2014.

i. Geological information

4.9.3 The baseline geology, ground conditions and hydrogeology data of the Gas Connection Site has been gathered from the following sources:

- Landmark Information Group Envirocheck Report. Presented in Appendix 8.1;
- Preliminary Geo-Environmental Risk Assessment from Abergelli Power Project (Appendix 8.2); and
- BGS. Digital Geological map of Great Britain at 1:50,000 scale (Ref.5.35).

Made Ground

4.9.4 There is no Made Ground indicated within the Gas Connection Site, based on published BGS records. Made Ground is only considered to be likely to be present an areas associated with previous development such as the landfill and colliery. It may also be present if the landowner undertook land levelling. If any Made Ground is present within the Gas Connection Site, its composition and provenance would be unknown.

Superficial Geology

4.9.5 There are three types of superficial deposits identified across the Gas Connection Site comprising: glacial diamicton till, glaciofluvial deposits of sand and gravel and quaternary peat.

4.9.6 The BGS indicates that there are three boreholes located in Gas Connection Site, however only one is available to view online and presented in Appendix 8.3. The borehole log is located east of Abergelli Farm in an area mapped as being underlain by Devensian glaciofluvial deposits of sand and gravel.

4.9.7 The borehole log indicates superficial deposits comprising yellow brown sandy gravelly clay down to 6.4 metres below ground level (mbgl), overlying grey brown clayey gravelly sand, clayey sand and sandy clay down to 15.8 mbgl considered to be representative of glaciofluvial deposits. These are underlain by firm yellow clay becoming stiff grey gravelly clay described in the log as possible boulder clay which is likely to be glacial till; proven to a maximum depth of 16.8 mbgl. Traces of coal were identified at 10.7 mbgl within the clayey sand.

Bedrock Geology

4.9.8 The bedrock geology underlying the Gas Connection Site consists of the Grovesend Formation of the South Wales Upper Coal Measures Formation, comprising argillaceous mudstones and siltstones, with well-developed coals, and minor lithic sandstones. The BGS (Ref.5.36) indicates that the Grovesend Formation is the youngest unit found in the South Wales coalfield.

4.9.9 The north eastern corner of the 1 km search buffer surrounding the Gas Connection is underlain by the Swansea Member, comprising green-grey Pennant Sandstone, with thin mudstone/siltstone and seatearth interbeds and (mainly thin) coals. This geological formation is overlain conformably by the Grovesend Formation.

4.9.10 The Preliminary Geo-Environmental Risk Assessment (Ref.5.37) indicates that there was a 'Slant' (inclined shaft or level) identified at Abergelli Colliery, which provided access to both the Graigola and Swansea Four Feet coal seams.

ii. Soils and Agriculture

4.9.11 The soil and agriculture land classifications are discussed in the Preliminary Geo-Environmental Risk Assessment (Ref.5.37) and confirmed by NATMAP Soilscapes indicate the following:

- There are two different soil classification areas across the Gas Connection Site. The predominant soil classification is described as "slowly permeable, wet, very acidic upland soils with a peaty surface". The soils are described as "low fertility" and land cover is described as "moorland rough grazing and forestry". The precipitation "drains to the stream network". Overgrazing of this soil could lead to accelerated run-off and soil erosion.
- The soils are described as "freely draining, slightly acid loamy soils". The soils are of "low fertility", with "arable and grassland" land cover and precipitation "drains to local groundwater and rivers". There is potential for groundwater contamination with these soils, comprising nitrate, siltation and nutrient enrichment of streams from soil erosion.
- The agricultural land classification for the land within and surrounding the Gas Connection Site is Grade 4 ("poor quality agricultural land") "with severe limitations which significantly restricts the range of crops and/or level of yields, mainly suited to grass with occasional arable crops".
- The Gas Connection Site is known to be utilised as improved grazing for sheep and horses, with small areas of interspersing the improved grassland.

iii. Ground Workings and Mineral Resources

4.9.12 The Envirocheck (Appendix 8.1) does not indicate the presence of any historical ground workings on the Project Site, however within the 1 km search buffer there are ten records of historical ground working features. These have all ceased production and are listed in Table 4-28. These comprise nine opencast mines producing sandstones and sands and gravel and one underground mine producing coal.

Table 4-28: Recorded Opencast and Underground Mines

Site Name	Distance and direction	Type of site	Status	Geology and Commodity
Aber-Gelli-Fach Gravel Pit	161 m NE	Opencast	Ceased	Glaciofluvial Deposits - sand and gravel
Bryn-Whilach Plantation Gravel Pit	456 m SE	Opencast	Ceased	Till - sand and gravel
Waen Ffyrdd Plantation Sand Pit	474 m W	Opencast	Ceased	Glaciofluvial Deposits - sand
Gelli-Gron	621 m NE	Opencast	Ceased	Swansea Member - sandstone
Llidiard -Y-Cleders	648 m NW	Opencast	Ceased	Grovesend Formation - sandstone
Bryn-Whilach	676 m SE	Underground	Ceased	Grovesend Formation - deep coal
Nant-Y-Ganol Wood Sand Pit	800 m S	Opencast	Ceased	Till - sand
Waterworks Cottage	893 m N	Opencast	Ceased	Swansea Member - sandstone
Gelli-Feddan	956 m N	Opencast	Ceased	Grovesend Formation - sandstone
Pen-Y-Fedw-Isaf	976 m W	Opencast	Ceased	Swansea Member - sandstone

4.9.13 The Coal Authority Mining Report (Appendix 8.4) identified Abergelli Colliery located adjacent to the Project Site Boundary. A coal pit, shaft, colliery, and mine spoil heap have all been identified on historical mapping at locations extending to between 480 m and 1 km from the Gas Connection Site Boundary (i.e. outside the boundaries of the Project Site).

4.9.14 The Coal Authority Mining Report (dated 30 July 2014) indicated that the Gas Connection is in the “likely zone of influence from workings in three seams of coal, at shallow to a depth of 380 m”. Figure 4.20 presents the mine workings from the mine abandonment plan across the Project Site. This plan shows that the entire Project Site is influenced by mine workings.

4.9.15 As illustrated in Figure 4.21, there is one mine and one shaft entry located within or close to the Project Site. The mine entry is located outside the Gas Connection Site Boundary, in the vicinity of Abergelli Colliery (north of Abergelli Farm). The mine shaft is located south of the Substation at (NGR 264970, 200800). There is no record of any treatment to the mine/shaft entries. A site visit undertaken on the 12th March 2018 has confirmed that the shaft has been back filled and no open void was visible.

4.9.16 The Coal Authority indicates that reserves of coal exist and could be worked in the future. However, the Gas Connection Site is currently not in an area for which the Coal Authority is determining to grant a licence to remove coal using underground methods, where a licence has been granted, or in an area that is likely to be affected at the surface from any planned future underground workings.

4.9.17 The Coal Authority report states that the Gas Connection Site is not within the boundary of an opencast site from which coal has been removed by opencast methods, and does not lie within 200 m of a boundary of an opencast site. It also states that the Gas Connection Site is not within 800 m of the boundary of an opencast site for which the Coal Authority are determining whether to grant a licence to remove coal by opencast methods, or for which a licence to remove coal has been granted.

iv. Ground Stability/Subsidence

4.9.18 The Coal Authority Mining Report indicates that no notice of the risk of the land being affected by subsidence has been given under Section 46 of the Coal Mining Subsidence Act 1991.

4.9.19 Abergelli Farm has been subject to remedial works, by or on behalf of the Coal Authority under its emergency surface hazard call out procedures. No further information was provided, however two damage notices or claims for alleged subsidence damage were made in June 1995 and November 1996 both of which were rejected.

4.9.20 Geological hazards across the Gas Connection Site have been identified in the Landmark Envirocheck Report; these are detailed in Table 4-29.

Table 4-29: Geological Hazards

Geological Hazard		Hazard Potential:
Stability Hazards	Collapsible Ground	No hazard to very low
	Compressible Ground	No hazard to high
	Ground Dissolution	No hazard
	Landslide Ground	Very low to low
	Running Sand Ground	No hazard to low
	Shrinking or Swelling Clay Ground	No hazard to very low
Radon Affected Areas	Lower probability radon area (less than 1% of homes are estimated to be at or above the Action Level).	
Radon Protection Measures	No radon protective measures are necessary in the construction of new dwellings or extensions	

4.9.21 Consideration of this hazard will be made in the design of any ground works (including ground investigation, earthworks, de-watering) and foundation design. There is an impact associated with any measure selected to mitigate the risk of settlement of compressible peat deposits (if present). The final design will incorporate suitable mitigation on the basis of the ground investigation findings to minimise the interaction of the Gas Connection with the peat / disturbance of the peat as a result of the Project. In the event that there will be some disturbance of peat, part of the embedded mitigation is to undertake a peat survey, including probing of the peat to determine the thickness and extent of the deposits, and the production of a Peat Management Plan, which will detail how to handle the peat properly and maximise on-site reuse of any excavated peat. The peat survey methodology and Peat Management Plan (if a reasonable amount of peat is found) will be prepared in consultation with and approved by CCS and NRW prior to construction (Appendix 2.1, G02).

v. Hydrogeology

4.9.22 The superficial glaciofluvial deposits and the bedrock geology are both classified as Secondary A Aquifers. Secondary A Aquifers are defined as '*permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers*.'

4.9.23 The superficial glacial till deposits are classed as Unproductive Strata, defined as 'rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow'.

4.9.24 The Landmark Envirocheck report has identified no groundwater abstraction licences associated with the Gas Connection Site. There is only one licence located within 100 m of the Gas Connection Site, recorded 56 m to the north-east for a well at Abergelli Farm, licence number 22/59/4/0027 dated February 1993, for general farming and domestic use. There are a further seven licensed groundwater abstractions within 1 km of the site all for general farming and domestic use and a further 21 within 2 km of the Gas Connection Site. Swansea Council has also identified a number of private water supplies located in close proximity to the Project Site.

4.9.25 The Gas Connection Site does not lie within a groundwater Source Protection Zone (SPZ).

4.9.26 The Landmark Envirocheck identifies the groundwater vulnerability classification of the soils beneath the Gas Connection Site and surrounding area. These vary between Low (L) to High (H) Leaching Potentials (classifications of L, H1, H3, I1 and U). These classifications are described as follows:

- L: Soils in which pollutants are unlikely to penetrate the soil layer because water movement is largely horizontal or they have large ability to attenuate diffuse pollutants. Lateral flow from these soils contributes to groundwater recharge elsewhere in the catchment.
- H1: Soils which readily transmit liquid discharges because they are either shallow or susceptible to rapid by-pass flow directly to rock, gravel or groundwater.
- H3: Coarse textured or moderately shallow soils which readily transmit non-absorbed pollutants and liquid discharges but which have some ability to attenuate absorbed pollutants because of their large clay or organic matter contents.
- I1: Soils which can possibly transmit a wide range of pollutants.
- U: Soil information for restored mineral workings and urban areas is based on fewer observations than elsewhere. A worst case vulnerability classification (H) assumed, until proved otherwise.

4.9.27 There have been no Pollution Incidents to Controlled Waters recorded on the Gas Connection Site by the Envirocheck Report. There have been three between 250 m and 500 m of the Gas Connection Site, which were classed as Category 3 minor incidents and a further eight incidents between 500 m and 1 km of the Gas Connection Site. These were classed between Category 1 major incident and Category 3 minor incidents.

vi. Soil Chemistry

4.9.28 The Envirocheck Report has identified the estimated background soil chemistry (for selected key elements) across the Gas Connection Site. They are summarised as:

- Arsenic: 25 – 35 mg/kg,
- Cadmium: <1.8 – 3.0 mg/kg,
- Chromium: 60 – 90 mg/kg
- Nickel: 15 – 45 mg/kg; and
- Lead: <100 mg/kg.

vii. Landfill

4.9.29 The Envirocheck Report indicates that there are no landfill sites located within the Gas Connection Site Boundary.

4.9.30 The closest landfill sites to the Gas Connection Site is one registered landfill and an adjacent historic "Landfill Extension" located at Abergelli Fach Farm located between 92 m and 121 m north east of the Gas Connection Site. The current status of the registered landfill is 'closed' and it was only able to accept non-biodegradable wastes. The total void space was calculated at 75,000 m^3 with a total tonnage of 142,500 t.

4.9.31 The Landfill Extension is reported to have accepted inert waste. The planning application for this extension was granted in 1997. NRW provided the Working Plan and associated drawings for the landfill which were dated March 1994. The total void space was calculated at 99,898 m^3, with a total tonnage of 179,816 t. The Working Plan described the land as low lying, and poorly drained. Approximately three quarters of the landfill area was covered by a mine soil dump from Abergelli Colliery. This mine waste was removed leaving a layer of well compacted mine waste over the majority of the landfill area. The area of ground that was covered by the mine spoil was used for drying out of water treatment sludge (aluminium sulphate) though ceased when the landfill became operational. No further information on this operation is known.

4.9.32 Swansea City Waste Disposal Company Ltd gained planning permission for 'excavation and removal of inert material from landfill site and restoration' at Abergelli Farm in February 2003 (CCS Ref: 2002/0312). This consent was subsequently amended, extending the permission to allow the excavation and removal of inert material until 31st December 2010 (2007/0907). The site has now been fully restored.

4.9.33 There are also an additional three historical landfills within 400 m of the Gas Connection, all located between 294 m and 402 m south-east of the Gas Connection Site. The first is located 294 m east of the Gas Connection Site at Gorswen Farm and accepted unspecified waste between 1971 and 1972. The second landfill was licenced to British Steel and located 309 m south-east. It was active between 1980 and 1994 and received deposited waste included industrial and household waste. The third landfill is located 402 m south-east and was active been 1955 and 1970 receiving deposited waste included inert, industrial and special waste.

viii. Recorded Animal Burial Grounds

4.9.34 Information obtained from CCS indicates there was no local cull of animals in Swansea, Neath Port Talbot or Carmarthenshire during the Foot and Mouth outbreak in 2001. No mass burial of animals have been recorded at the Gas Connection Site.

ix. Historical Land Use

4.9.35 Historical maps have been provided in the Landmark Envirocheck Report, presented in Appendix 8.1. The historical development of the Gas Connection Site is summarised in Table 4-30.

Table 4-30: Historical Development

Dates / Sources	On Gas Connection Site	Surrounding Area
1877 1:2,500 1884 1:10,560	The Gas Connection Site is predominantly agricultural fields and tracks, with areas of woodland and marshland.	The land is predominantly agricultural. A lime kiln is identified approx. 500 m south of the Gas Connection Site; west of the Maes-eglwys development. There are a number of buildings associated with Abergelli Fach and Bryn-Mawr to the west of the Project Site, Abergelli Fawr to the east of the Gas Connection Site.
1890 1:10,560 1898 – 1899 1:2,500	The woodland to the west of the Gas Connection Site has now been identified as Abergelli Fach Plantation.	A gravel pit is identified to the west of Abergelli Fach approx. 250 m west of the Gas Connection Site.
1921 1:10,560 1917-1918 1:2,500	Rises and streams are now indicated on the map.	A tank is identified next to a spring 250 m west of the Gas Connection Site, north of Abergelli Fach Plantation. The gravel pit located to the west of the Gas Connection Site is now identified as ‘old’. The limekiln previously identified west of Maes-eglwys is now labelled as ‘Old Limekiln’.
1935-1936 1:10,560 1935 1:2,500	No significant changes.	Abergelli Colliery, associated buildings, engine houses, railway sidings, slant (loading bay) and tank are identified on the map, north of Abergelli Fach and adjacent to the Gas Connection Site Boundary. The gravel pit to the west of Abergelli Fach is no longer labelled.
1951 1:10,560	No significant changes.	The buildings associated with Abergelli Colliery have changed slightly but still appear to be operational
1964 1:10,560 1961 1:2,500	No significant changes.	The colliery is now identified as disused. A spoil heap/tip adjacent to the colliery is identified to the north west of the mine with a routeway into the centre of the tip. Railway sidings tracks run through the colliery and ends at the edge of the spoil heap/tip. The tank next to Abergelli Plantation is no longer identified.
1976 1:10,000 1973-1975 1:2,500	Electricity pylons are identified across the Gas Connection Site in a north-east to south-west direction.	The majority of the buildings associated with Abergelli Colliery no longer remain. The Substation is presented adjacent to the south east of the Gas Connection Site. Associated pylons run south, north and east.

Dates / Sources	On Gas Connection Site	Surrounding Area
1986 1:2,500	No significant changes.	A gas valve compound is shown adjacent to the north western Gas Connection Site Boundary. Beyond the gas valve compound are covered reservoirs and associated water treatment works.
1990 1:2,00	No significant changes.	The spoil heap/tip/landfill adjacent to the former Abergelli colliery is no longer present on the map.
1991 1:10,000 1992 1:2,500 1999 Google Earth Pro imagery	The Substation is present southwest of the Gas Connection Site adjacent to Lletty-Morfil Plantation.	A large warehouse building is now present in the area adjacent to the former Abergelli Colliery (which is no longer labelled). From the earliest imagery available on Google Earth Pro the landfill adjacent the former Abergelli colliery appears to be backfilled and the slope graded. The majority of the landfill extension to the south of the Gas Connection Site is vegetated. Abergelli Fach is now labelled as Abergelli Farm and looks to have been redeveloped. Abergelli Fawr to the east of the Gas Connection Site is now labelled as ruins.
1999 1:10,000	No significant changes.	Velindre Works to the south of the Gas Connection Site is no longer present.
2000 Aerial photography	No significant changes.	
2002 1:10,000 2002 Google Earth Pro imagery	No significant changes.	Two buildings associated with the former colliery remain along with a large warehouse.
2006 1:10,000	No significant changes.	An area to the west of Abergelli Farm is cleared of vegetation. Part of the former tip to the north of the former Abergelli Colliery has been redeveloped into an area of hardstanding.
2008 Google Earth Pro imagery	No significant changes.	The Felindre Gas Compressor Station located to the west of the Gas Connection Site is being developed. A large tract of land leading north from the station is cleared of vegetation to allow for the pipelines to be buried. The area of ground west of Abergelli Farm which was cleared in 2006 now has a number of small buildings present.
2010 Google Earth Pro imagery	No significant changes.	There is a new access road serving the Felindre Gas Compressor Station development. Two new residential dwellings have been built on the open ground to the west of Abergelli Farm.
2013 Google Earth Pro imagery	No significant changes.	The access road serving the Felindre Gas Compressor Station development is no longer present.

Dates / Sources	On Gas Connection Site	Surrounding Area
2015 Google Earth Pro imagery	No significant changes.	A new area of hardstanding has been developed on the landfill site adjacent to the former Abergelli Colliery. Two solar parks have been developed; Rhyd-y-pandy solar park to the east of the Gas Connection Site and Abergelli Farm to the west of the Gas Connection Site.

x. Potentially Contaminative Land Uses

4.9.36 The study area for this section is 250 m from the Project Site Boundary. Table 4-31 lists land uses identified which have the potential to cause contamination within this study area. Land uses further than 250 m from the Project Site Boundary are not considered as they are unlikely to affect the Project Site. The table also details contaminant groups potentially present as a result of these land uses.

Table 4-31: Land Uses and Potentially Present Contaminant Groups

Process / Land use	Location	Contaminant Groups Potentially Present
Abergelli Colliery with associated engine houses, tanks, conveyor belt and spoil heap	Off-Site: North of Abergelli Fach (Farm) immediately west of the Project Site.	Metals and metalloids, phenols, sulphates, asbestos, total petroleum hydrocarbons (TPH) and polycyclic aromatic hydrocarbons (PAHs). Ground gas including coal bed methane.
Railway sidings associated with Abergelli Colliery	Off-Site: North of Abergelli Fach (Farm) immediately west of the Project Site.	Hydrocarbons including lubricating oils/fuel, PCBs, PAHs, ethylene glycol, heavy metals, asbestos, combustion ash, herbicides, creosote, sulphate.
Drying out of water treatment sludges	Off-Site: Abergelli Colliery and location of landfill extension (~120 m west of Project Site).	Aluminium sulphate and heavy metals
Historic Landfill and Landfill Extension	Off-Site: North west and west of Abergelli Colliery (north of Abergelli Fach) ~100 m west of the Project Site at its closest point.	Heavy metals, hydrocarbons, asbestos and other unknown contaminants associated with the waste (reported to be non-biodegradable wastes). Mining wastes including mine tailings/spoil potentially containing high concentrations of arsenic, copper and other metals, phenols, sulphates, asbestos, TPH and PAHs. Gases such as carbon dioxide, methane and hydrogen sulphide generated from fill materials of unknown constituents.
Felindre Gas Compressor Station, the Substation and electricity pylons	Off-Site: West of the Project Site, located north and south of the Access Road. Sites operated by National Grid Gas Plc. Electricity pylons located across the Project Site	Polychlorinated biphenyls (PCB's), other transformer oils and solvents
Agricultural land	On-Site: Across the majority of the Project Site including plantations to the south of the Project Site.	Fertilisers, pesticides, herbicides, fuel and oil hydrocarbons associated with machinery, organic and biological contaminants.

xi. Sources of Contamination

4.9.37 It is considered that the most likely sources of contamination for the Gas Connection Site are:

- Contamination associated with the off-site historic landfill and landfill extension including aluminium sulphate sludge; and
- Contamination from agricultural land use.

xii. Preliminary Conceptual Site Model (CSM)

4.9.38 On the basis of the information summarised above, a preliminary CSM has been developed for the Gas Connection. The CSM identifies potential contaminants, receptors (both on and off-site) and exposure pathways that may be present. The identification of such potential “pollutant linkages” is a key aspect of the evaluation of potentially contaminated land. Potential “pollutant linkages” associated with the Project Site are detailed within Table 4-32.

4.9.39 It should be noted that the identification of potential “pollutant linkages” does not indicate that they are significant in any way or that the Gas Connection Site is unsuitable for its current/proposed use. It does, however, act as a way of focusing future data collection at the Gas Connection Site and identifying any key potential risks associated with the Gas Connection Site.

4.9.40 The model is based on a desk study and a walkover undertaken in 2014 and will be confirmed through intrusive investigation prior to detailed design.

Table 4-32: Preliminary Conceptual Site Model

Source	Pathway	Receptor	Risk	Risk Description
Off-Site: Waste within the historic landfill and landfill extension (including the process of drying out water treatment sludge)	Direct contact with shallow groundwater impacted with landfill leachates.	Construction Workers	Low	The majority of the development area will comprise hardstanding; therefore the risk of exposure is negligible. Regular contact with this potential contaminative source is unlikely. The presence of vegetation across the majority of the Gas Connection Site limits exposure via the direct contact pathway.
Landfill gas generation	Inhalation of soil vapours outdoors	Construction Workers	Low	There is potential for landfill gases to be present within the landfill and landfill extension. The gas generation is anticipated to be low as the landfill was licenced to only receive inert and non biodegradable waste. This needs to be considered as buried structures will be constructed to the east of the landfills.
	Migration of ground gases / vapours into buildings including accumulation in confined spaces	Human Health: Future workers on the Generating Equipment	Low	
		Built environment / structures / services		
Mine gas generation	Inhalation of soil vapours outdoors	Construction workers	Moderate / Low	During the construction works there is a possibility that ground gas from coal bed methane or mine workings may be disturbed. The Coal Authority report indicates that there are shallow workings present in 3 seams of coal to depths of 380 m. Ground investigation is required to assess the likelihood and level of risk. With current land use the risk is considered to be moderate to low as there has been minimal ground disturbance.
	Migration of ground gases / vapours into buildings including accumulation in confined spaces	Human Health: Future workers on the Generating Equipment		
		Built environment / structures / services		
Natural gas from potential peat stratum	Inhalation of soil vapours outdoors	Human Health: Future workers on the Generating Equipment	Moderate / Low	There is potential for natural ground gases to be present within the peat stratum mapped in localised areas within the Gas Connection Site. The gas generation is anticipated to be moderate to low in these areas and this currently vents naturally.
	Migration of ground	Construction workers	Moderate	Construction workers may potentially disturb the peat

Source	Pathway	Receptor	Risk	Risk Description
	gases / vapours into buildings including accumulation in confined spaces	Built environment / structures / services	/ Low	habitat during the construction works; this is particularly relevant with sub-surface construction activities where ground gas may accumulate.
Agricultural land (potential sheep dips, use of fertilisers)	Surface run-off	Controlled waters (groundwater in Secondary A superficial and bedrock aquifers and drainage ditches within the Gas Connection Site Boundary)	Low	Fertilisers could be washed into receiving surface waters. Drainage ditches run across the Gas Connection Site and may transport contaminants. The farming practices and potential use of chemicals is unknown but as the land is predominantly used for grazing the risk is considered low.
	Dermal contact and ingestion of soils and dust Inhalation of dust	Human Health: Future workers on the Generating Equipment	Low	The majority of the development area will comprise hardstanding; therefore the risk of exposure is negligible. Regular contact with this potential contaminative source is unlikely. The presence of vegetation across the majority of the Gas Connection Site limits exposure via the direct contact pathway.
		Construction workers	Low	As above. In addition, the exposure durations are limited and the receptor class is less sensitive. Regular contact with site soils is unlikely.
Natural radon gas	Inhalation of soil vapours outdoors	Human Health: Future workers on the Generating Equipment	Low	The Envirocheck report indicates that the radon potential is low in this area.
	Inhalation of soil vapours indoors	Construction workers		
Aggressive soil conditions	Direct contact with shallow groundwater and soil	Buried concrete structures of the Project	Low	Whilst aggressive soil conditions (sulphate / pH) may be present, the area which will require buried structures is on greenfield land and therefore the probability of the risk occurring is unlikely; therefore the risk is considered low.

Source	Pathway	Receptor	Risk	Risk Description
Chemicals used during construction works including oils/fuels, liquid concrete and other materials	Accidental releases to ground including spillage/ leakage from containers and engines, followed by vertical/lateral migration	Controlled Waters: Secondary A superficial and bedrock aquifers	Low	If spillage of chemicals occurred during construction operations it is likely that this would be quickly recognised and contained, due to operational requirements. Construction industry pollution prevention guidelines will be followed, as detailed in the CEMP, such as use of bunded storage of any chemicals or fuel kept on site, the introduction of petrol interceptors to filter run off from areas of hardstanding created for construction plant.

b) Potential Environmental Effects

i. Construction

Geology and Soils: Sand and Gravel Reserves

4.9.41 Should ground investigation works demonstrate that there are sand and gravel reserves at the depth of the Gas Connection works, there will be a permanent sterilisation of potential sand and gravel reserves along the Gas Connection where the pipe laying activities are expected to occur. No additional mitigation is proposed

4.9.42 Sand and gravel reserves were not identified within the AGI area on the UDP Proposals Map (shown in Figure 4.22).

Geology and Soils: Coal Reserves

4.9.43 The UDP Proposals Map indicates that coal reserves are present underlying the Gas Connection (including AGI), shown in Figure 4.22. Should the ground investigation works demonstrate that coal reserves will be directly affected by the depth of the Gas Connection; there will be permanent sterilisation on future coal extraction along the Gas Pipeline route. No additional mitigation is proposed.

Agricultural Land

4.9.44 The construction phase associated with the Gas Connection will be a corridor with a working width of 50 m to 200 m wide and result in a temporary sterilisation of Grade 4 agricultural land during the construction period. Grade 4 land is defined as land with severe limitations which significantly restrict the range of crops and / or level of yield.

4.9.45 AGI will be approximately 0.3 ha, and result in the localised, permanent sterilisation of poor quality agricultural land. Grade 4 land is defined as land with severe limitations which significantly restrict the range of crops and / or level of yield. No additional mitigation is proposed.

4.9.46 With the embedded mitigation as set out in G01 - G05 Mitigation Register (Appendix 2.1) no significant effects during construction are anticipated.

ii. Operation

4.9.47 No significant effects are anticipated during the operation phase.

5. Summary of Effects

5.1.1 The potential environmental effects of the Gas Connection are set out in Section 5 of this Report and the Screening Matrix in Appendix 1. No likely significant effects have been identified.

Table 5-1: Summary of Effects of the Gas Connection

Technical Topic	Potential Effect(s)	Additional Mitigation and Proposed Management Plans	Significance
Ecology	Effects on habitats and species through loss and temporary loss of habitat during construction. Effects on standing water after the provision of habitat ponds.	E01 – E26 Mitigation Register (Appendix 2.1) Outline CEMP (GEN01) Outline LEMS (GEN02)	Not significant
Flood Risk and Water Quality	Effects on water quality from construction activities. No flooding impacts identified. The effects from the AGI on flooding during the operational phase.	Outline Surface Water Management Plan and Drainage Strategy (WQ01, WQ02, WQ03)	Not significant
Air Quality	Effects on human health, nuisance and ecological impacts during construction.	AQ01 – AQ04 Mitigation Register (Appendix 2.1) Outline CEMP (GEN01)	Not significant
Noise and Vibration	Noise levels during construction.	N01- N09 Mitigation Register (Appendix 2.1) Outline CEMP (GEN01).	Not significant
Landscape and Visual	Landscape character and visual effects during construction/ decommissioning.	LV01 Mitigation Register (Appendix 2.1) Outline CEMP (GEN01) Outline LEMS (GEN02)	Not significant
Historic Environment	None	CH01 and CH02 Mitigation Register (Appendix 2.1)	N/A
Traffic, Transport and Access	Potential effects on construction traffic generation, driver delay and PROW users due to severance.	CTMP and CSTP (T01 – T05)	Not significant.
Geology, Ground Conditions and Hydrogeology	Sterilisation effects on mineral and coal reserves resulting from construction. Potential effects on agricultural land during construction. During operation, potential structural effects from chemical attack.	G01 - G05 Mitigation Register (Appendix 2.1)	Not significant

6. Conclusion

6.1.1 Based on the nature, size and location of the Gas Connection, its setting within the Gas Connection Site and from the assessment of potential effects as outlined above, it is considered that the Gas Connection will not have significant effects on the environment.

7. References

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Ref.5.16 A. F. Pearson. Roman roads and vici in Southeast Wales: Year 2 report, GGAT Report 2002/061, 2002.

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Figures

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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power
A Drax Group company

LEGEND

- Gas Connection Site
- Project Site Boundary

AECOM Internal Project No:

60542910

Drawing Title:

SITE LOCATION PLAN

Scale at A3: 1:25,000

Drawing No:			Rev:
FIGURE 1			005
Drawn:	**Chk'd:**	**App'd:**	**Date:**
GM	CC	CA	26/07/18

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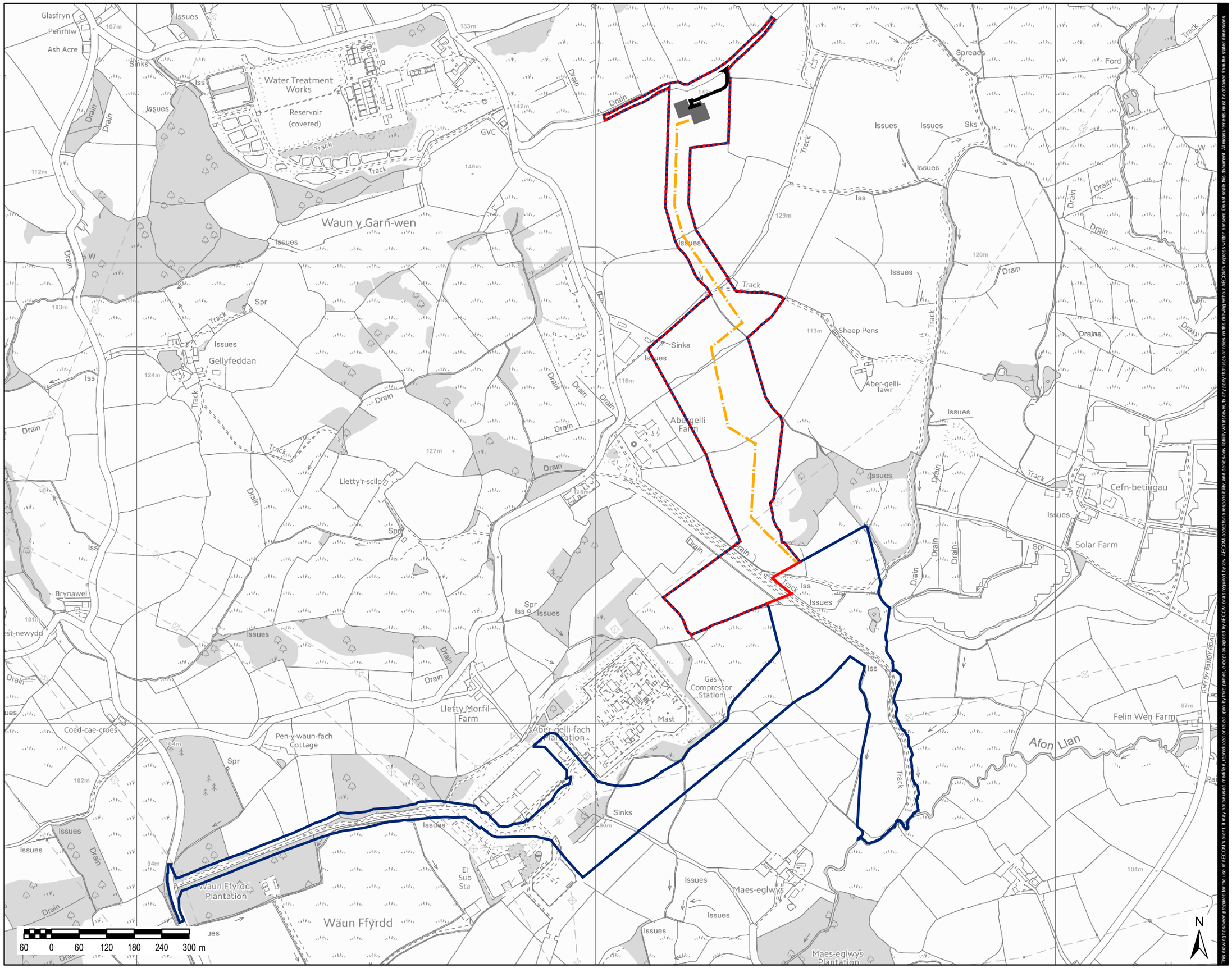

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Project Title:

ABERGELLI POWER PROJECT

Client:

LEGEND

- Gas Pipeline Site
- Project Site Boundary
- Access
- AGI
- Gas Pipeline

AECOM Internal Project No:

60542910

Drawing Title:

SITE LAYOUT PLAN

Scale at A3: 1:7,500

Drawing No:			Rev:
FIGURE 2			005
Drawn:	**Chk'd:**	**App'd:**	**Date:**
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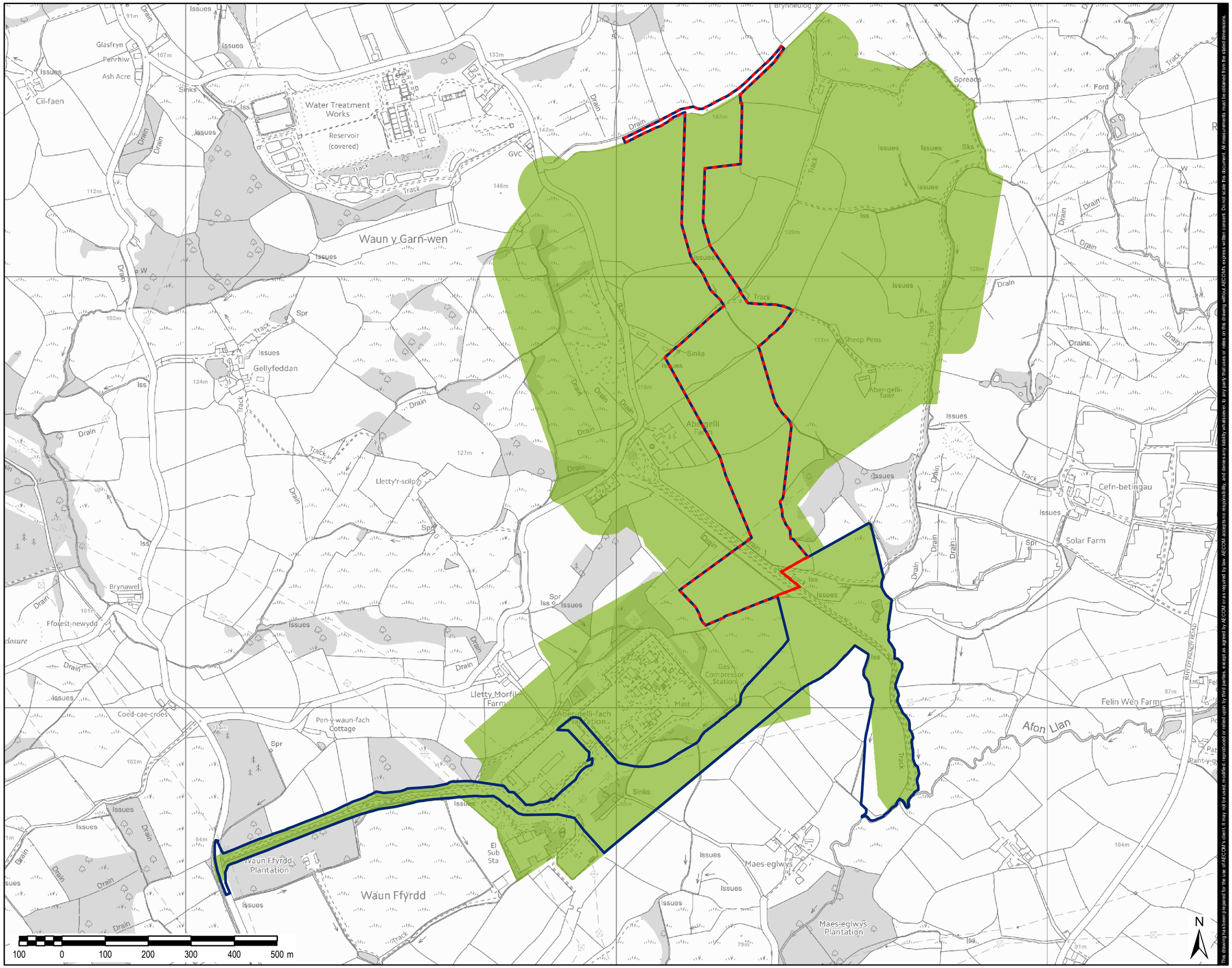

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Project Title:

ABERGELLI POWER PROJECT

Client:

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LEGEND

- Gas Connection Site
- Project Site Boundary
- BSG Ecology 2014 Site Boundary

Copyright:

AECOM Internal Project No:

60542910

Drawing Title:

ECOLOGICAL STUDY AREA

Scale at A3: 1:8,000

Drawing No:			Rev:
FIGURE 4.1			002
Drawn:	**Chk'd:**	**App'd:**	**Date:**
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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power
A Drax Group company

LEGEND

- Proposed Stack Location
- Gas Connection Site
- Project Site Boundary
- 10km Study Area
- Special Protection Area
- Special Area of Conservation
- Site of Special Scientific Interest
- Ancient Woodlands
- Ramsar Site
- SINCs

AECOM Internal Project No:

60542910

Drawing Title:

DESIGNATED SITES 1

Scale at A3: 1:90,000

Drawing No:			Rev:
FIGURE 4.2			005
Drawn:	**Chk'd:**	**App'd:**	**Date:**
GM	CC	CA	20/07/18

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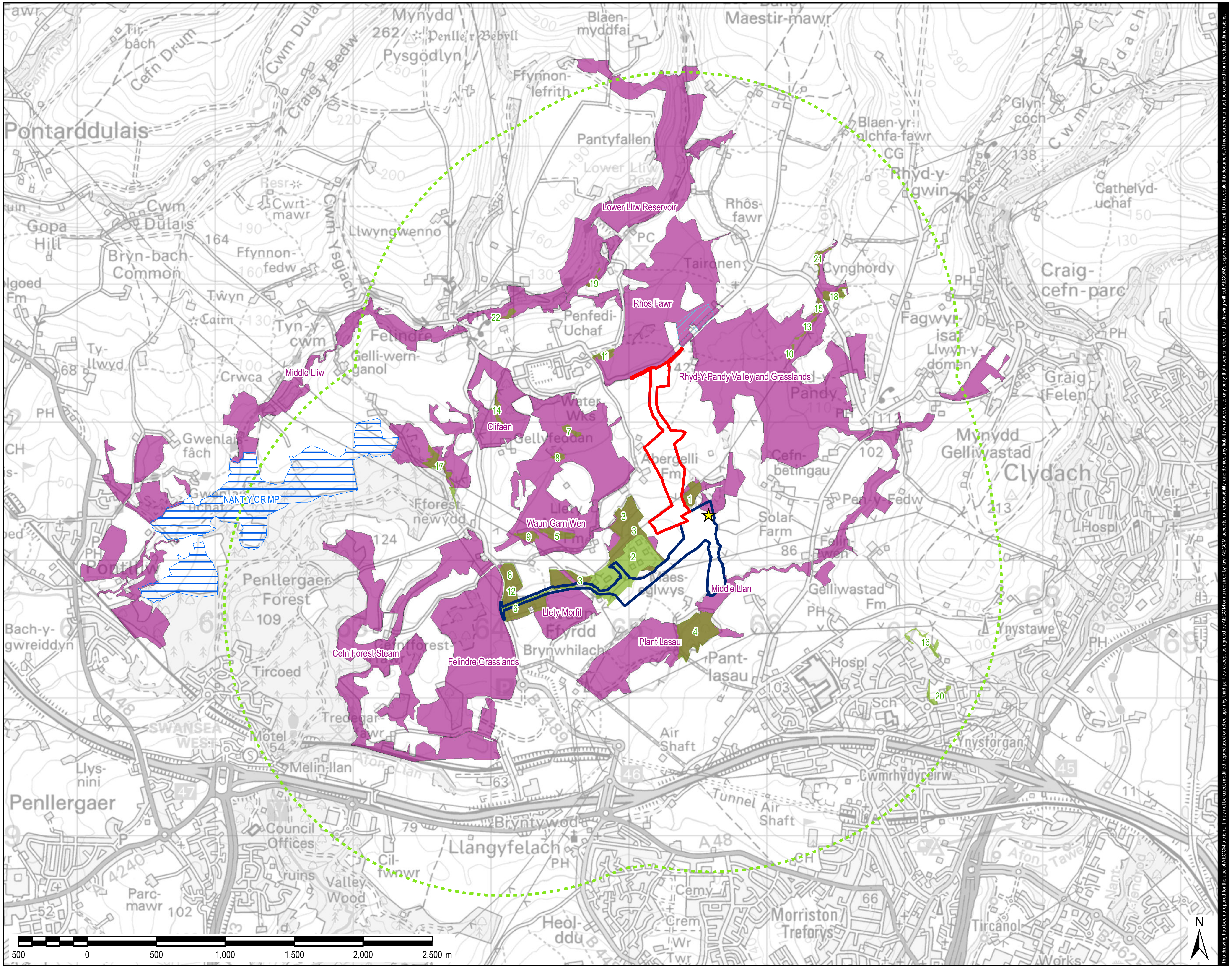

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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power
A Drax Group company

LEGEND

- Gas Connection Site
- Project Site Boundary
- 2km Study Area
- Site of Special Scientific Interest
- Coed Barcud Wildlife Trust Reserve
- Ancient Woodland
- SINCs
- Proposed Stack Location

AECOM Internal Project No:

60542910

Drawing Title:

DESIGNATED SITES 2

Scale at A3: 1:25,000

Drawing No:			Rev:
FIGURE 4.3			005
Drawn:	**Chk'd:**	**App'd:**	**Date:**
GM	CC	CA	20/07/18

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N

Felindre Water Treatment Works

Above Ground Installation

Proposed hedgerow and tree planting to tie in with existing hedgerow and to avoid conflict with the proposed ditch from the attenuation pond

Planting around the AGI to be developed in parallel with the detailed design. Planting to incorporate hedgerow and hedgerow tree planting along the road edge to help screen views of AGI from road users. All planting will respect visibility splay constraints associated with the new access road into the AGI site. Additional hedgerow and native structure planting around the AGI to assist in screening the structures from views, particularly from the Public Right of Way.

Felindre Gas Compressor Station

Swansea North Substation

0 50 100 200 500 M

Notes:

1) The outline LEMP is for illustrative purposes only and identifies the principles of the landscape and ecological mitigation. The final LEMP will be subject to the detailed design layout and will be completed as part of a planning condition.
2) This figure should be read in conjunction with Landscape and Ecology Mitigation Strategy, Outline Lighting Strategy, and Flood Consequence Assessment - Outline Drainage Strategy.
3) All detailed planting design to reflect utility easements.
4) All existing trees and hedgerows within the Project Site Boundary will be retained where reasonably practical.
5) All construction laydown areas to be fully reinstated (save for maintenance compound).
6) All boundary features (fencelines, hedgerows etc) and fields to be reinstated along Pipeline corridor and to the edge of the new access road corridor, subject to utility easements.
7) The location of existing landscape features, including hedgerows, woodland areas and solar farms shown on this figure has been informed by a combination of aerial photography and site observation.
8) Final form of attenuation ponds to be developed in parallel with detailed design.
9) Refer to Appendix 3.10. Figure 1.1 for Otter and Water Vole Survey Area and Survey Results.

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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power
A Drax Group company

Key:

- Gas Connection Site
- Project Site Boundary
- Perimeter fence
- Water main
- Footpath
- Oil Pipeline
- Overhead power lines

Existing Features

- Hedgerows

Proposed Features

- Hedgerows with trees
- Woodland structure planting
- Attenuation pond
- Access Road
- Temporary laydown areas
- Gas Connection

AECOM Internal Project No:

60542910

Drawing Title:

LANDSCAPE AND ECOLOGY MITIGATION PLAN- GAS CONNECTION SITE

Not to scale

Drawing No:			Rev:
FIGURE 4.4			001
Drawn:	**Chk'd:**	**App'd:**	**Date:**
CS	RM	CA	20/07/18

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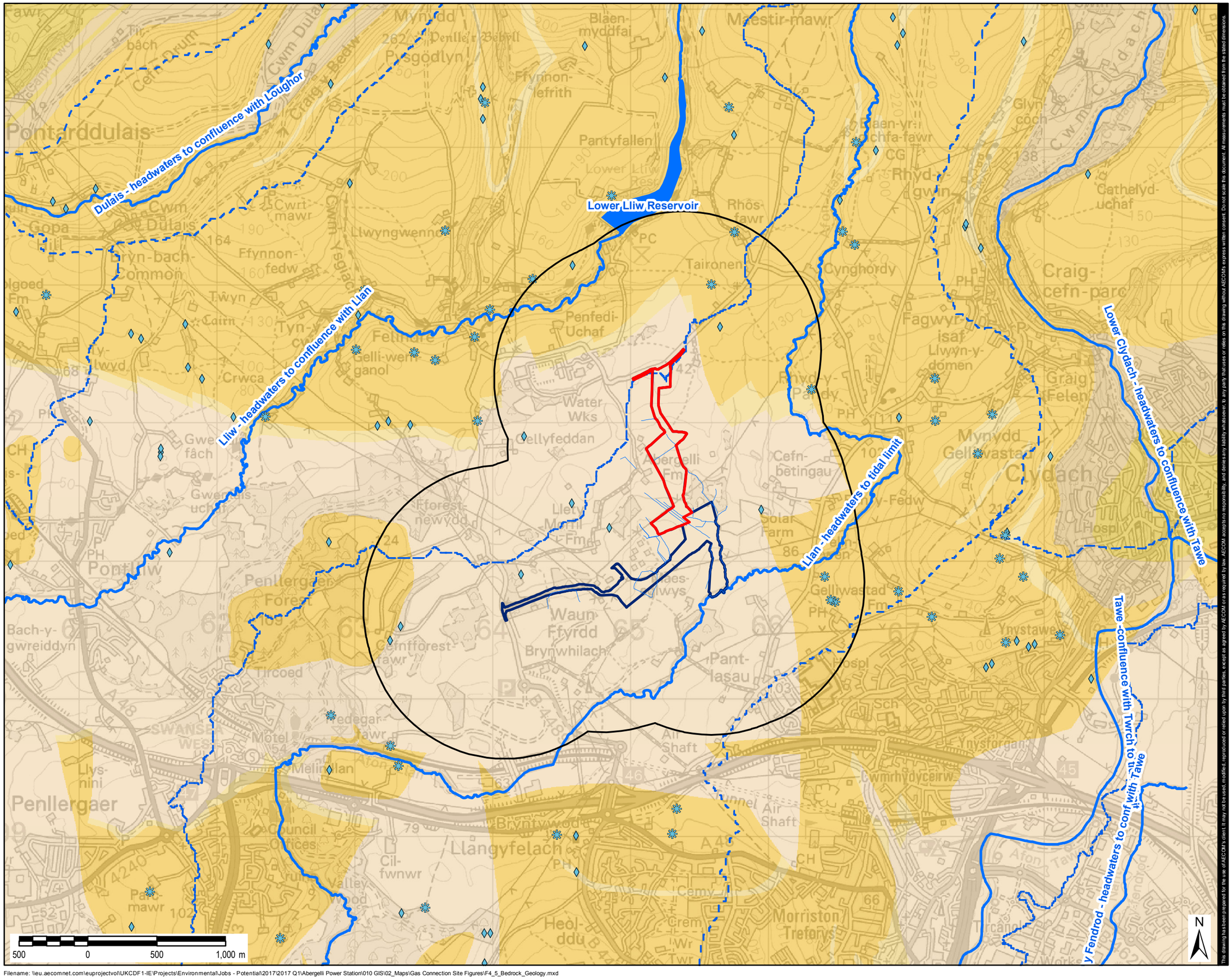

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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power

LEGEND

- Gas Connection Site
- Other Watercourses
- Project Site Boundary
- 1 km Buffer
- Wells
- Springs
- WFD Rivers
- WFD Lakes

Bedrock Geology

- Grovesend Formation
- Swansea Member Sandstone
- Swansea Member Mudstone Siltstone Sandstone

AECOM Internal Project No:

60542910

Drawing Title:

BEDROCK GEOLOGY

Scale at A3: 1:25,000

Drawing No:			Rev:
FIGURE 4.5			001
Drawn:	**Chk'd:**	**App'd:**	**Date:**
JN	GM	CA	20/07/18

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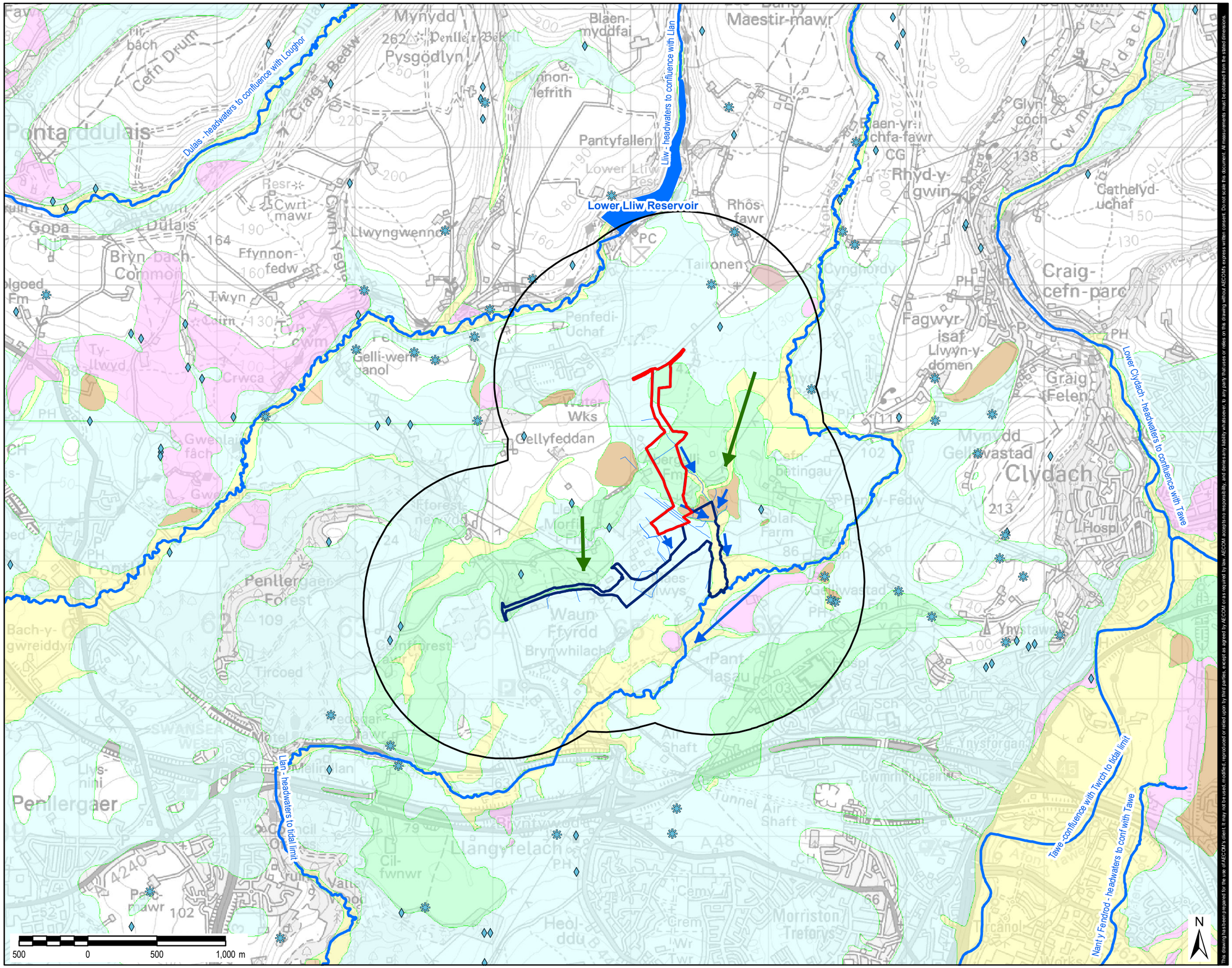

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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power

LEGEND

- Gas Connection Site
- Project Site Boundary
- 1 km Buffer
- Wells
- Springs

Inferred Water Flow Direction

- Groundwater
- Surface Water
- WFD Rivers
- WFD Lakes

Superficial Geology

- Till
- Glacial Deposits
- Glaciolfluvial Deposits
- Alluvium
- Peat

AECOM Internal Project No:

60542910

Drawing Title:

SUPERFICIAL GEOLOGY

Scale at A3: 1:25,000

Drawing No:			Rev:
FIGURE 4.6			001
Drawn:	**Chk'd:**	**App'd:**	**Date:**
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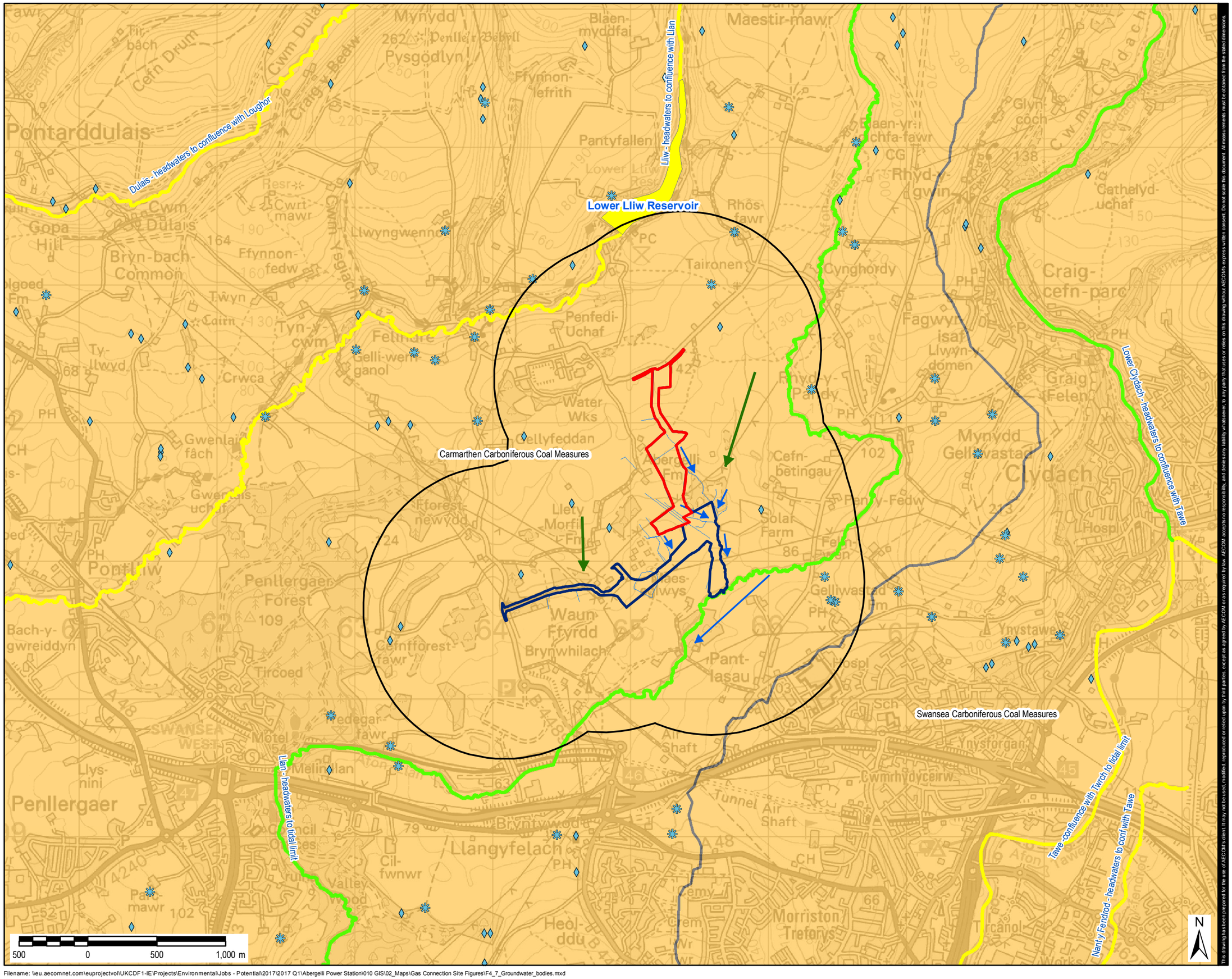

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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power

LEGEND

- Gas Connection Site
- Project Site Boundary
- 1 km Buffer
- Wells
- Springs

Inferred Water Flow Direction

- Groundwater
- Surface Water

WFD Lakes

- Moderate

WFD Rivers

- Good
- Moderate

WFD Groundwater Bodies

- Poor

Copyright:

AECOM Internal Project No:

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Drawing Title:

GROUNDWATER BODIES

Scale at A3: 1:25,000

Drawing No:			Rev:
FIGURE 4.7			001
Drawn:	**Chk'd:**	**App'd:**	**Date:**
JN	GM	CA	20/07/18

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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power

LEGEND

- Gas Connection Site
- Project Site Boundary
- 1 km Buffer
- Wells
- Springs
- Disused adit
- Wales Incident Recording System (WIRS)
- National Incident Recording System (NIRS)
- Historic Industrial Sites
- Industrial Sites
- NRW Historic Landfill Sites
- WFD Lakes
- WFD Rivers
- WFD SW Catchments

Inferred Water Flow Direction

- Surface Water

Main River Flood Risk

- High
- Medium
- Low
- Very Low

AECOM Internal Project No:

60542910

Drawing Title:

POTENTIAL POLLUTION SOURCES

Scale at A3: 1:25,000

Drawing No:			Rev:
FIGURE 4.8			001
Drawn:	**Chk'd:**	**App'd:**	**Date:**
JN	GM	CA	20/07/18

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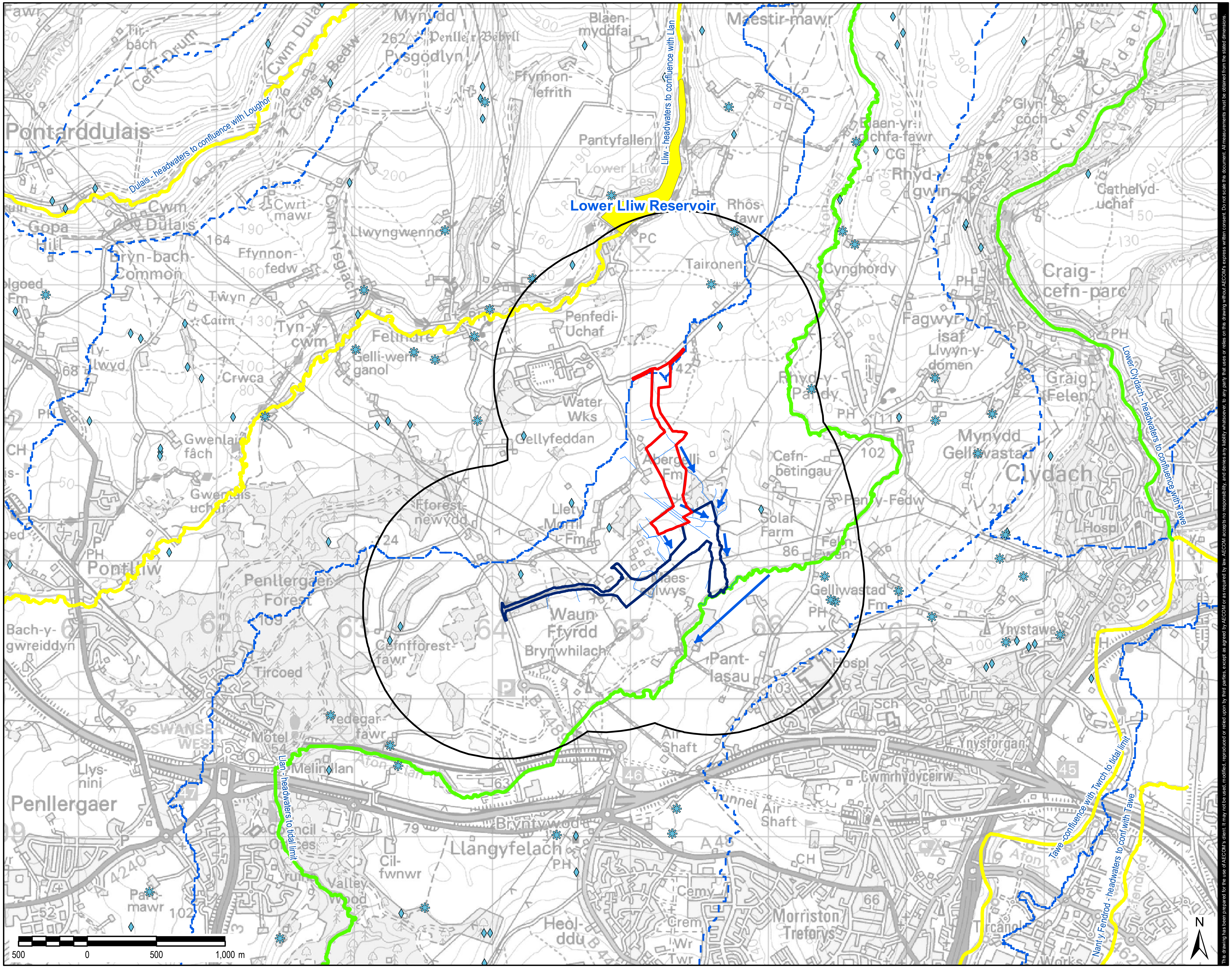

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Project Title:

ABERGELLI POWER PROJECT

Client:

LEGEND

- Gas Connection Site
- Project Site Boundary
- 1 km Buffer
- Wells
- Springs
- Surface Water

WFD Lakes

- Moderate

WFD Rivers

- Good
- Moderate
- WFD SW Catchments

AECOM Internal Project No:

60542910

Drawing Title:

SURFACE WATER BODIES

Scale at A3: 1:25,000

Drawing No:			Rev:
FIGURE 4.9			001
Drawn:	**Chk'd:**	**App'd:**	**Date:**
JN	GM	CA	20/07/18

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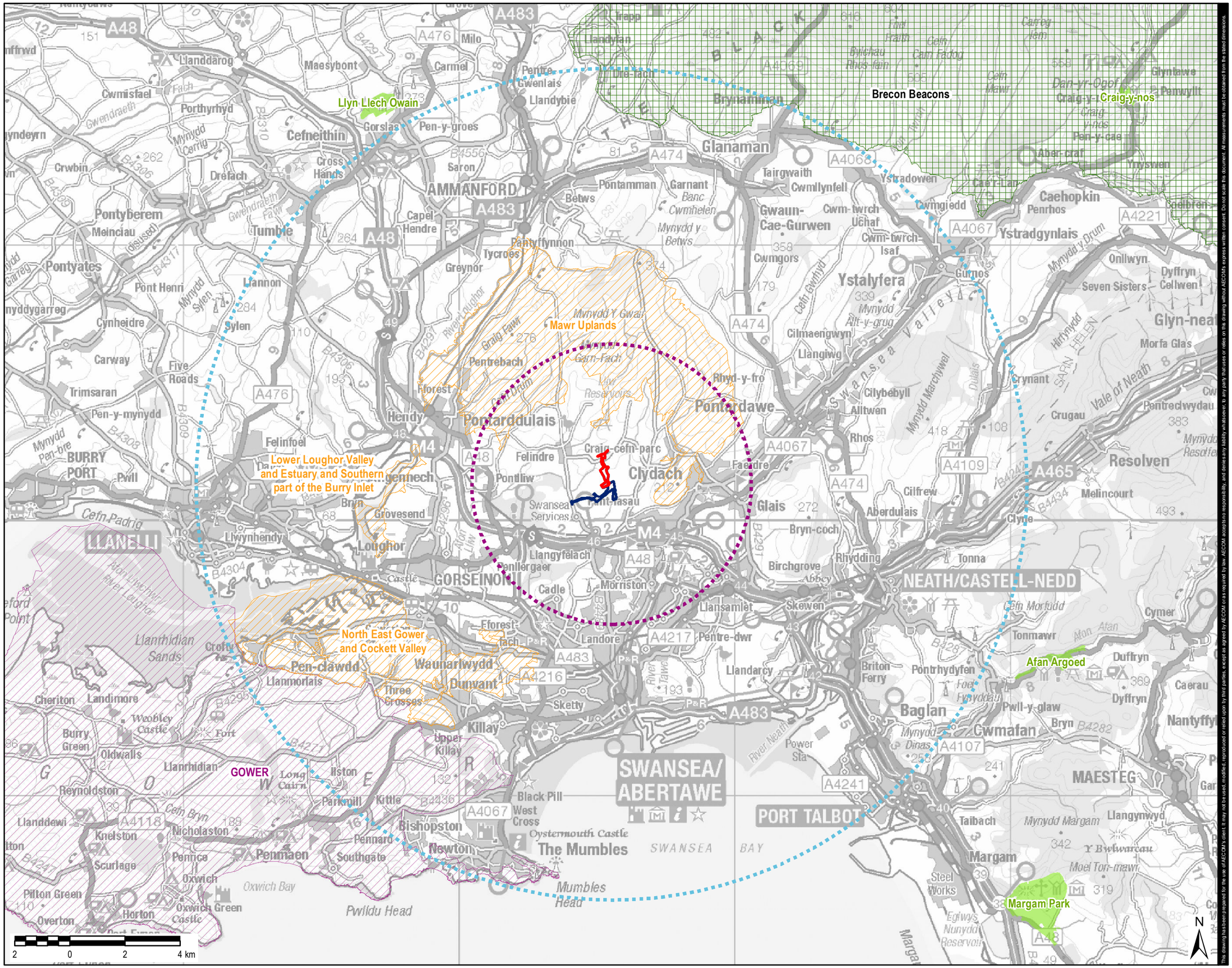

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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power

LEGEND

- Gas Connection Site
- Project Site Boundary
- 15km Study Area
- 5km Study Area
- Special Landscape Areas
- Country Park
- Area of Outstanding Natural Beauty
- National Park

Copyright:

AECOM Internal Project No:

60542910

Drawing Title:

LANDSCAPE DESIGNATION

Scale at A3: 1:125,000

Drawing No:			Rev:
FIGURE 4.11			001
Drawn:	**Chk'd:**	**App'd:**	**Date:**
GM	RM	CA	20/07/18

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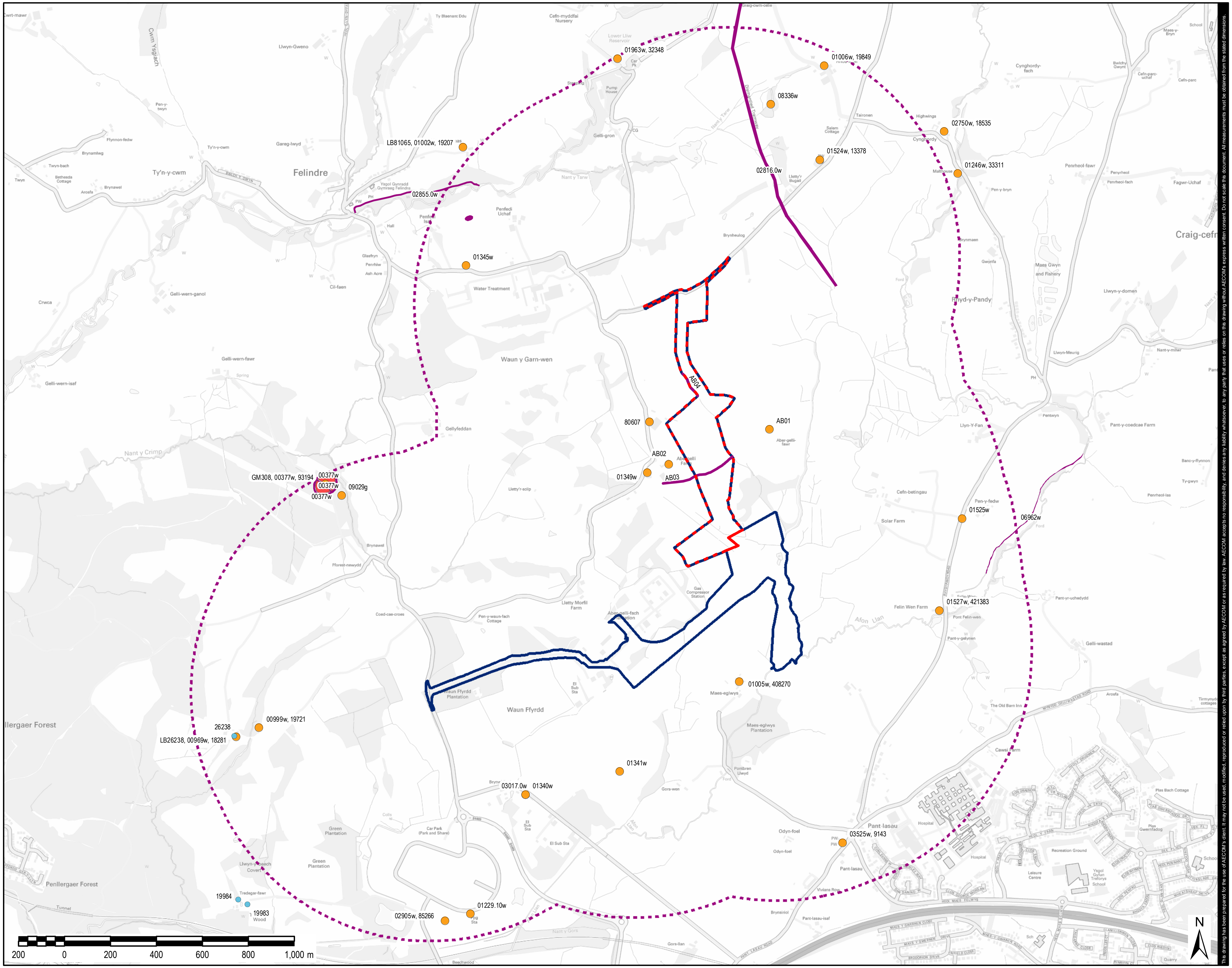

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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power — A Drax Group company

LEGEND

- Gas Connection Site
- Grade II - Listed Building
- Historic Asset - Point
- Historic Asset - Linear
- Scheduled Monument
- 1km Study Area
- Project Site Boundary

Copyright:

AECOM Internal Project No:

60542910

Drawing Title:

HISTORIC ASSETS 1KM STUDY AREA

Scale at A3: 1:15,000

Drawing No:			Rev:
FIGURE 4.12			005
Drawn:	**Chk'd:**	**App'd:**	**Date:**
GM	CC	CA	20/07/18

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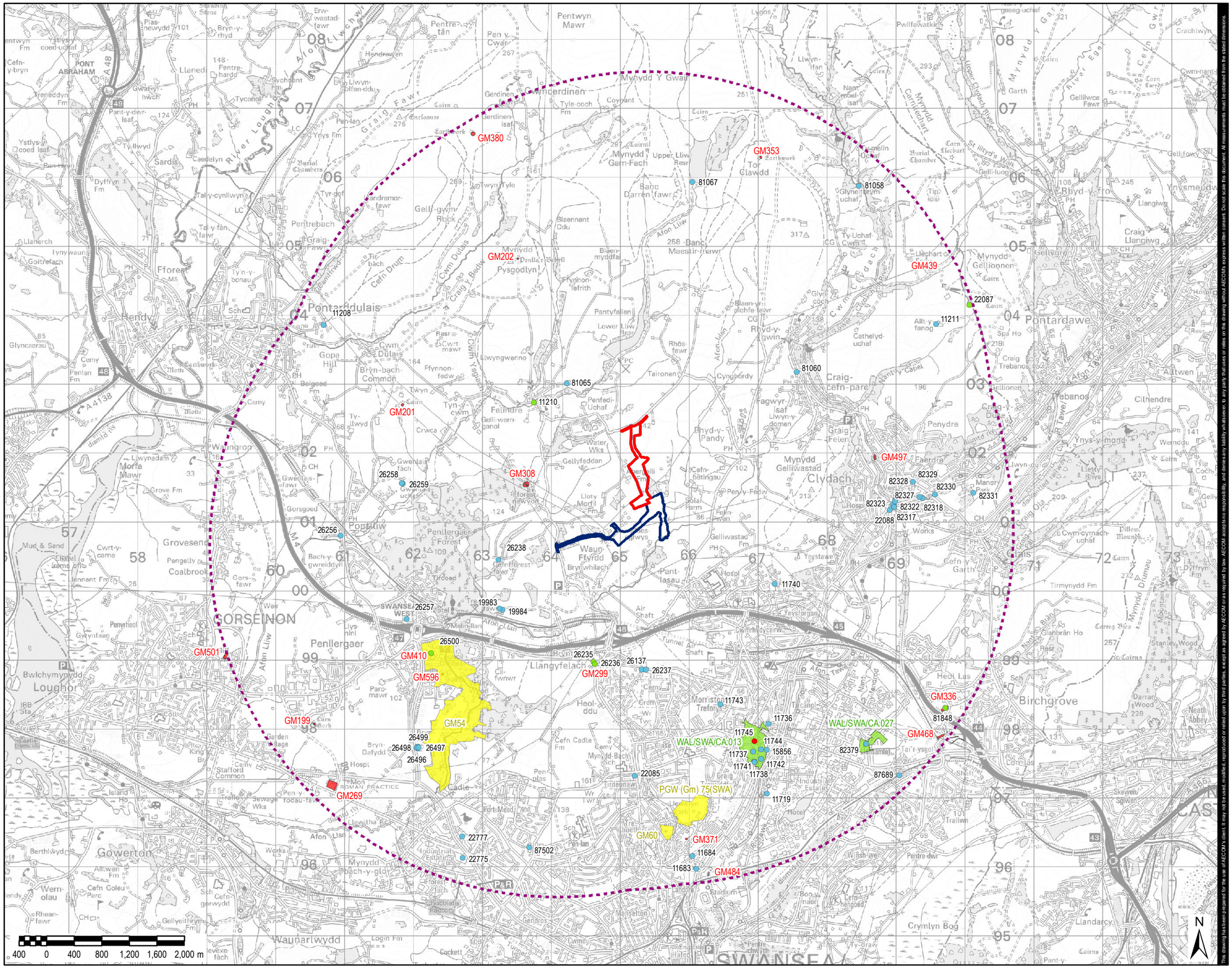

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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power
A Drax Group company

LEGEND

- Gas Connection Site
- Project Site Boundary
- Grade I - Listed Building
- Grade II* - Listed Building
- Grade II - Listed Building
- Conservation
- Parks and Gardens
- Scheduled Monument
- 5km Study Area

Copyright:

AECOM Internal Project No:

60542910

Drawing Title:

DESIGNATED HISTORIC ASSETS IN THE 5KM STUDY AREA

Scale at A3: 1:50,000

Drawing No:	Rev:
FIGURE 4.13	005

Drawn:	Chk'd:	App'd:	Date:
GM	CC	CA	20/07/18

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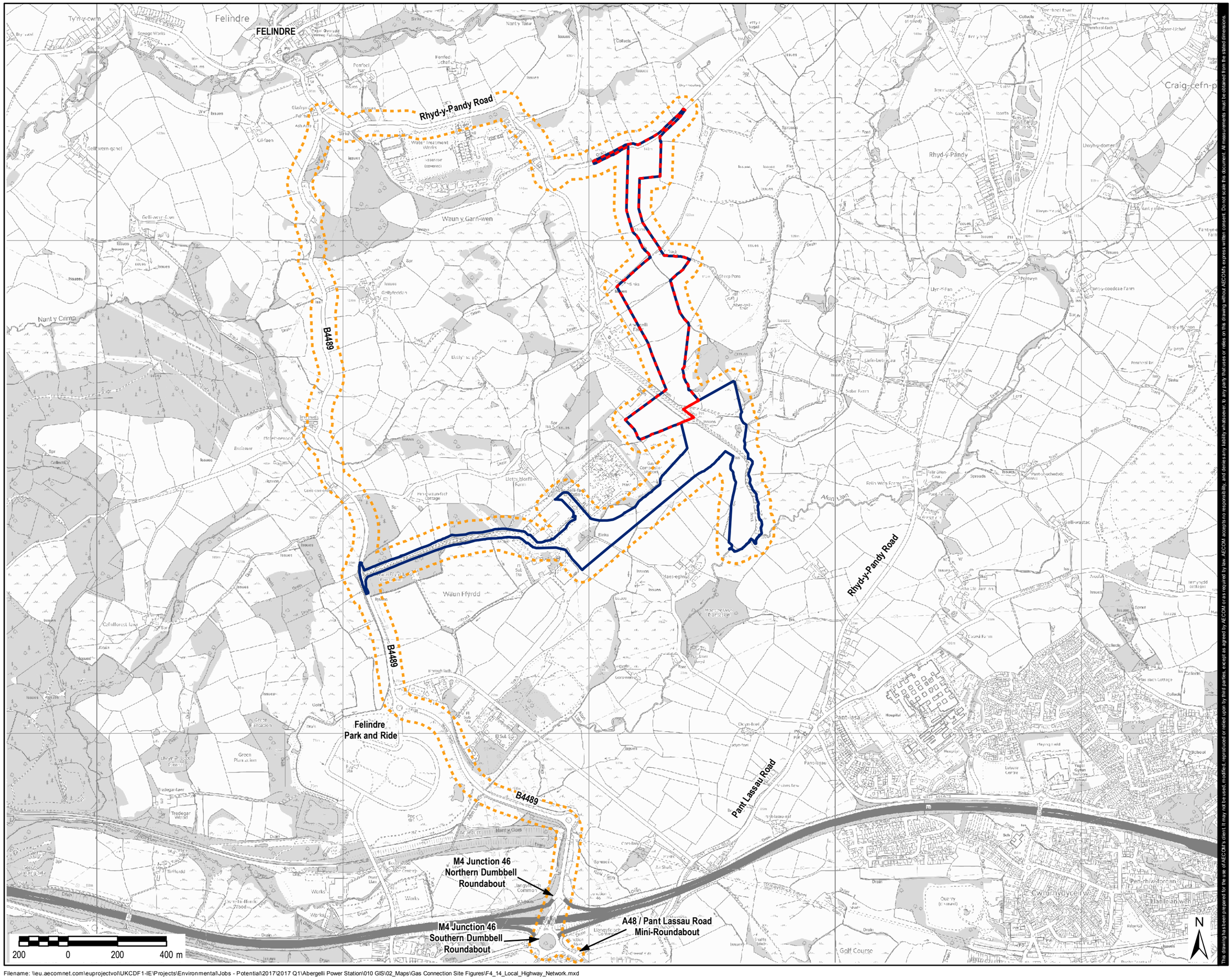

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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power

LEGEND

- Gas Connection Site
- Project Site Boundary
- Study Area

AECOM Internal Project No:

60542910

Drawing Title:

LOCAL HIGHWAY NETWORK

Scale at A3: 1:14,000

Drawing No:			Rev:
FIGURE 4.14			001
Drawn:	**Chk'd:**	**App'd:**	**Date:**
GM	NW	CA	20/07/18

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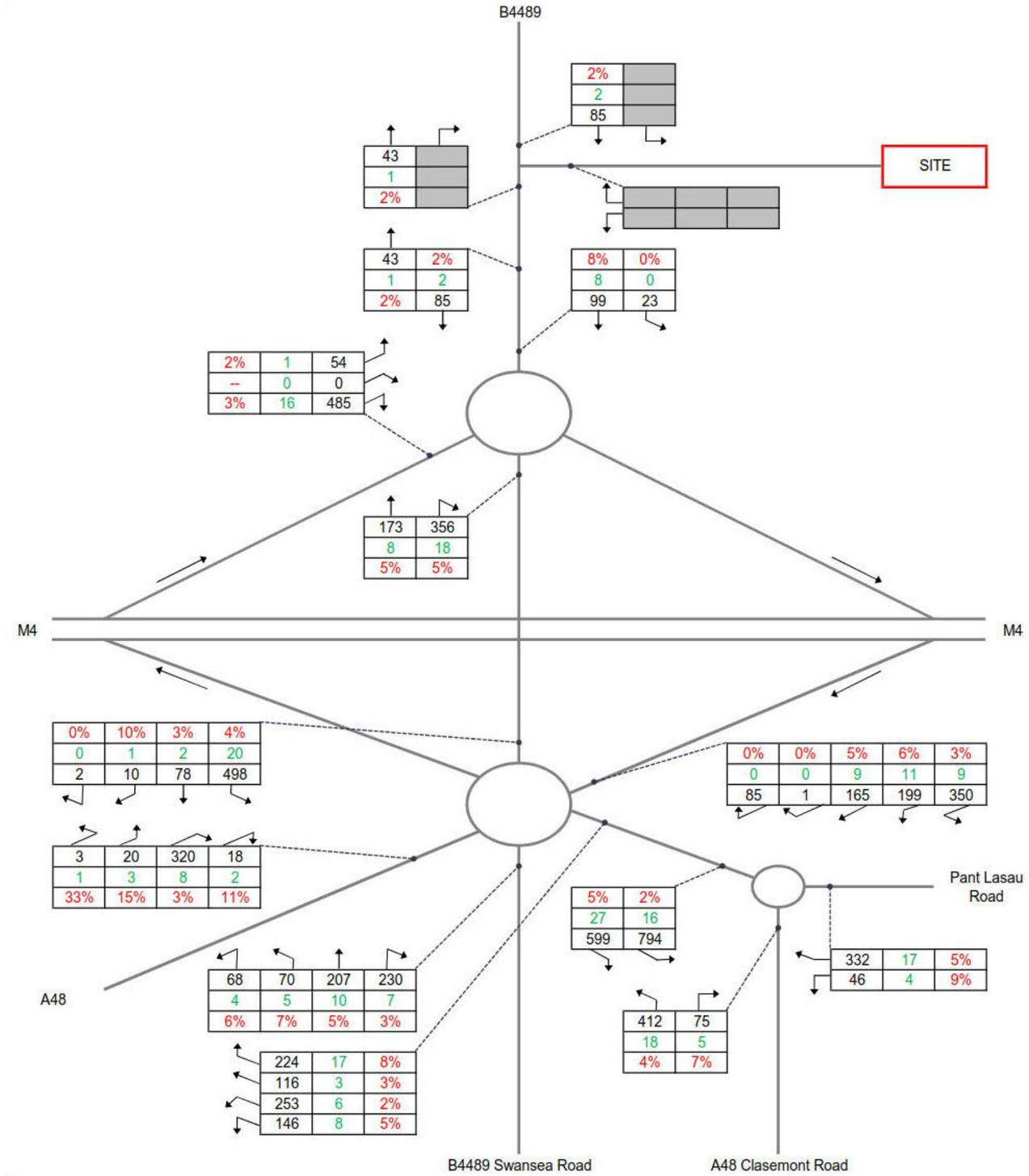

Key:

XX Total Vehicles XX HGVs XX HGV %

Notes:

1. Traffic flows at M4 J46 and A48/Pant Lasau Road junction based on Junction Turning Count (JTC) surveys undertaken on 16/10/2014.
2. Traffic flows on the B4489 based on Automatic Traffic Count (ATC) survey undertaken between 16/10/2014 and 22/10/2014.
3. Peak hour derived from analysis of junction inflows.
4. Cells highlighted in grey indicate that this movement has not been surveyed.

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Project Title:

ABERGELLI POWER PROJECT

Client:

LEGEND

Copyright:

AECOM Internal Project No:

60542910

Drawing Title:

TRAFFIC FLOWS – 2014 OBSERVED: WEEKDAY AM PEAK HOUR

Scale at A3: Not To Scale

Drawing No:	Rev:
FIGURE 4.15	001

Drawn:	Chk'd:	App'd:	Date:
GM	NW	CA	20/07/18

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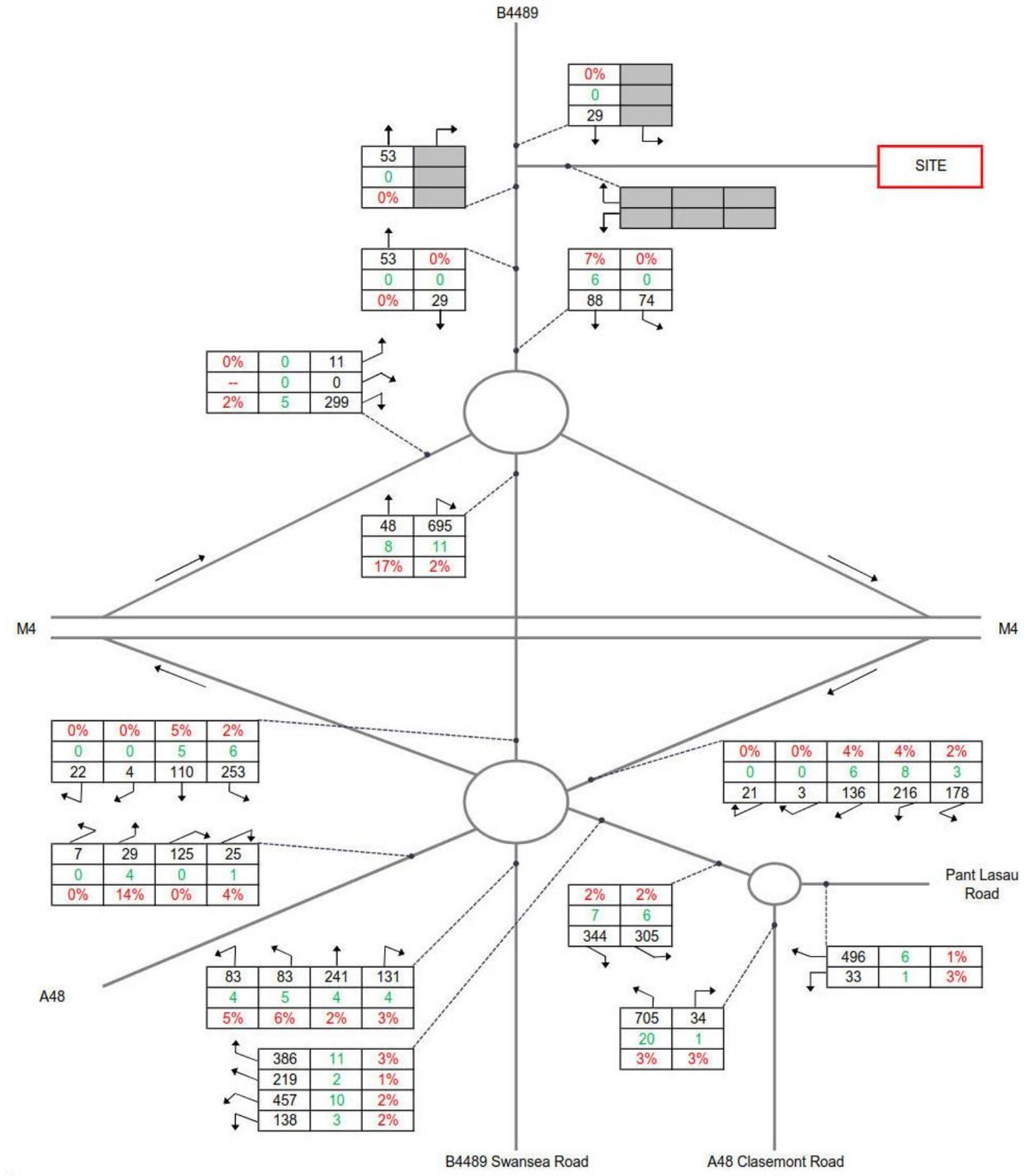

Key:

XX Total Vehicles XX HGVs XX HGV %

Notes:

1. Traffic flows at M4 J46 and A48/Pant Lasau Road junction based on Junction Turning Count (JTC) surveys undertaken on 16/10/2014.
2. Traffic flows on the B4489 based on Automatic Traffic Count (ATC) survey undertaken between 16/10/2014 and 22/10/2014.
3. Peak hour derived from analysis of junction inflows.
4. Cells highlighted in grey indicate that this movement has not been surveyed.

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Project Title:

ABERGELLI POWER PROJECT

Client:

LEGEND

AECOM Internal Project No:

60542910

Drawing Title:

TRAFFIC FLOWS – 2014 OBSERVED: WEEKDAY PM PEAK HOUR

Scale at A3: Not To Scale

Drawing No:			Rev:
FIGURE 4.16			001
Drawn:	**Chk'd:**	**App'd:**	**Date:**
GM	NW	CA	20/07/18

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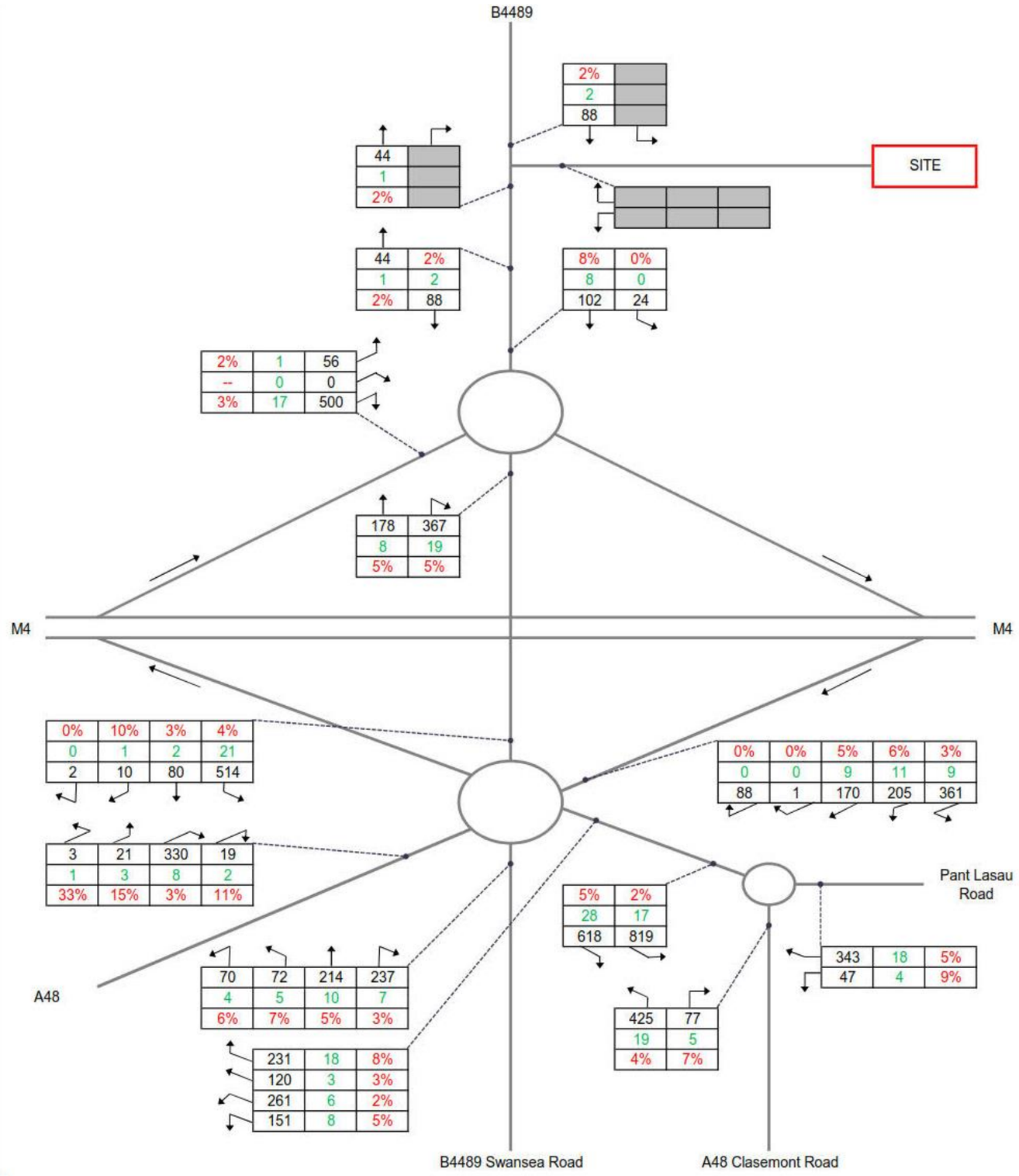

Key:

XX Total Vehicles | XX HGVs | XX HGV %

Notes:

1. TEMPro Weekday AM Peak Growth Factor = 1.0317 (applied to all movements).
2. Cells highlighted in grey indicate that this movement has not been surveyed.

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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power

LEGEND

AECOM Internal Project No:

60542910

Drawing Title:

TRAFFIC FLOWS – 2017 BASE YEAR: WEEKDAY AM PEAK HOUR

Scale at A3: Not To Scale

Drawing No:				Rev:
FIGURE 4.17				001
Drawn:	**Chk'd:**	**App'd:**	**Date:**	
GM	NW	CA	19/07/18	

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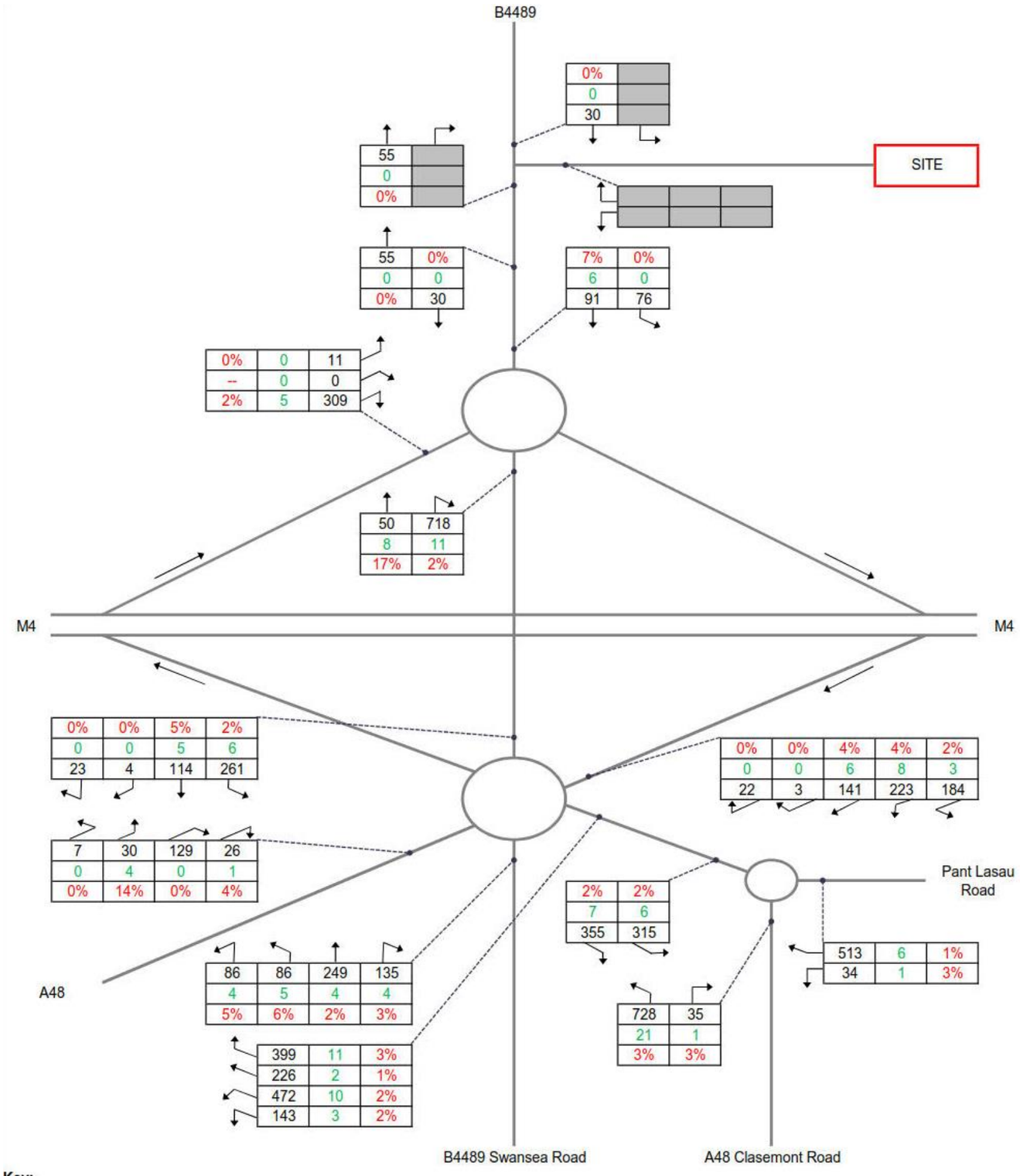

Key:

XX Total Vehicles | XX HGVs | XX HGV %

Notes:

1. TEMPro Weekday AM Peak Growth Factor = 1.0333 (applied to all movements).
2. Cells highlighted in grey indicate that this movement has not been surveyed.

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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power

LEGEND

AECOM Internal Project No:

60542910

Drawing Title:

TRAFFIC FLOWS – 2017 BASE YEAR: WEEKDAY PM PEAK HOUR

Scale at A3: Not To Scale

Drawing No:			Rev:
FIGURE 4.18			001
Drawn:	**Chk'd:**	**App'd:**	**Date:**
GM	NW	CA	19/07/18

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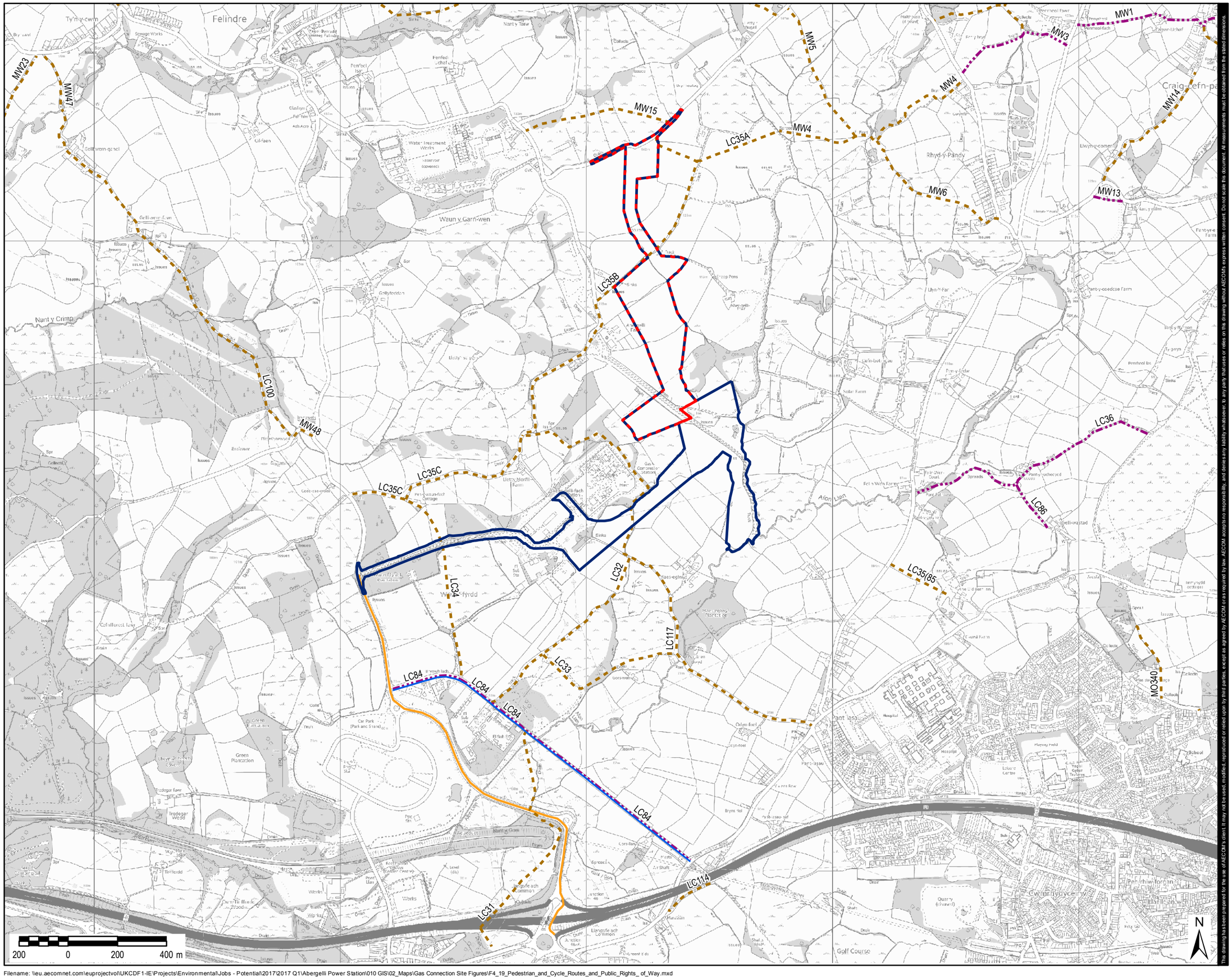

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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power
A Drax Group company

LEGEND

- Gas Connection Site
- Project Site Boundary
- Bridleway
- Footpath
- Traffic Free Cycle Route
- Footway

AECOM Internal Project No:

60542910

Drawing Title:

PEDESTRIAN AND CYCLE ROUTES AND PUBLIC RIGHTS OF WAY

Scale at A3: 1:14,000

Drawing No:			Rev:
FIGURE 4.19			001
Drawn:	**Chk'd:**	**App'd:**	**Date:**
GM	NW	CA	20/07/18

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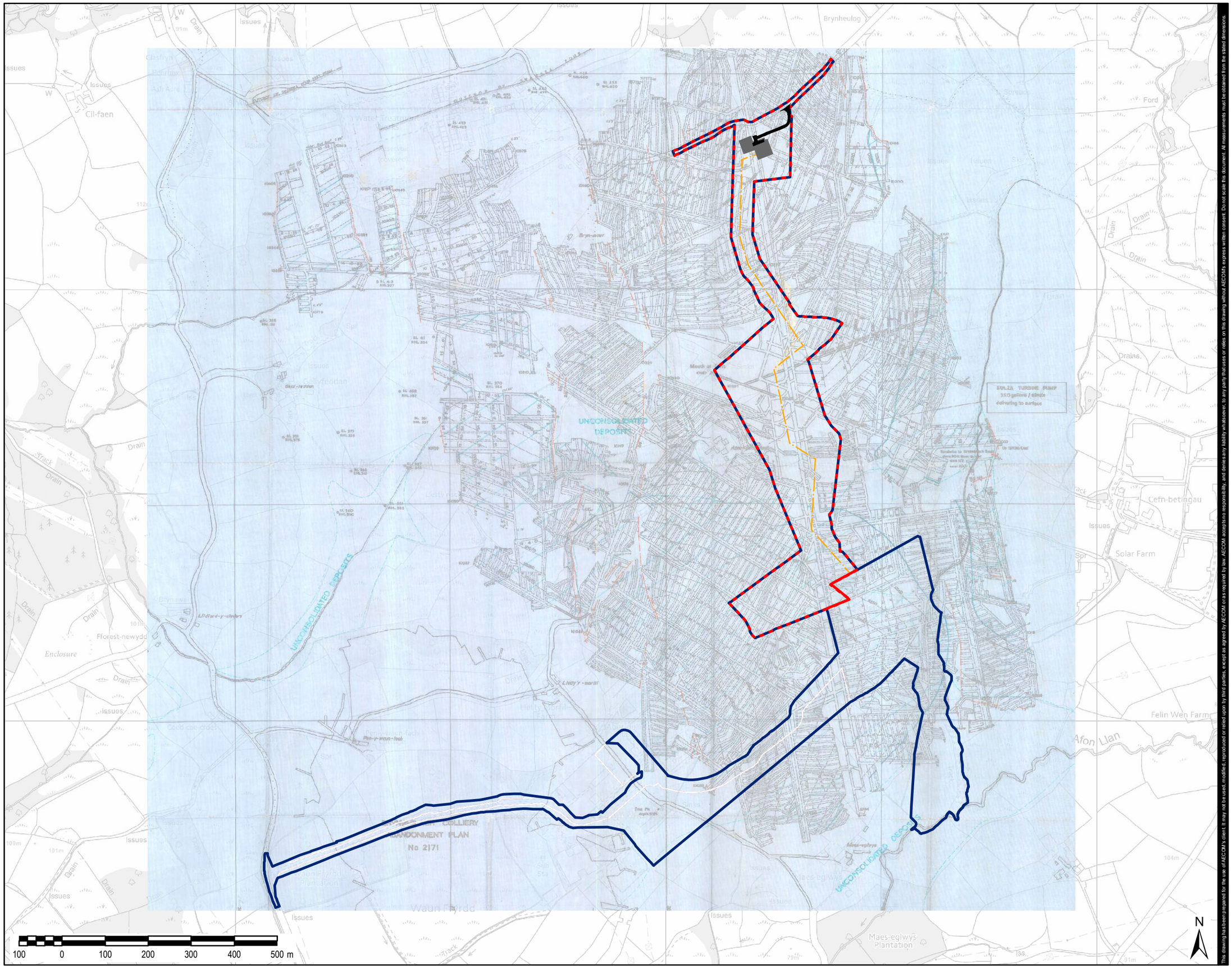

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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power
A Drax Group company

LEGEND

- Gas Connection Site
- Project Site Boundary
- Access
- AGI
- Gas Pipeline

AECOM Internal Project No:

60542910

Drawing Title:

MINE ABANDONMENT PLAN

Scale at A3: 1:8,000

Drawing No:			Rev:
FIGURE 4.20			005
Drawn:	**Chk'd:**	**App'd:**	**Date:**
GM	CC	CA	31/07/18

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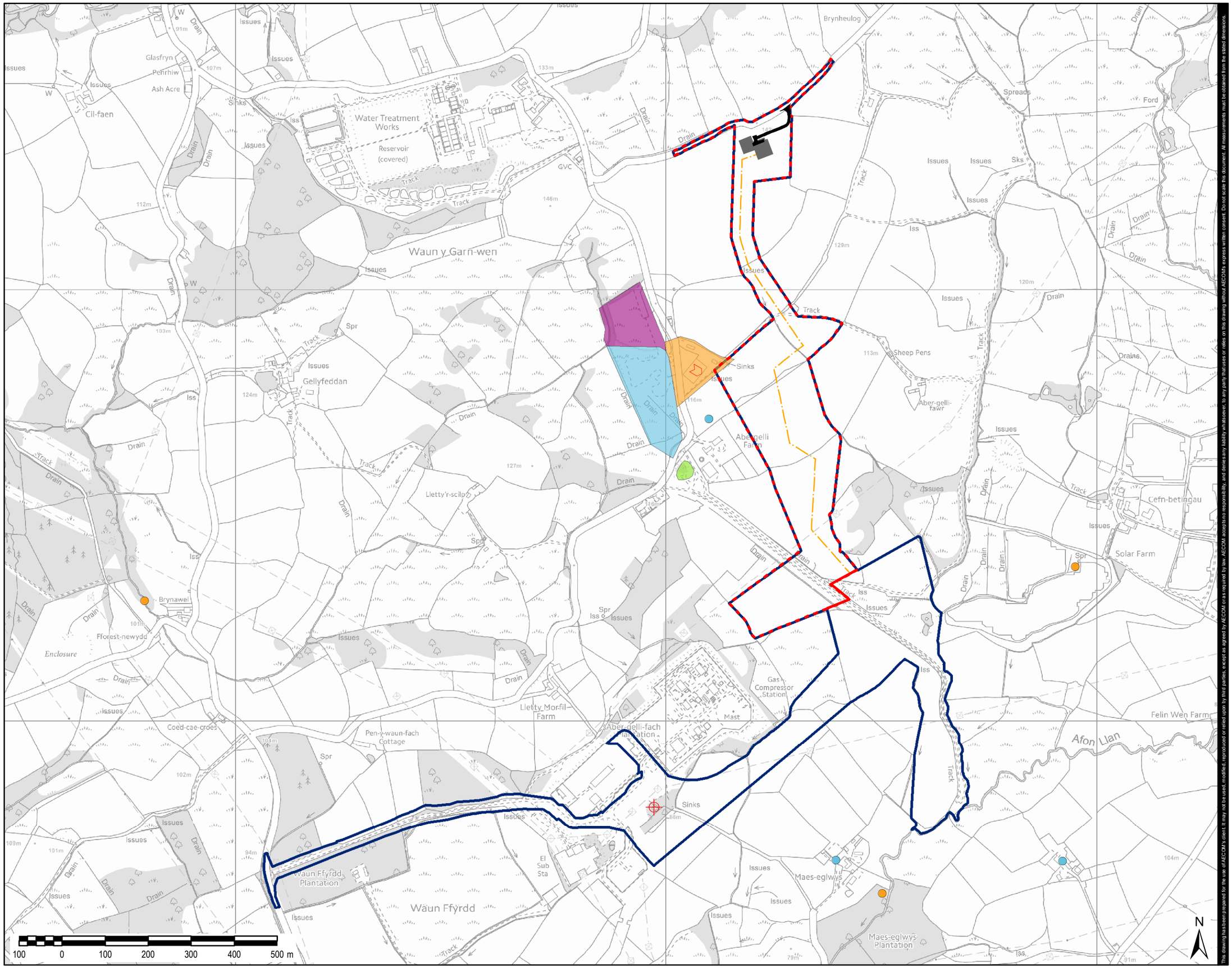

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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power

LEGEND

- Gas Connection Site
- Project Site Boundary
- Access
- AGI
- Gas Pipeline
- Abergelli Farm landfill
- Abergelli Farm landfill and historical mine spoil heap
- Disused Abergelli Collery
- Old gravel pit
- Groundwater Abstraction
- Groundwater Abstraction Licence known not to be used
- Disused adit
- Disused mine shaft

AECOM Internal Project No:

60542910

Drawing Title:

POTENTIAL SOURCES OF CONTAMINATION AND LOCATIONS OF INTEREST

Scale at A3: 1:8,000

Drawing No:			Rev:
FIGURE 4.21			005
Drawn:	**Chk'd:**	**App'd:**	**Date:**
GM	CC	CA	31/07/18

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Project Title:

ABERGELLI POWER PROJECT

Client:

Abergelli power
A Drax Group company

LEGEND

- Gas Connection Site
- Project Site Boundary
- Access
- AGI
- Sand and Aggregates
- Coal
- Gas Pipeline

Copyright:

AECOM Internal Project No:

60542910

Drawing Title:

UDP MINERAL RESOURCES PLAN

Scale at A3: 1:8,000

Drawing No:			Rev:
FIGURE 4.22			005
Drawn:	**Chk'd:**	**App'd:**	**Date:**
GM	CC	CA	31/07/18

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