

MONA OFFSHORE WIND PROJECT

Environmental Statement

Volume 7, Annex 1.1: Aquifers, groundwater abstractions and ground conditions

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Image of an offshore wind farm

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Glossary

Term	Meaning
Abstraction licence	The authorisation granted by the Environment Agency to allow the removal of surface water or groundwater.
Aquifer	A water-bearing geological unit that can yield economically viable amounts of groundwater.
Groundwater	Water that is contained in underground rocks and sediments below the ground surface.
Groundwater Body	Groundwater bodies are the discrete groundwater management units defined by the Environment Agency as required under Article 5 of the Water Framework Directive.
Source Protection Zone	Groundwater catchment areas defined by travel time around important potable groundwater abstraction sites to safeguard drinking water quality. Certain land-uses are controlled or prohibited with certain source protection zone areas.

Acronyms

Acronym	Description
BGS	British Geological Survey
GCR	Geological Conservation Review
GHGC	Geology, hydrogeology and ground conditions
JNCC	Joint Nature Conservation Committee
NRW	Natural Resource Wales
PWSS	Private Water Supply Source
RIGS	Regionally Important Geological Site
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest

Units

Unit	Description
km ²	Square kilometres
km	Kilometres
m	Metres

1 AQUIFERS, GROUNDWATER ABSTRACTIONS AND GROUND CONDITIONS

1.1 Introduction

1.1.1 Overview

1.1.1.1 This technical report provides a summary of key information on aquifers, groundwater abstractions, pollution incidents and ground conditions to inform the baseline environment and assessment of Volume 3, Chapter 1: Geology, hydrogeology and ground conditions of the Environmental Statement.

1.1.2 Study area

1.1.2.1 The study area to be used for the assessment of geology, hydrogeology and ground conditions focuses on areas located above Mean High Water Springs (MHWS) where potential impacts are most likely to occur on geological and hydrogeological receptors. As such, the geology, hydrogeology and ground conditions (GHGC) study area includes:

- The area of land to be temporarily or permanently occupied during the construction, operation and maintenance and decommissioning of the Mona Offshore Wind Project (hereafter referred to as the Mona Onshore Development Area)
- Geological and hydrogeological receptors within 1 km of the Mona Onshore Development Area. The 1 km buffer was used as impacts on geological, hydrogeological and ground conditions receptors are most likely to occur within this distance
- Ground condition constraints within the Mona Onshore Development Area.

1.1.2.2 The GHGC study area represents the latest version of the Mona Onshore Development Area available prior to submission of the Environmental Statement.

1.2 Methodology

1.2.1 Desk top data sources

1.2.1.1 The data presented in this technical report has been taken from the following sources:

- Geological information from the British Geological Survey (BGS) and Natural Resources Wales (NRW)
- Aquifer unit information from the BGS
- Information regarding ground conditions within the geology, hydrogeology and ground conditions study area taken from a Groundsure Insights report that includes the following datasets:
 - General information regarding geological, hydrogeological and hydrological setting
 - Groundwater abstraction licences
 - Current and historical landfill sites
 - Current and historical waste sites

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- Pollution incidents
- Discharge consents
- Current and historical land-use
- Mining and ground working areas (coal and non-mining)
- Geotechnical constraints
- Historical Ordnance Survey mapping and some aerial photography.

1.2.2 Geology

1.2.2.1 The bedrock geology and superficial deposits present across the GHGC study area has been obtained from the mapped data of the BGS. Nationally, regionally and locally important geological sites are also presented and, where present, include:

- Sites of Special Scientific Interest (SSSI) of geological and geomorphological importance
- Geological Conservation Review (GCR) sites as defined by the Joint Nature Conservation Committee (JNCC)
- Regionally Important Geological Sites (RIGS).

1.2.3 Hydrogeology

1.2.3.1 Aquifer units in the bedrock geology and superficial deposits have been obtained from the designations provided by the Environment Agency. Information on key groundwater receptors have been reviewed and, where present, include:

- Licensed groundwater abstractions (active and historical) as presented in the Groundsure Insights report
- Groundwater Source Protection Zones (SPZs) that have been defined to safeguard drinking water quality around important potable groundwater abstraction sites
- Nationally and locally important ecological sites that may have a groundwater dependence.

1.2.3.2 The location and details of Private Water Supply Sources (PWSSs) present within the GHGC study area have been identified from records held by Conwy County Borough Council and Denbighshire County Council. Details of abstraction licences have also been requested from landowners within GHGC study area. Information on the PWSSs is presented in this annex and assessed in Volume 7, Annex 1.2 Groundwater supply sources: hydrogeological risk assessment of the Environmental Statement.

1.2.4 Ground conditions

1.2.4.1 Ground conditions, most notably land quality, is a potentially constraint during the construction of the Mona Offshore Wind Project. A qualitative ground condition constraints assessment has been undertaken for the key aspects across the GHGC study area. The assessment is based on the Groundsure Insights report, the details of which are summarised in Table 1.1.

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Table 1.1: Summary of the Groundsure Insight report to inform geology, hydrogeology and ground conditions.

Title	Extent of data coverage	Contractor	Format	Date
Mona Onshore Development Area	18.7 km ²	Groundsure	Hardcopy report	27/06/2022

1.2.4.2 The qualitative assessment considers the potential risk posed by the land use (current and historical) and activities identified in the GHGC study area, based on the following risk criteria:

- ***High Risk*** - Presence of an activity or land use with the potential to result in highly contaminated land or groundwater, particularly where activities are recent, well-defined and/or situated close to or within the Mona Onshore Development Area
- ***Moderate Risk*** - Presence of an activity or land use with the potential to result in contaminated land or groundwater. Or higher risk activities or land use situated at distance from the Mona Onshore Development Area or are historical in nature
- ***Low Risk*** - Activity or land-use considered unlikely to result in significant contamination. Or potentially contaminative activity or land use which by virtue of position, age or certainty is considered unlikely to represent a significant constraint to the Mona Onshore Development Area.

1.2.4.3 On the constraints plans only those activities or land uses with a risk considered to be above low risk have been presented.

1.3 Results

1.3.1 Geology

1.3.1.1 The bedrock geology and superficial deposits across the geology, hydrogeology and ground conditions study area are presented in Figure 1.1 and Figure 1.2 respectively.

Geological and Groundwater Dependent Designated Sites

1.3.1.2 Designated sites identified within the GHGC study area are shown in Figure 1.1 and Figure 1.2 and summarised in Table 1.2.

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Table 1.2: Protected sites within the GHGC study area

RPS ID	Site name	Site type	Qualitative risk ranking	Justification
PS_01	Coedydd ac Ogofau Elwy a Meirchion	SSSI	Low	The SSSI is designated on the basis of the geological and palaeontological interest of Galltfaenan, Cefn and Pontnewydd Caves. It also has botanical interest in the presence of semi-natural broadleaved woodland, rare lowering plant and scarce bryophyte assemblages. Located 820 m southwest of the Mona Onshore Development Area.
PS_02	Llanddulas Limestone and Gwrych Castle Wood	SSSI	Moderate	The SSSI includes geological features but is designated largely on the basis of ecology rather than its geological or geomorphological importance. Located within the Mona Onshore Development Area
PS_03	Coed y Gopa	SSSI	Low	The SSSI is principally designated on the presence of bat roosts. Located 850 m east of the Mona Onshore Development Area.
PS_04	Traeth Pensarn	SSSI	Low	The SSSI is designated on the basis of importance of botanical features in coastal zone. Located within the Mona Onshore Development Area.

1.3.1.3 The Coedydd ac Ogofau Elwy a Meirchion SSSI contains four GCR sites which are important for the Pleistocene sediments and vertebrate mammalian fossils within the caves. The Coedydd ac Ogofau Elwy a Meirchion SSSI (and the GCR sites) are located outside the Mona Onshore Development Area.

1.3.1.4 There are two RIGs within the GHGC study area: they are summarised in Table 1.3 and shown in Figure 1.1 and Figure 1.2. Both RIGs are located outside the Mona Onshore Development Area.

Table 1.3: Summary of RIGS in the GHGC study area.

RPS ID	Site Name	Notes
GS_01	Cefn yr Ogof	It is noted that BGS records show localised areas of tufa formation approximately 330 m to the southwest of this site.
GS_02	Cefn Meiriadog	Comprised of a network of interlinking limestone caves. The cave network is also designated as a Scheduled Ancient Monument.

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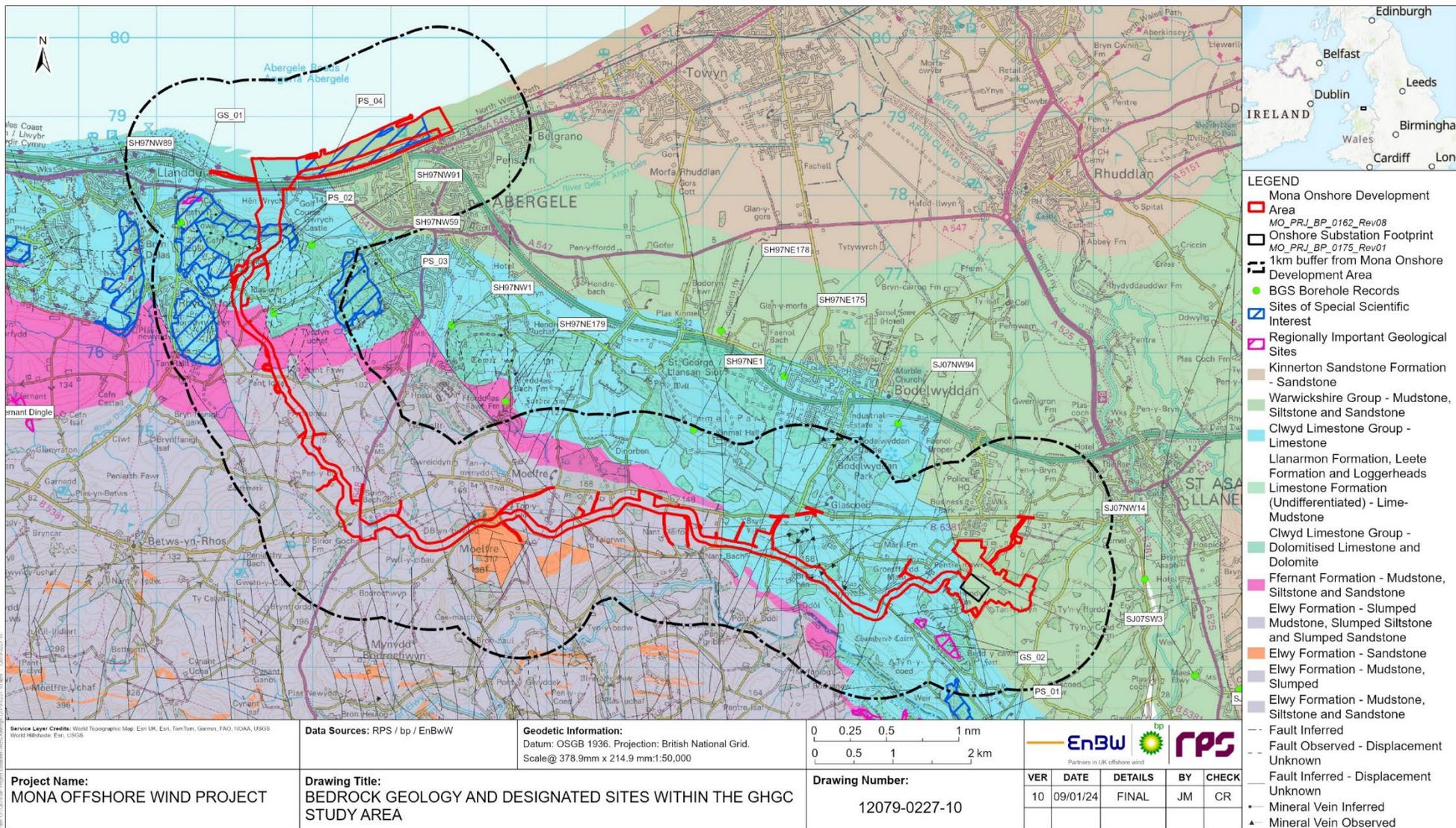


Figure 1.1: Bedrock geology and designated sites within the GHGC study area.

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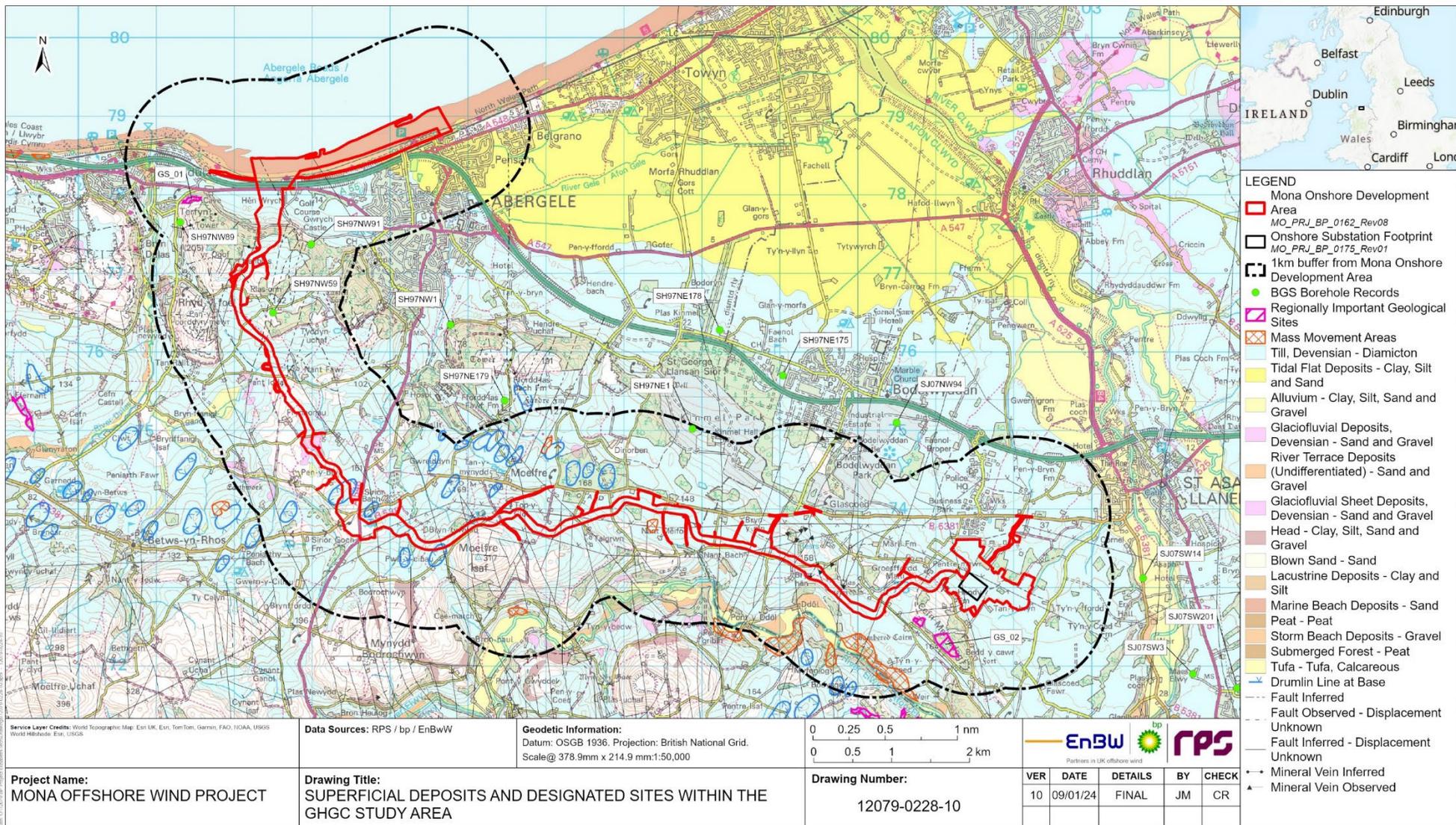


Figure 1.2: Superficial deposits and designated sites within the GHGC study area.

1.3.2 Hydrogeology

Aquifer designation

1.3.2.1 Aquifer designations for the bedrock geology and superficial deposits across the GHGC study area are shown in Figure 1.3 and Figure 1.4 respectively. The following designations are presented in those drawings:

- **Principal aquifers** that yield significant groundwater that support regionally or nationally important supplies and support rivers, lakes and wetlands
- **Secondary A aquifers** that comprise permeable layers that can support local water supplies and may form an important source of baseflow to rivers
- **Secondary B aquifers** that are mainly lower permeability layers that may store and yield limited amounts of groundwater
- **Secondary undifferentiated** aquifers where it is not possible to apply either a Secondary A or B definition because of the variable characteristics of the rock type, but generally have only a minor resource value
- **Unproductive strata** that are largely unable to provide usable water supplies and are unlikely to have surface water and wetland ecosystems dependent on them.

Licensed groundwater abstractions

1.3.2.2 One licensed abstraction has been identified in the GHGC study area: it is shown on Figure 1.3 and Figure 1.4 and summarised in Table 1.4. The abstraction is historical (i.e. not currently used): there are no records of active licensed groundwater abstractions within the GHGC study area. The nearest active licensed groundwater abstractions are GWA_06 and GWA_07: both are situated above the Warwickshire Group bedrock in St Asaph.

Table 1.4: Licensed groundwater abstractions within the GHGC study area.

RPS ID	Point name	Status	Geology/ aquifer	Notes
GWA_02	Borehole at Bryn Pin Mawr	Historical	Clwyd Limestone Group	Approximately 230 m from the Mona Onshore Development Area.

Private groundwater abstractions

1.3.2.3 DCC has confirmed that they have no records of any current or historic private groundwater abstractions within the GHGC study area.

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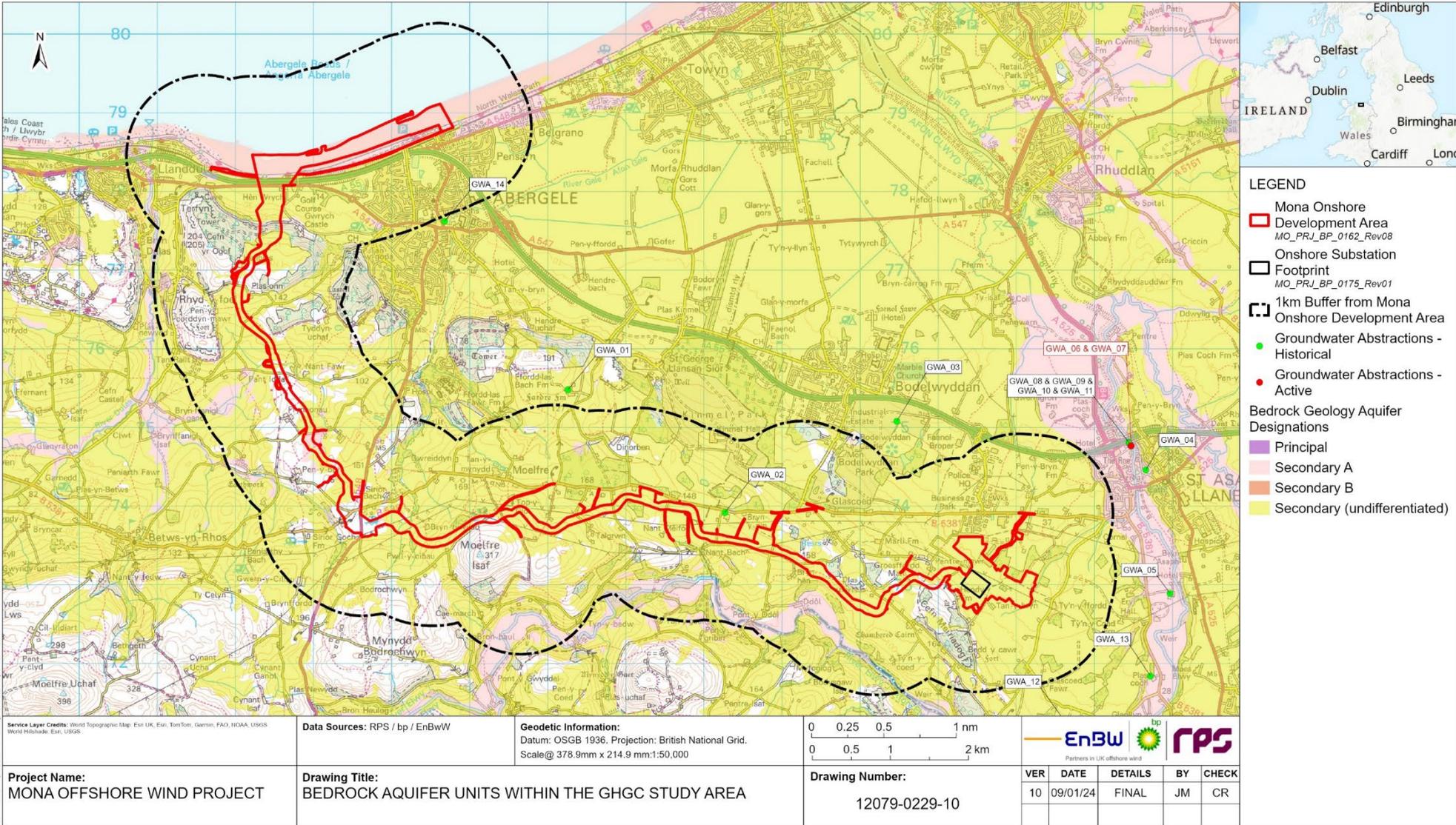


Figure 1.3: Bedrock aquifer units within the GHGC study area.

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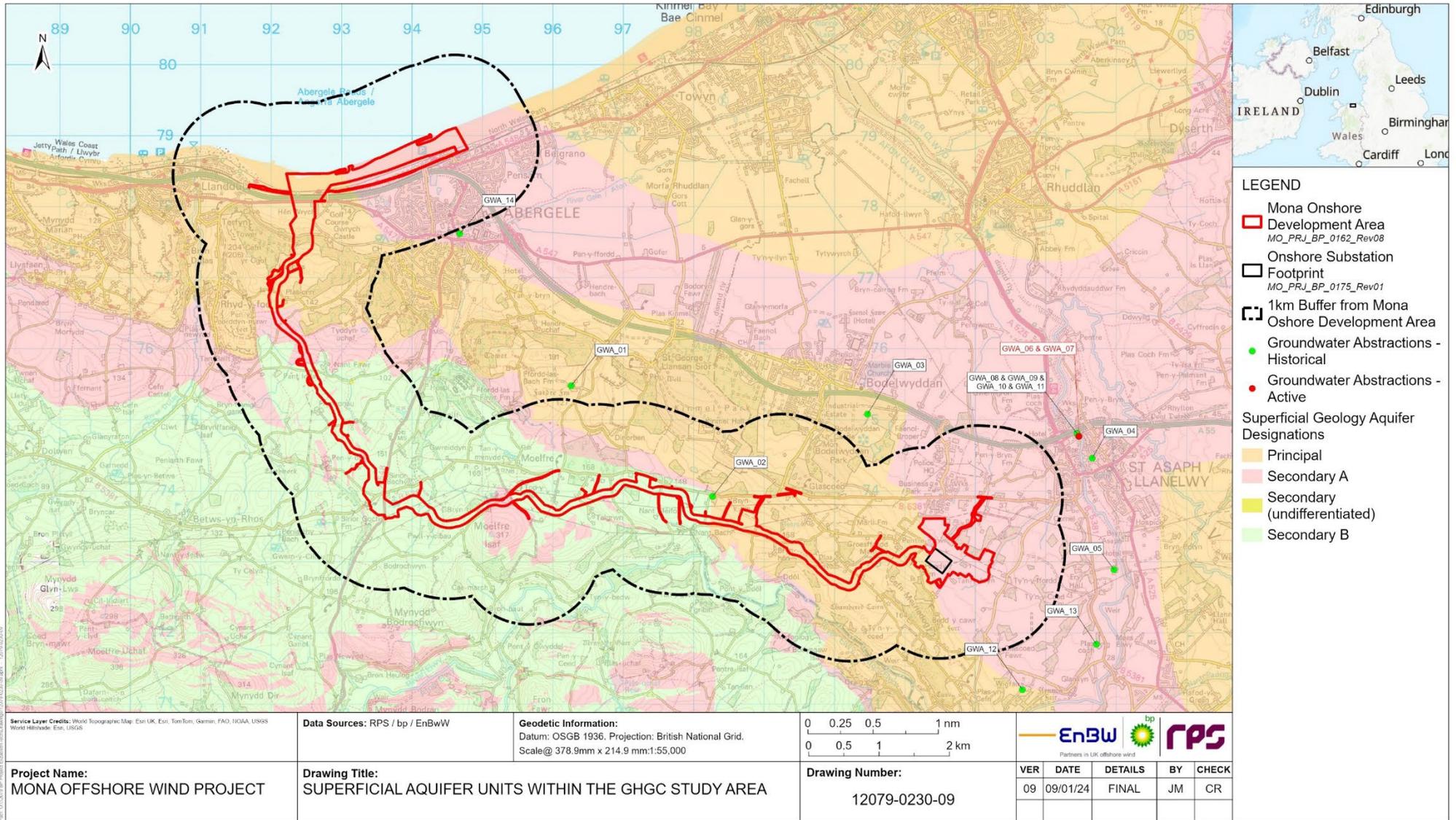


Figure 1.4: Superficial aquifer units within the GHGC study area.

Groundwater Source Protection Zones

1.3.2.4 There are no groundwater SPZs within the GHGC study area. The closest SPZs are at Llannerch Park and Trofarth Farm. The Llannerch Park abstraction borehole is located 3.5 km to the east of the Mona Onshore Development Area and abstracts groundwater from the Kinnerton Sandstone formation. The Trofarth Farm abstraction borehole is located over 8 km to the west/southwest of the Mona Onshore Development Area where water is abstracted from the Elwy Formation.

1.3.3 Ground conditions

1.3.3.1 The detailed ground condition constraints maps are presented in Figure 1.6 to Figure 1.8.

Landfill sites

1.3.3.2 Details of the current and historical landfill sites presented in those figures are summarised Table 1.5.

Table 1.5: Landfill sites (current and historical) within the GHGC study area

RPS ID	Site name and status)	Waste type accepted	Qualitative risk ranking	Justification
LF_01A	Llanddulas Beach Landfill (Historical)	Industrial, Commercial, Household	High	The landfill contains potentially biodegradable 'household' waste and has active leachate and gas monitoring in place. The landfill is historical and located within the Mona Onshore Development Area.
LF_01B	Llanddulas Beach No.1. (Historical)	Industrial, Commercial, Household	Moderate	The landfill contains a possible biodegradable or contaminated waste mass but is a small site and is situated on the edge of the Mona Onshore Development Area.
LF_02	Ty Mawr Ucha Farm (Active / recent)	Non-biodegradable waste or 'other waste'	Low	The landfill is situated 740 m northeast of Mona Onshore Development Area on opposite side of area of high topography.
LF_03	Moelfre (Historical)	Inert, Household (NRW: Inert)	Low	The landfill contains a possible biodegradable waste mass, but is a historical site situated on Silurian bedrock of the Elwy Formation and glacial till. It is located 10 m to the north of the Mona Onshore Development Area.
LF_04	Plas Newydd Cefn (Historical)	Industrial, Commercial, Household	Low	The landfill contains a possible biodegradable waste mass but is a historical site of small area. It is located 340 m north of the Mona Onshore Development Area.

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Licensed waste sites

1.3.3.3 Details of licensed waste sites identified in the GHGC study area are summarised Table 1.6. The waste management licences for the sites at Llanddulas Beach and Ty Mawr Farm suggest they relate to the landfills LF_01A and LF_02 in Table 1.5. The licences are registered to the postcode of where the licence was registered rather than the location of the waste site, which explains the inconsistency in locations.

Table 1.6: Licensed waste sites within the GHGC study area

RPS ID	Site name	Licence number	Qualitative risk ranking	Justification
WS_01	Llanddulas Beach Landfill	JEN001	High	This is likely to be the same landfill site as LF-01A and therefore, the same risk ranking has been applied.
WS_02	Ty Mawr Farm Landfill	GRI034	Low	This is likely to be the same landfill site as LF-02 and therefore, the same risk ranking has been applied. Located 600 m northeast of the Mona Onshore Development Area.

Pollution incidents

1.3.3.4 Details of the recorded pollution incident identified in the GHGC study area is summarised Table 1.7. Four categories of pollution incident are recorded:

- Category 1 – major, serious, persistent and/or extensive impact or effect on the environment, people and/or property
- Category 2 – significant impact or effect on the environment, people and/or property
- Category 3 – minor or minimal impact or effect on the environment, people and/or property
- Category 4 – substantiated incident with no impact.

1.3.3.5 Only the Category 1 and 2 pollution incidents that affect land and water within the GHGC study area have been presented.

Table 1.7: Environmental pollution incident within the GHGC study area

RPS ID	Incident ID	Principal impacted medium (pollutant)	Severity category	Qualitative risk ranking	Justification
PI_01	4189	Land (Inert materials and wastes)	2	Low to Moderate	Not a major incident. The area is underlain by thick glacial till. The incident was located 260 m north of the Mona Onshore Development Area.

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Licensed discharges to groundwater

1.3.3.6 Details of the 10 licensed discharges to groundwater are identified in the GHGC study area and summarised Table 1.8.

Table 1.8: Licensed discharges to groundwater within the GHGC study area.

RPS ID	Permit Number	Location (Effluent Type)	Consent Status	Qualitative risk ranking	Justification
GD_01	CG0301201	Glascoed – Chlorinated O/F (Unspecified)	Expired	Low	Possible organic compounds in discharge but is historical and is likely to have been controlled by risk assessment and permit conditions. Located 280 m north of the Mona Onshore Development Area.
GD_02	CM0145201	Cefn Marli sewage treatment works (presumed treated sewage)	Expired	Low	Likely to have been controlled by risk assessment and permit conditions. The discharge consent is historical. It was located 500 m north of the Mona Onshore Development Area at lower topographic elevation.
GD_03	CM0145301	Marli Glascoed sewage treatment works (treated sewage)	Effective	Low to Moderate	As for GD_02 but active.
GD_05	YP3325GU	Hunters Hamlet Caravan Park (Treated sewage)	Effective	Negligible to Low	Historical discharge. Area underlain by Silurian bedrock. Located 460 m southwest of the Mona Onshore Development Area on opposite side of watercourse.
GD_06	EPRYP3325GU	Hunters Hamlet Caravan Park (Treated sewage)	New. Issued under EPR 2010	Low	As for GD_05 except active discharge.
GD_07	VP3820XR	Bryn Olwyn Farm (Treated sewage)	Effective	Low to Moderate	Active discharge. Area underlain by Silurian bedrock but 650 m north of the Mona Onshore Development Area at lower elevation.
GD_08	EPRVP3820XR	Bryn Olwyn Farm (Treated sewage)	New. Issued under EPR 2010	Low to Moderate	As for GD_07.
GD_09	CG0428301	Castle Cove Caravan Park (Treated sewage)	Effective	Low to Moderate	Active infiltration system. Located adjacent to the Mona Onshore Development Area.
GD_10	TP3727GC	Sewage treatment plant serving Elwydale, (Treated sewage)	Effective	Low to Moderate	Active discharge but located 380 m northeast of the Mona Onshore Development Area at lower elevation and down hydraulic gradient.

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RPS ID	Permit Number	Location (Effluent Type)	Consent Status	Qualitative risk ranking	Justification
GD_11	EP RTP3727GC	Sewage treatment plant serving Elwydale, (Treated sewage)	New. Issued under EPR 2010	Low to Moderate	As for GD_10.

Fuel stations and hazardous waste storage sites

1.3.3.7 Fuel stations represent a particular risk to land and groundwater quality. The details of the current garage identified in the GHGC study area is summarised Table 1.9. There are no records of historical fuel stations within the GHGC study area.

Table 1.9: Recent and historical fuel stations within the GHGC study area

RPS ID	Address	Status	Qualitative risk ranking	Justification
FS_01	Penreefail Crossroads, Moelfre, Abergele, Conwy, LL22 8PN	Open	Moderate	The fuel station is underlain by Silurian bedrock (Elwy Formation) and glacial till. It is located 100 m north of the Mona Onshore Development Area.

1.3.3.8 Only one site has been identified within the GHGC study area that is licensed for the storage of hazardous substances. That site is summarised Table 1.10.

Table 1.10: Hazardous substance storage within the GHGC study area

RPS ID	Locations (Substances)	Application Ref Number	Qualitative risk ranking	Justification
HZ_01	Pilkington Special Glass Ltd, St Asaph. (Substances not known)	46/2000/0756	Moderate	Substances not known. Site is no longer in operation. Located 75 m northwest of the Mona Onshore Development Area and is underlain by thick glacial till.

Historical licensed industrial activities

1.3.3.9 Four historical licensed industrial activities are identified with the GHGC study area. Those sites are shown in Figure 1.6 to Figure 1.8 and summarised Table 1.11. It is evident that the four licensed activities all relate to the former Pilkington Glass factory site in St. Asaph. The site is no longer operational.

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Table 1.11: Historical licensed industrial activities within the GHGC study area.

RPS ID	Permit number	Location (process)	Effective date	Status	Qualitative risk ranking	Justification
HA_01	AP4742	Glascoed Road, St. Asaph. LL17 0ER (Inorganic Chemical Processes)	02/03/1998	Superseded By Variation	Moderate to High	The area is underlain by thick glacial till and is located 220 m north of the Mona Onshore Development Area.
HA_02	BD0583	Glascoed Road, St. Asaph. LL17 0ER (Inorganic Chemical Processes)	30/11/1998	Revoked	Moderate to High	As for HA_01.
HA_03	BC0693	Glascoed Road, St. Asaph. LL17 0LL (Inorganic Chemical Processes)	06/07/1999	Superseded By Variation	Moderate	The area is underlain by thick glacial till and is located approximately 90 m northwest of the Mona Onshore Development Area.
HA_04	BK4995	Glascoed Road, St. Asaph. LL17 0LL (Inorganic Chemical Processes)	31/05/2001	Revoked. Now IPPC	Moderate	As for HA_03

1.3.3.10 Table 1.5 to Table 1.11 identify those activities and land uses that are considered to represent the highest risk with respect to ground conditions within the GHGC study area and potentially the most significant constraints for the construction phase and operations and maintenance phase of the Mona Offshore Wind Project.

1.3.3.11 There is also evidence of a wide range of other current, recent or historical activities and land uses. These features are shown in the constraints mapping in Figure 1.6 to Figure 1.8.

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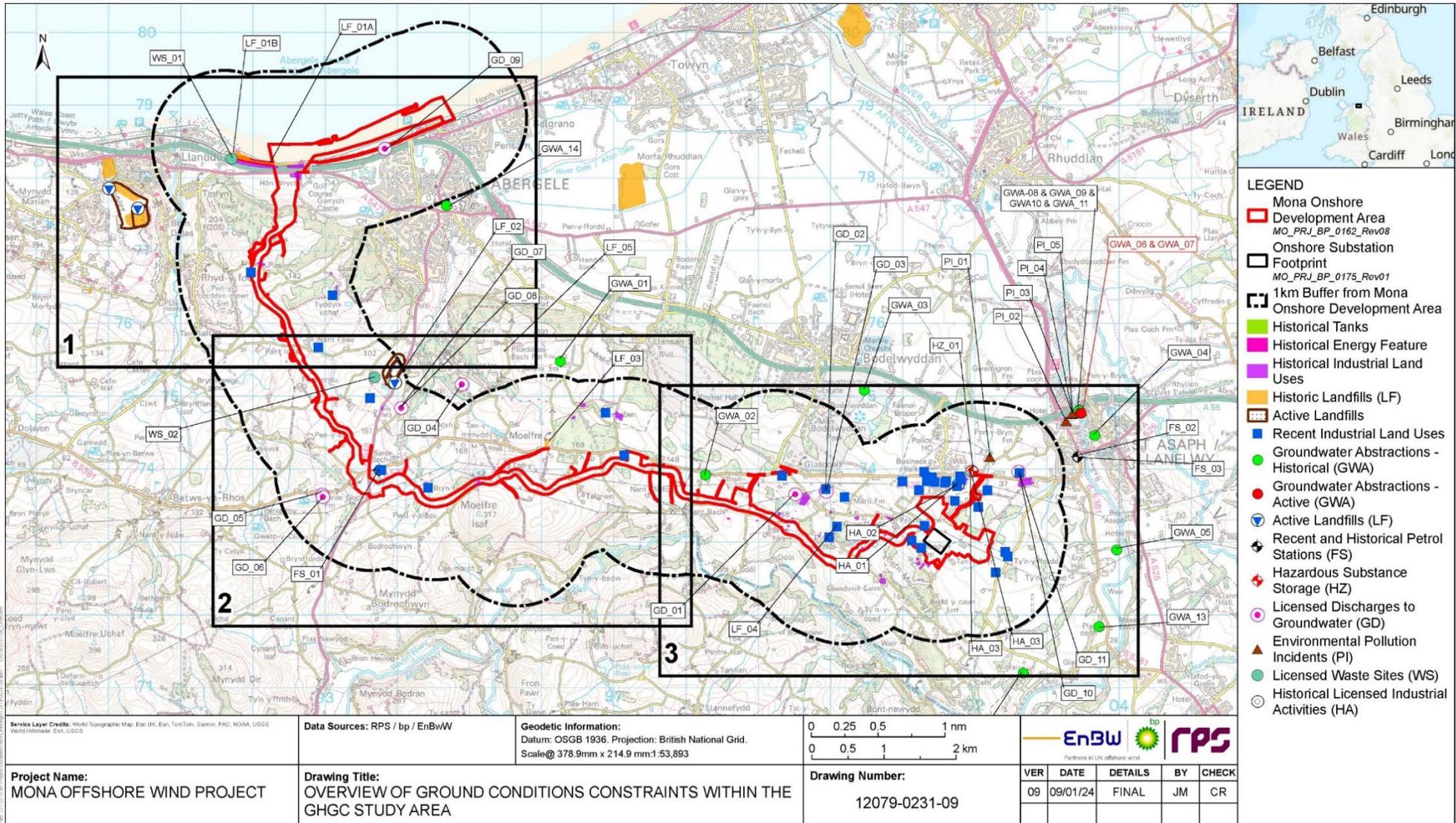


Figure 1.5: Overview of ground conditions constraints within the GHGC study area

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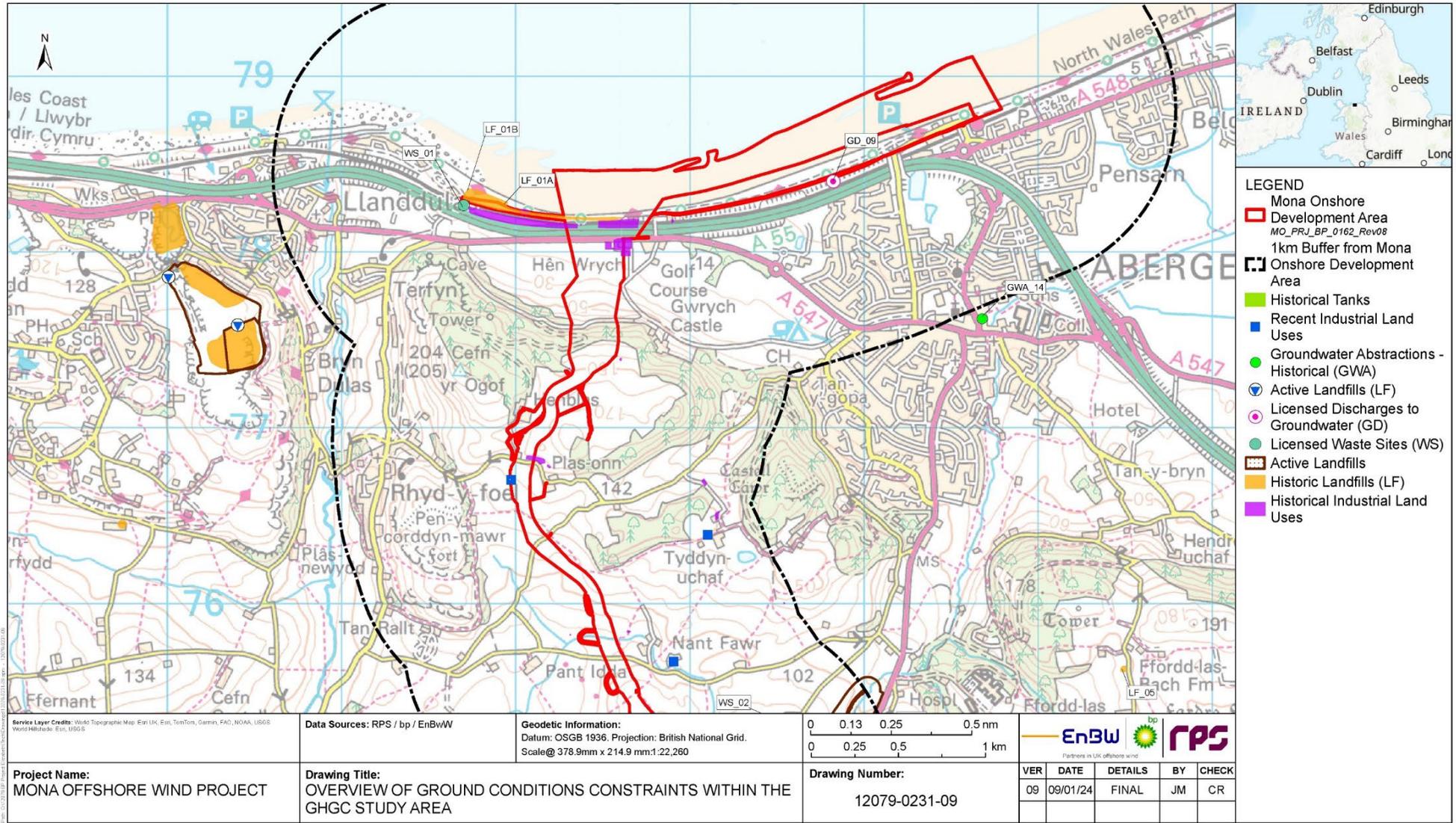


Figure 1.6: Ground conditions constraints within the GHGC study area (Sheet A)

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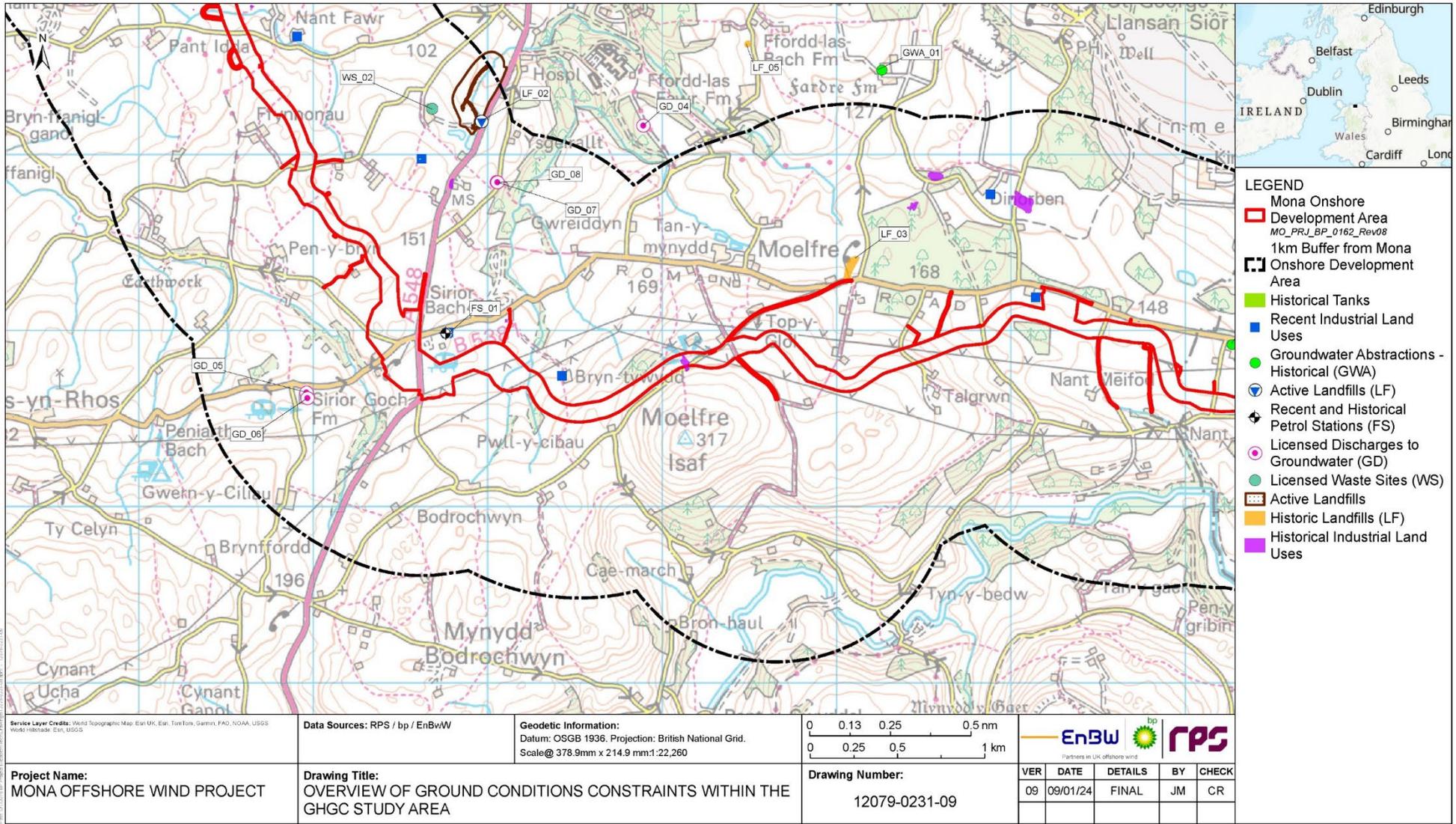


Figure 1.7: Ground conditions constraints within the GHGC study area (Sheet B)

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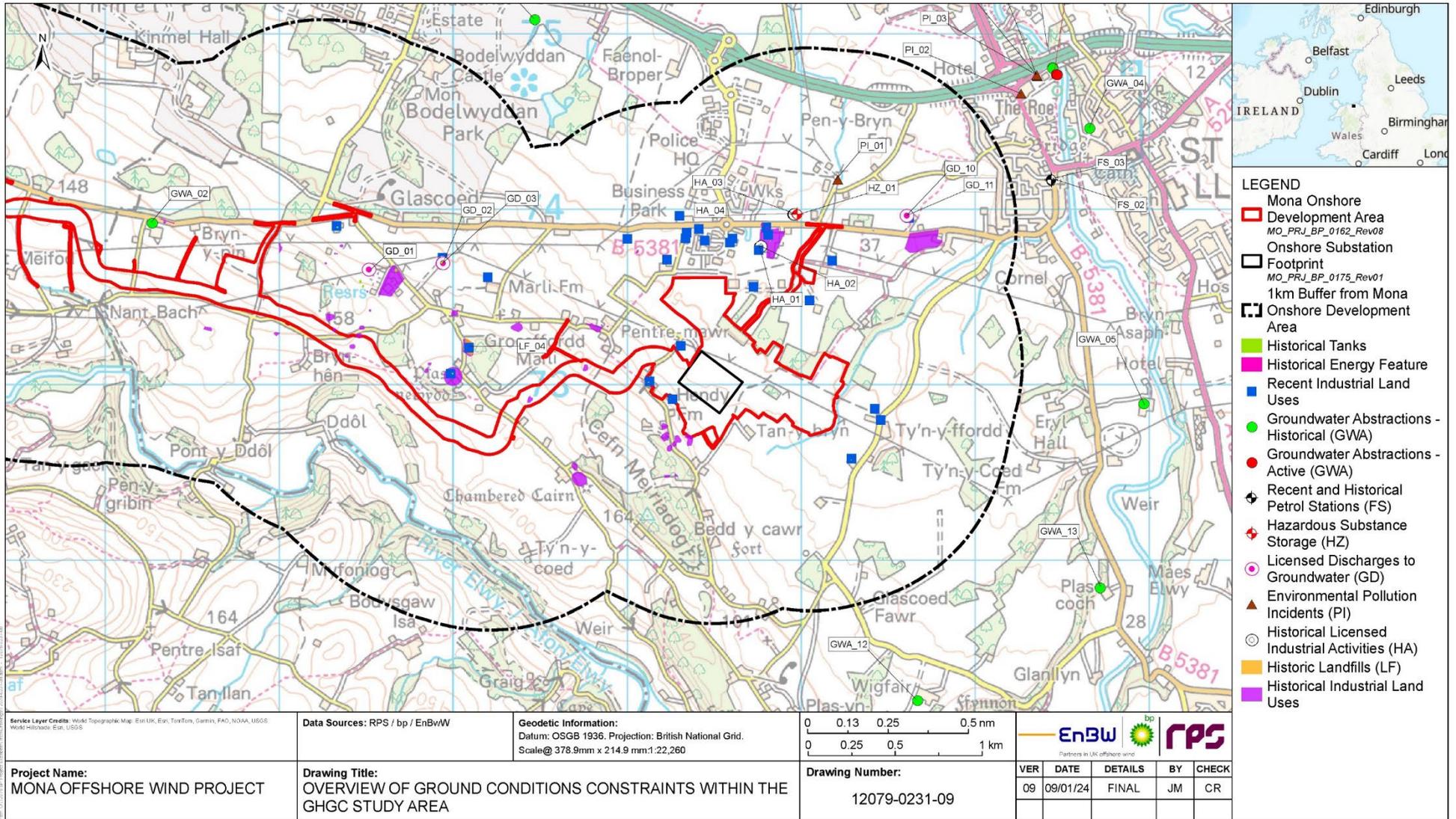


Figure 1.8: Ground conditions constraints within the GHGC study area (Sheet C)

Historical mining operations

- 1.3.3.12 The Groundsure Insights reports presents multiple datasets that relate to historical mining within the GHGC study area. The digital data for those datasets has been used to produce Figure 1.9. Individual features and their associated risk will be reviewed as part of route refinement and detailed design. Several historical mines have also been identified from BGS reporting. These features are listed in Table 1.12 and shown in Figure 1.9.
- 1.3.3.13 A strong spatial correlation can be observed between these reported mines and the historical mining features / datasets identified in the Groundsure Insights.

Table 1.12: Historical mines reported by the British Geological Survey within and adjacent to the GHGC study area.

Name	Easting	Northing	Qualitative risk ranking	Justification
Cefn yr Ogof	291700	377300	Low	Located 360 m west of the Mona Onshore Development Area.
Castell Cawr – North / Ffos-y-Bleiddiaid	293600	376600	Negligible to Low	Located 1.2 km east of the Mona Onshore Development Area.
Castell Cawr – South / Tyddyn Morgan Mine	293700	376400	Negligible to Low	Located 1.2 km east of the Mona Onshore Development Area.
Nant uchaf Mine	293400	376000	Negligible to Low	Located 830 m east of the Mona Onshore Development Area.
Bodelwyddan Mine	299700	374900	Negligible to Low	Located 930 m north of the Mona Onshore Development Area.
Score Mine	299300	373700	Moderate	Located 250 m south of the closest point of the Mona Onshore Development Area. Located 330 m north of the Onshore Cable Corridor.
Coed-Carreg-Dafydd Mine	299500	373300	Moderate	Located adjacent to the Mona Onshore Development Area.
Panty Celyn Lead Mine	301300	372700	Low	Located adjacent to the Mona Onshore Development Area at higher elevation.

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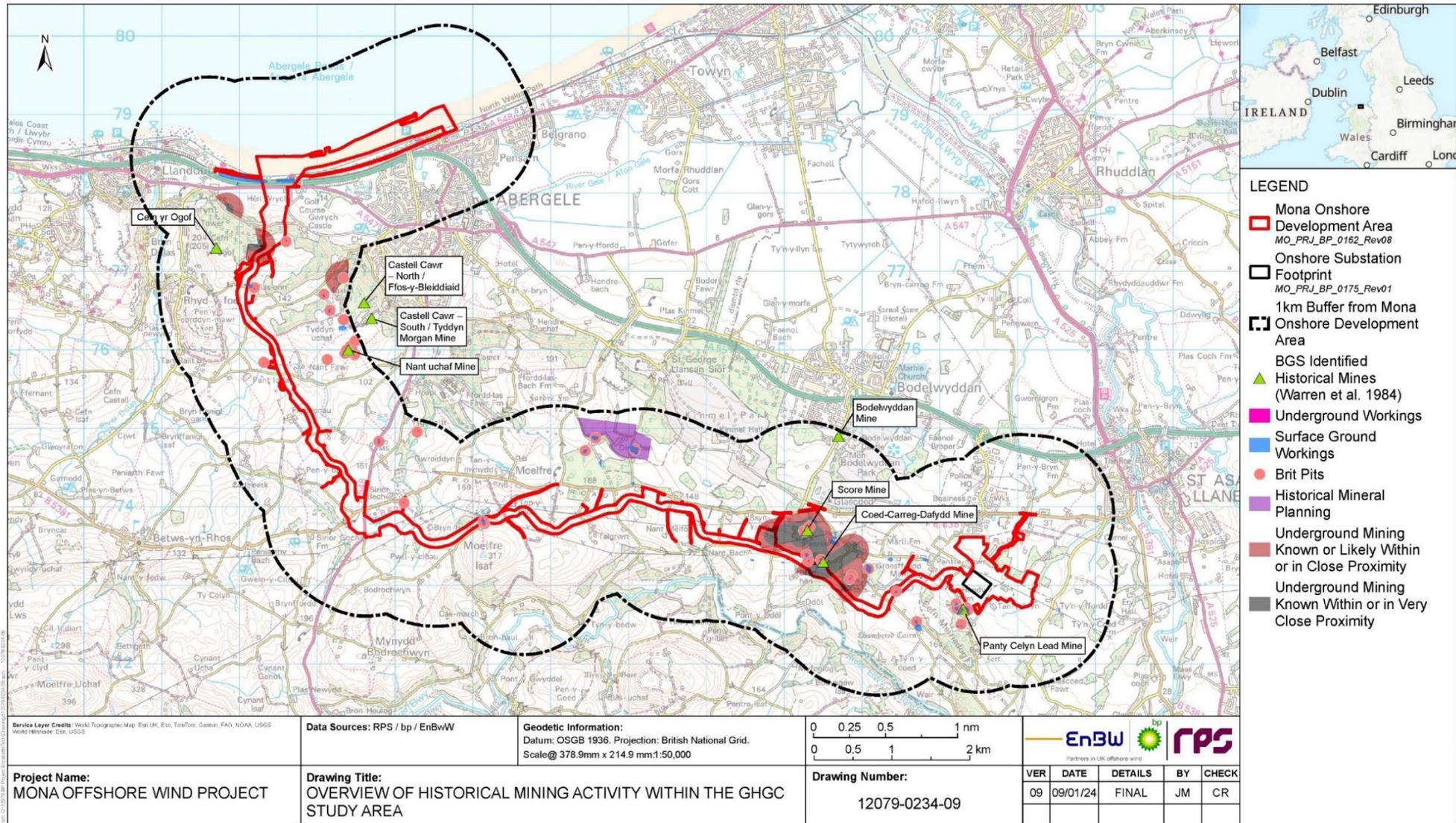


Figure 1.9: Overview of historical mining activity within the GHGC study area

1.4 References

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