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CYNGOR GWYNEDD COUNCIL

Pwllheli Harbour Dredge and Disposal

Water Framework Directive (WFD) Assessment

P2843_R7016_Rev1 | 30 October 2026

DOCUMENT RELEASE FORM

CYNGOR GWYNEDD COUNCIL

P2843_R7016_Rev1

Pwllheli Harbour Dredge and Disposal

Water Framework Directive (WFD) Assessment

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SUMMARY

Project Overview

Cyngor Gwynedd Council (CGC) proposes to undertake maintenance dredging within Pwllheli Harbour and dispose of dredged material offshore within the outer bay, approximately 200 metres (m) outside the harbour. The proposed works comprise a corrective maintenance dredge of up to 60,000m³ of sediment, followed by periodic maintenance dredging campaigns (of 10,000m^3 to 20,000m^3) to maintain navigable depths within the harbour.

Purpose of this Report

This Water Framework Directive (WFD) assessment has been undertaken by Intertek Metoc (Intertek) to support the Marine Licence Application and to evaluate the potential effects to the status or objectives of the relevant WFD water bodies from the proposed dredging and disposal activities that are required to maintain navigable channels and berthing in the harbour. The assessment considers the potential impacts on hydromorphology, biology (habitats and fish including invasive species), water quality (including chemicals), and WFD protected areas.

Assessment

The assessment considers the potential effects associated with the dredging and disposal activities including suspended sediment concentrations, sediment deposition, contaminant resuspension and effects on aquatic ecology.

Conclusion

The assessment determined that the effects on all four relevant water bodies (Tremadog Bay, Erch Estuary, Cardigan Bay North and Glaslyn Estuary) are expected to be negligible, and any effects are expected to be localised and temporary. No WFD quality elements were assessed as being at risk of deterioration and the dredging and disposal activities are not predicted to prevent relevant water bodies from achieving their WFD objectives.

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GLOSSARY

AA
Appropriate Assessment

AL1
Action Level 1

AL2
Action Level 2

As
Arsenic

Cd
Cadmium

CEFAS
Centre of Environment, Fisheries and Aquaculture Science

CGC
Cyngor Gwynedd Council

Cr
Chromium

Cu
Copper

EA
Environment Agency

EQSD
Environmental Quality Standards Directive

Hg
Mercury

HMWB
Heavily Modified Water Body

HRA
Habitats Regulations Assessment

INNS
Invasive non-native species

MarLIN
Marine Life Information Network

MLA
Marine Licence Application

Ni
Nickel

NM
Nautical Mile

NOAA
National Oceanic and Atmospheric Administration

NRW
Natural Resources Wales

Pb
Lead

PLAS
Pen Llŷn a'r Sarnau

SAC
Special Area of Conservation

SHA
Statutory Harbour Authority

SPA
Special Protection Area

SSSI
Site of Special Scientific Interest

UWWTR
Urban Waste Water Treatment Regulations

WFD
Water Framework Directive

Zn
Zinc

1. INTRODUCTION

1.1 Regulatory Framework

The Water Framework Directive (WFD) established a framework to protect and improve the ecological health of European waters, including inland surface waters (rivers and lakes), transitional waters, coastal waters and groundwater. Protection of coastal waters under the WFD extends from the mean low water mark up to one nautical mile (NM) from shore and requires that licenced projects or activities do not *'cause deterioration in a water body'*. As part of the Marine Licence Application (MLA) for disposal of dredging materials, Cyngor Gwynedd Council (CGC) will consider the effects of the Project in accordance with the below legislation as appropriate:

- The Water Environment (WFD) (England and Wales) (Amendment) Regulations 2016 (implementing Directive 2000/60/EC establishing a framework for community action in the field of water policy).
- The Bathing Water Regulations 2013 (implementing Directive 2006/7/EC concerning the management of bathing water quality (Bathing Water Directive).

This WFD Compliance Assessment has been prepared in accordance with the relevant Natural Resources Wales (NRW) and Environment Agency (EA) guidance to ensure that all potential receptors and impact pathways have been identified and assessed (Environment Agency, 2017; Natural Resources Wales, 2024).

1.2 Background

The Pwllheli Harbour is an operating marina that requires regular maintenance dredging to maintain navigable channels and berthing in the harbour. The CGC are proposing to undertake maintenance dredging of the Pwllheli Harbour in order to bring the harbour to its approved design depths which is required to maintain safe and navigable harbour for its users. However, existing on-site disposal options are now at capacity with the stilling basin being full, and significant dredging is still required. Due to its fine-grained, silt/clay nature, the dredged material is unsuitable for use within beach nourishment projects and, instead, it is proposed that the sediment will be deposited into the outer bay.

As the Statutory Harbour Authority (SHA), CGC are able to undertake licenced maintenance dredging under the Pwllheli Harbour Act 1983; however, any disposal of the material within the marine zone outside of the harbour would require a Marine Licence application to be granted by NRW. It is noted that whilst the dredging part of the proposed operations are not required to be included within the Marine Licence application, the impacts of the dredging has been considered in this assessment to ensure the worst-case and cumulative effects are considered.

Prior to the marine application, CGC produced a dredge plume modelling study report (prepared by Intertek Metoc) of which the results have been used to inform the scoping and assessment within this WFD. Within this report, it was noted that the deposition of dredged material was modelled to cover up to 53.8km^2 under a worst-case scenario, with the suspended sediment also covering a footprint of 225.3km^2. It is further noted that within the modelling report, suspended sediment footprint was confirmed to be anything over 0.1mg/l and a deposition threshold of over 0.1mm.

1.3 Project Description

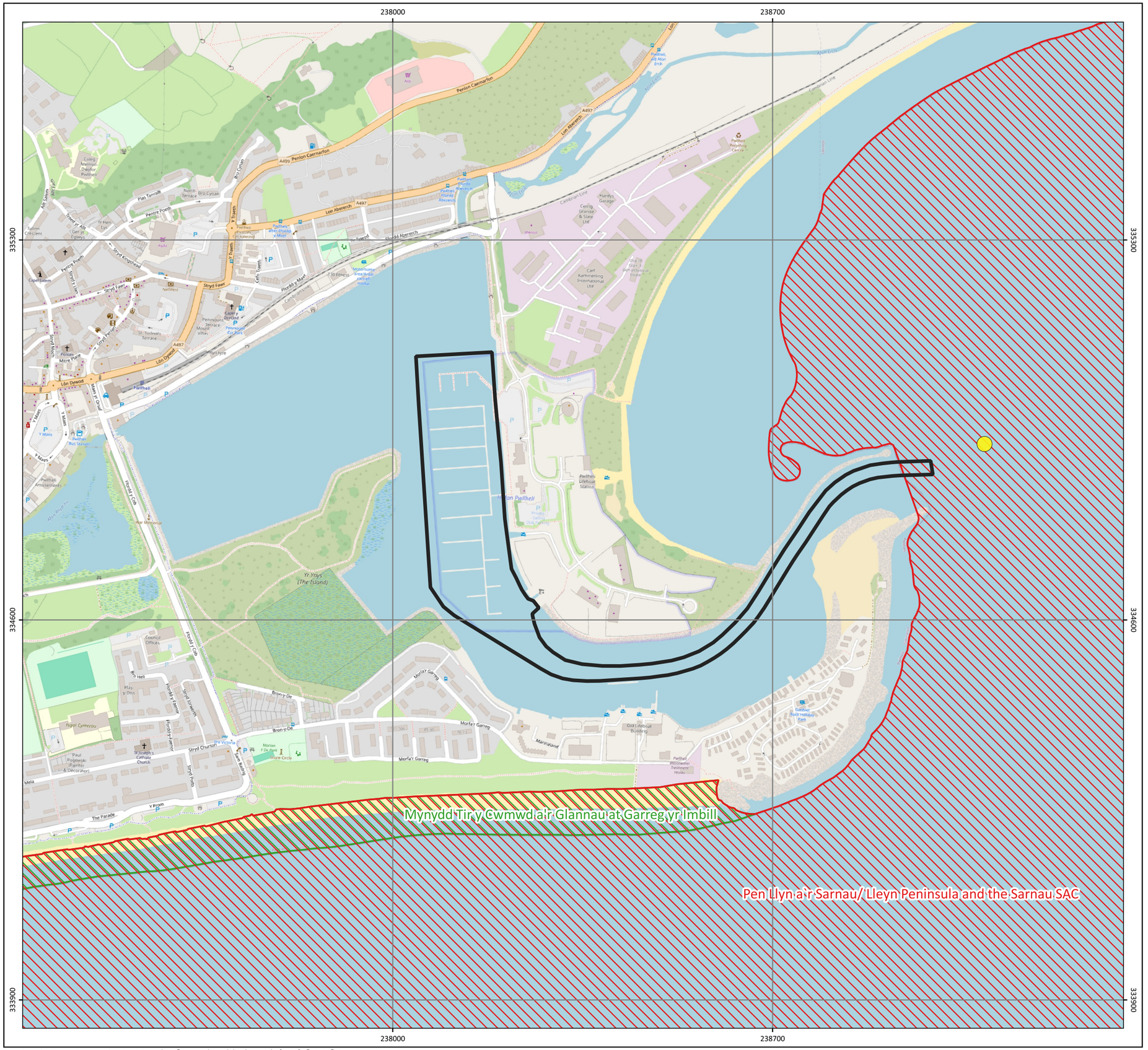
1.3.1 Pwllheli Harbour

Pwllheli Harbour, located on the south coast of the Llŷn Peninsula in Wales, comprises a historical tidal harbour and the Hafan Pwllheli Marina which was developed during the 1990s. The harbour is protected by breakwater structures whilst the wider waters are protected by the Sarn Badrig (St Patrick's Causeway). The Pwllheli Harbour is situated within the Pen Llyn a'r Sarnau / Lleyn Pensinsula and the Sarnau Special Area of Conservation (SAC), with several habitats listed under Annex I of the Habitats Directive, which lists species and habitats whose conservation requires designation of SACs including reefs, sub-tidal sandbanks, and others. Two Sites of Special Scientific Interest (SSSI's) are within a 5 kilometre (km) radius; Morfa Abererch (ID: 31WKP) directly east of the harbour mouth, and Mynydd Tir y Cwmwd a'r Glannau at Garreg yr Imbill (ID: 31WTA) west of the Llŷn Peninsula. The protected sites are shown in Figure 1-2 (Drawing Ref: P2843_PROT_002).

Table 1-1 Project Overview

Project Item	Description
Applicant name	Cyngor Gwynedd Council
Name of activity	Pwllheli Harbour maintenance dredging and disposal
Location of activity	See Figure 1-1 (Drawing Ref: P2843_LOC_005)
Timings of activity (Start to end)	April 2027 to May 2028*
Extent of activity	To be confirmed
Use or release of chemicals	See Section 2.2.5

*It is noted that the dredging operations will be on hold during the bathing season. This is therefore the general dredging window – specific operational dates to be confirmed.



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PWLLEHLI MARINA

LOCATION OVERVIEW

Approximate Dredge and Disposal Location

Drawing No: P2843_LOC_005	A

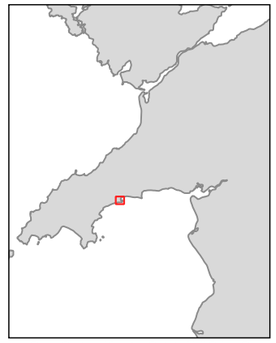
Legend

- Indicative Proposed Disposal Location
- Approximate Dredging Area

Protected Areas

- SAC
- SSSI

N



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WKID	EPSG:27700
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Created By	Adam Johns
Reviewed By	Eloïse Boblin
Approved By	Eloïse Boblin

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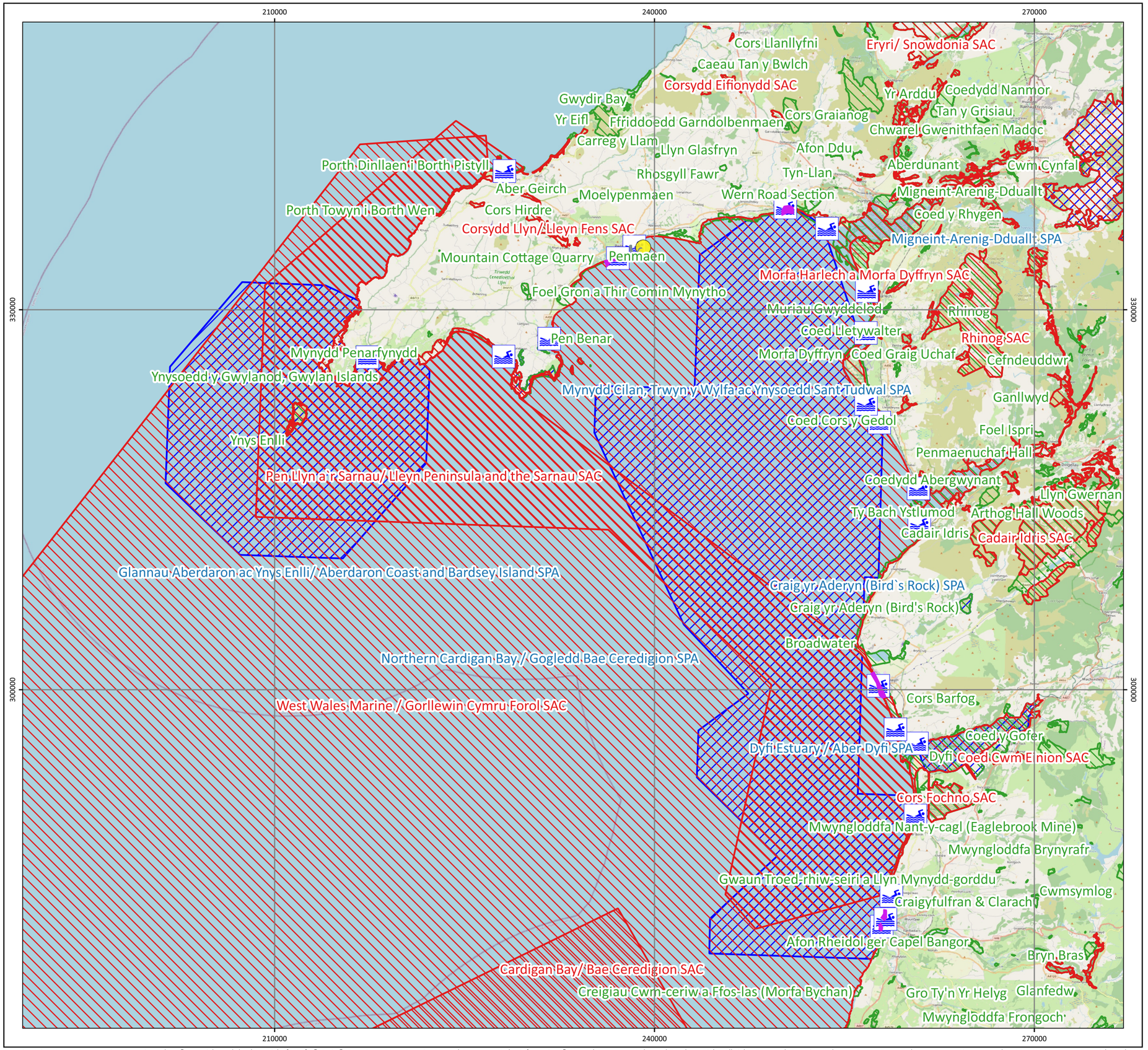
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PWLLEHLI MARINA

Protected Sites

Local Environmental Designations

Drawing No: P2843_PROT_002 | A



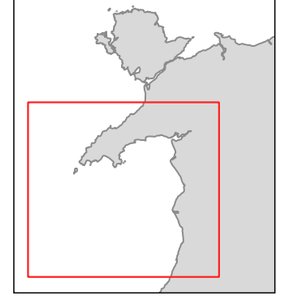
Legend

- Indicative Proposed Disposal Location
- Dredging Area

Environmental Designations

- Bathing Waters
- UWWTR
- SAC
- SSSI
- SPA

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Approved By	Eloïse Boblin

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1.3.2 Relevant Water Bodies

The relevant water bodies and key summary information for the WFD assessment are presented in Table 1-2 and shown in Figure 1-3 (Drawing Ref: P2843_ENV_007).

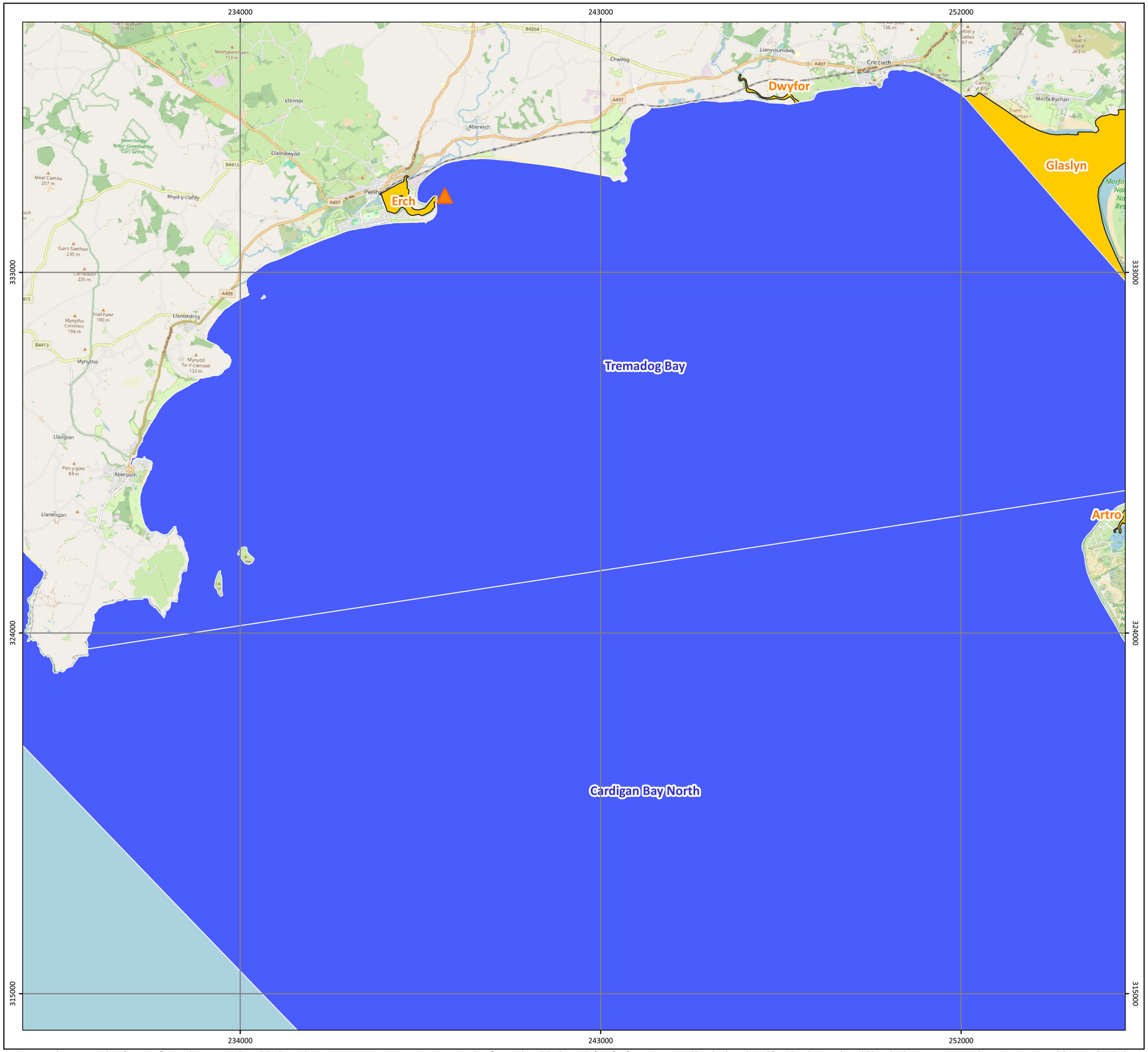
Table 1-2 Relevant Water Body Information

Parameters	Tremadog Bay (within)	Erch Estuary (0.2km)	Cardigan Bay North (9.8km)	Glaslyn Estuary (13.2km)
Water body ID	GB651009350000	GB521006509600	GB621009600000	GB511006507300
River basin district name	Western Wales	Western Wales	Western Wales	Western Wales
Water body type (estuarine or coastal)	Coastal	Transitional	Coastal	Transitional
Water body total area (km^2)	239.42	0.51	712.18	15.67
Overall water body status (2021)	Good	Moderate	Moderate	Good
Ecological status	Good	Moderate	Good	Good
Chemical status	High	Good	Moderate	High
Target water body status and deadline	Good by 2027	Good by 2015	Good by 2015	Good by 2015
Hydromorphology status of water body	High	Not high	Not high	Not high
Heavily modified water body (HMWB) and for what use	No	Heavily modified	No	No
Higher sensitivity habitats present	Intertidal and subtidal seagrass Subtidal kelp beds Mussel beds Polychaete reef	Saltmarsh	Subtidal kelp beds Mussel beds Polychaete reef	Intertidal and subtidal seagrass Mussel beds Saltmarsh
Lower sensitivity habitats present	subtidal rocky reef, rocky shore, intertidal soft	intertidal soft sediments like sand and mud,	subtidal rocky reef, rocky shore, cobbles,	rocky shore, intertidal soft sediments like sand

Parameters	Tremadog Bay (within)	Erch Estuary (0.2km)	Cardigan Bay North (9.8km)	Glaslyn Estuary (13.2km)
	sediments like sand and mud, subtidal boulder fields, subtidal soft sediments like sand and mud, cobbles, gravel and shingle	subtidal soft sediments like sand and mud	gravel and shingle, intertidal soft sediments like sand and mud, subtidal boulder fields, subtidal soft sediments like sand and mud	and mud, subtidal soft sediments like sand and mud)
Phytoplankton status	N/A	N/A	Good	N/A
History of harmful algae	Not reported	Not reported	Not reported	Not reported
WFD protected areas within 2 kilometres (km)*	Pen Llŷn a'r Sarnau SAC West Wales Marine SAC Morfa Harlech SAC Morfa Dyffryn SAC Northern Cardigan Bay SPA Mynydd Cilan, Trwyn y Wylfa ac Ynysoedd Sant Tudwal SPA Glannau Aberdaron ac Ynys Enlli / Aberdaron Coast and Bardsey Island SPA Pwllheli Bathing Water Glan Don Beach Bathing Water Abersoch Bathing Water Criccieth Bathing Water Craig du beach central Bathing Water Harlech Bathing Water Llan Danwg Bathing Water Porth Neigwl Bathing Water Aberdaron Bathing Water Pwllheli Urban Waste Water Treatment Regulations (UWWTR) Criccieth UWWTR			

Parameters	Tremadog Bay (within)	Erch Estuary (0.2km)	Cardigan Bay North (9.8km)	Glaslyn Estuary (13.2km)
	Morfa Abererch SSSI Mynydd Tir y Cwmwd a'r Glannau at Garreg yr Imbill SSSI Glannau Aberdaron SSSI Wig Bach a'r Glannau i Borth Alwm SSSI Porth Ceiriad, Porth Neigwl ac Ynysoedd Sant Tudwal SSSI Tiroedd a Glannau Rhwng Cricieth ac Afon Glaslyn SSSI Morfa Harlech SSSI Morfa Dyffryn SSSI			

*Modelled suspended sediment and deposition areas provided within the modelling report.



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DREDGE & DISPOSAL OPERATION

Coastal Waterbodies

Drawing No: P2843_ENV_007	A

Legend

- Indicative Proposed Disposal Location

Waterbodies

- Coastal
- Transitional

N



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Created By	Adam Johns
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1.3.3 Previous Maintenance Dredging Activities

Following the initial construction and dredging in the 1990's, the Pwllheli Harbour requires regular maintenance dredging in order to maintain navigable channels and berthing in the harbour. Between 1992 and 2007, a regular maintenance dredging programme was followed, with dredging undertaken in a variety of forms by the Local Authorities. In 2009, CGC produced a Pwllheli Harbour dredging strategy that covered plans for future maintenance dredging plans. In 2014, major dredging was completed, with more than 90,000m^3 of sediment removed from the harbour channel. However, in 2015, CGC drafted an updated Pwllheli Harbour dredging strategy, the original of which was documented in 2014. Within this new dredging strategy, Gwynedd Council proposed anticipated volumes of dredged material to be removed annually from locations around the harbour. In 2019 and 2021, the harbour basin and channel was dredged for 20m^3 per dredging activity. The last dredging activities occurred in October 2024, with approximately 20,000m^3 of material removed.

1.3.4 Proposed Maintenance Dredging and Disposal Activities

Following the requirement for the additional maintenance dredging on the Pwllheli Harbour, CGC have proposed a "corrective" maintenance dredge (of up to 60,000 m^3), followed by ongoing annual maintenance dredging (10,000 – 20,000 m^3 per year) to maintain design depths within the Harbour.

The initial larger campaign will restore harbour to its design depths which is required to maintain a safe and navigable harbour, while smaller annual dredging is expected to be periodic and seasonal, typically occurring outside the bathing season (October to May). Duration and exact timing will vary annually depending on sedimentation rates and weather conditions, with operations continuing as part of routine harbour maintenance.

1.3.4.1 Dredged Material Characteristics

Previous sampling of the dredged material from the harbour saw the material comprising of colloids (5.3%), clay (22.6%), fine silt (32.1%), medium silt (16.4%), coarse silt (12.9%), fine sand (10.6%), and sand (0.1%). The material within the approach channel is reported to be made up of colloids (0.4%), clay (0.6%), fine silt (0.9%), medium silt (0.6%), coarse silt (0.8%), fine sand (63.9%), sand (32.7%), and gravel (0.3%) (SOCOTEC & Ocean Ecology, 2026).

Sediment sampling undertaken in 2023 using vibrocore samples across Pwllheli Harbour indicates that sediments within the harbour are relatively uniform and dominated by fine-grained material (silts and clays), with limited gravel present (Ocean Ecology, 2023). Particle size analysis shows that typical harbour sediments are made up largely of clay and silt fractions with smaller amounts of fine sand and negligible sand and gravel. A small proportion of colloidal material is also present, which is consistent with cohesive harbour mud. In contrast, sediments from the harbour approach are much coarser, consisting mainly of fine sand and sand, with only very small amounts of silt and clay and minimal gravel. This shows a clear transition from fine, cohesive harbour sediments to sandier material in the outer bay. This provides evidence of finer riverine sediments being input into the harbour via the Afon Erch and Afon Rhyd-hir, whereas a larger proportion of sand at the main tidal channel is indicative of inputs from the high tidal currents.

Sediment sampling undertaken in 2026 (under the requested sediment sample plan PS2607) throughout the Pwllheli Harbour covered 10 locations throughout the harbour, stretching from the main tidal channel, as well as within the harbour. Sediment was taken from 10 locations within the harbour. Sediment particle sizes within the harbour remained uniform and similar to previous sediment sampling undertaken in 2023. Of the 10 sites, sampling sites within the main tidal channel (SS1 & SS2) presented larger particle sizes, dominated by fine sands, whilst the remaining sampling sites were dominated by fine silts.

Analysis was also undertaken at each of these sampling sites to determine the concentrations of various trace metals to identify the presence of contaminants that may have accumulated within the sediments within the Pwllheli Harbour. The following trace metals were analysed at each of the sampling sites: Arsenic (As), Cadmium (Cd), Chromium (Cr), Copper (Cu), Mercury (Hg), Nickel (Ni), Lead (Pb), and Zinc (Zn). Of these trace metals, Ni, Pb and Zn exceeded the standard Centre for Environment, Fisheries and Aquaculture Science (Cefas) trace metal Action Level one (AL1), however, no determinands exceeded Cefas AL2 thresholds. It was found that for lead in particular, concentrations were higher in the 2026 survey, with a maximum concentration of 182 mg/kg compared with 48.2 mg/kg in 2023. However, it is noted that historic lead mining activity and natural lead mineralisation are known to occur within the wider Llŷn area and may contribute to elevated background lead concentrations in local sediments. However, the source of the elevated lead concentrations recorded within the local sediments has not been specifically determined.

The results from the 2026 sediment sampling for both particle size and trace metal contaminants provide evidence that the proposed disposal site should be suitable for the deposit of dredged material. This is due to the sediment not changing the characteristics of the disposal site, with similar particle size and trace metals being found at the site.

1.3.5 Dredging and Deposition Programme

1.3.5.1 Dredging and Disposal Method

The method intended for the dredging of the Pwllheli Harbour will be via a cutter suction dredger. A cutter suction dredger operates by a rotating cutter head and a pump system that creates suction at the cutter suction head. This reduces the total spill at the cutter suction head but does not eliminate it. The pumped dredged material will typically be a slurry comprising of approximately 20% of solids, and 80% of seawater (pers. Comms. with Royal Smals 28/08/2025).

Dredged material will need to be disposed of via a pipeline, of which cannot extend more than 200m from the dredge location due to added stress on the pipeline from oceanographic conditions. Therefore, the practical solution is to dispose of the dredged material into the outer bay. The cutter suction dredger can dispose of material pumped through a pipeline into a settling basin/lagoon, or directly into the marine environment. Due to the dredge material not being suitable for reclamation or transport via barge, it is proposed that the dredged material will be disposed of offshore, within the outer bay. Due to the limitations of the maximum length of pipeline, the hydraulic capacity of the pump, and environmental conditions (causing stress onto the pipeline), it is expected that this disposal location will be estimated to be approximately 200m from the dredge location (pers. Comms. with Royal Smals 28/08/2025) (as seen in Figure 1-1 (Drawing Ref: P2843_LOC_005)).

Currently there are two dredging volumes being considered;

1. A large ‘corrective’ maintenance dredge in the order of up to 60,000m^3; and
2. A smaller annual maintenance dredge in the order of 10,000-20,000m^3 to maintain design depths.

The ‘corrective’ maintenance dredge is likely to occur in Spring 2027, during the non-bathing season. Exact timings will be confirmed as the project progresses and will be dependent on weather conditions. Approximately 600-700m^3 of sediment is expected to be dredged per day. Subsequent annual maintenance dredging is expected to occur between October 1st and May 1st to ensure works are undertaken outside of the bathing season. Dredging durations will be based on the quantity of material requiring removal, of which will vary each year.

2. WFD ASSESSMENT

2.1 Stage 1: Screening

The EA guidance identifies a range of low-risk activities that may be screened out from further assessment (Environment Agency, 2017). However, the dredging and disposal of Pwllheli Harbour does not meet the criteria for any of these exclusions, and a Scoping Assessment is required.

2.2 Stage 2: Scoping

2.2.1 Hydromorphology

Table 2-1 Hydromorphology Risk Information

Consider if your activity is:	Yes	No	Hydromorphology risk issue(s)
Tremadog Bay (within)			
Could the proposal lead to changes in: morphological conditions, for example depth variation, the seabed and intertidal zone structure; tidal patterns, for example, dominant currents; freshwater flow; or wave exposure.		Impact assessment not required	No – Whilst the proposed activity involves dredging of the Pwllheli harbour (Within the Erch Bay), the deposition of this material is not expected to change the morphological conditions of the Tremadog Bay water body.
Is the proposal in a HMWB?		Impact assessment not required	N/A – Not classified as heavily modified
Erch Estuary (0.2km)			
Could the proposal lead to changes in: morphological conditions, for example depth variation, the seabed and intertidal zone structure; tidal patterns, for example, dominant currents; freshwater flow; or wave exposure.		Impact assessment not required	No – The proposed maintenance dredging restores previously consented harbour depths and does not create new navigation channels or permanently alter the existing hydromorphological character of the water body.

Consider if your activity is:	Yes	No	Hydromorphology risk issue(s)
Is the proposal in a HMWB?	Requires impact assessment		Yes – Erch Estuary water body classified as heavily modified.
Cardigan Bay North (9.8km)			
Could the proposal lead to changes in: morphological conditions, for example depth variation, the seabed and intertidal zone structure; tidal patterns, for example, dominant currents; freshwater flow; or wave exposure.		Impact assessment not required	No – The Cardigan Bay North water body is located 9.8km away from the disposal site and will not lead to any changes in morphological conditions, tidal pattern, water flow or wave exposure.
Is the proposal in a HMWB?		Impact assessment not required	N/A – Not classified as heavily modified
Glaslyn Estuary (13.2km)			
Could the proposal lead to changes in: morphological conditions, for example depth variation, the seabed and intertidal zone structure; tidal patterns, for example, dominant currents; freshwater flow; or wave exposure.		Impact assessment not required	No – The Glaslyn Estuary water body is located 13.2km away from the disposal site and will not lead to any changes in morphological conditions, tidal pattern, water flow or wave exposure.
Is the proposal in a HMWB?		Impact assessment not required	N/A – Not classified as heavily modified

2.2.2 Biology – Habitats

Table 2-2 Habitat Risk Information

Consider if the footprint* of your activity is	Yes	No	Biology habitats risk issue(s)
Tremadog Bay (within)			
0.5km^2 or larger	Yes to one or more – requires impact assessment		Yes – Whilst dredging and disposal activity is not larger than 0.5km^2, the deposition of dredged material will cover up to 53.8km^2 under a worst-case scenario and the suspended sediment footprint is 225.3km^2.
1% or more of the water body's area			Yes - Water body is 239.42km^2. The disposal site is within the waterbody, and the zone of modelled suspended sediment extends across 191.53km^2 of the waterbody (80% of water body).
Within 500 metres (m) of any higher sensitivity habitat			Yes – Although the disposal site is not within 500m of higher sensitive habitat, the modelled suspended sediment is within 500m of higher sensitivity habitat (intertidal and subtidal seagrass (*Zostera marina*), subtidal kelp beds, mussel beds (*Mytilus edulis*), and polychaete reef (*Sabellaria alveolata*)).
1% or more of any lower sensitivity habitat			Yes – The footprint of the works and modelled suspended sediment will affect 1% or more of lower sensitivity habitat (subtidal rocky reef, rocky shore, intertidal soft sediments like sand and mud, subtidal boulder fields, subtidal soft sediments like sand and mud, cobbles, gravel and shingle).
Erch Estuary (0.2km)			
0.5km^2 or larger	Yes to one or more – requires impact assessment		Yes – Whilst dredging and disposal activity is not larger than 0.5km^2, the deposition of dredged material will cover up to 53.8km^2 under a worst-case scenario and the suspended sediment footprint is 225.3km^2.

Consider if the footprint* of your activity is	Yes	No	Biology habitats risk issue(s)
1% or more of the water body's area			Yes - Water body is 0.51km^2. The disposal site is within 200m of the waterbody and the zone of modelled suspended sediment extends across 0.50km^2 of the waterbody (98% of water body).
Within 500 metres (m) of any higher sensitivity habitat			Yes – Although the disposal site is not within 500m of higher sensitive habitat, the modelled suspended sediment is within 500m of higher sensitivity habitat (saltmarsh).
1% or more of any lower sensitivity habitat			Yes – The footprint of the modelled suspended sediment will affect 1% or more of lower sensitivity habitat (intertidal soft sediments like sand and mud, subtidal soft sediments like sand and mud).
Cardigan Bay North (9.8km)			
0.5km^2 or larger	Yes to one or more – requires impact assessment		Yes – Whilst dredging and disposal activity is not larger than 0.5km^2, the deposition of dredged material will cover up to 53.8km^2 under a worst-case scenario and the suspended sediment footprint is 225.3km^2.
1% or more of the water body's area			Yes - Water body is 712.18km^2. The disposal site is within 9.8km of the waterbody and the zone of modelled suspended sediment extends across 16.07km^2 of the waterbody (2% of water body).
Within 500 metres (m) of any higher sensitivity habitat			Yes – Although the disposal site is not within 500m of higher sensitive habitat, the modelled suspended sediment is within 500m of higher sensitivity habitat (mussel beds (*M. edulis),* subtidal kelp beds and polychaete reef (*S. alveolata*)).
1% or more of any lower sensitivity habitat			Yes – The footprint of the modelled suspended sediment will affect 1% or more of lower sensitivity habitat (subtidal rocky reef, rocky shore, cobbles, gravel and shingle, intertidal soft sediments like sand and mud, subtidal boulder fields, subtidal soft sediments like sand and mud).
Glaslyn Estuary (13.2km)			

Consider if the footprint* of your activity is	Yes	No	Biology habitats risk issue(s)
0.5km^2 or larger	Yes to one or more – requires impact assessment		Yes – Whilst dredging and disposal activity is not larger than 0.5km^2, the deposition of dredged material will cover up to 53.8km^2 under a worst-case scenario and the suspended sediment footprint is 225.3km^2.
1% or more of the water body's area			Yes - Water body is 15.67km^2. The disposal site is within 13.2km of the waterbody and the zone of modelled suspended sediment extends across 13.28km^2 of the waterbody (85% of water body).
Within 500 metres (m) of any higher sensitivity habitat			Yes – Although the disposal site is not within 500m of higher sensitive habitat, the modelled suspended sediment is within 500m of higher sensitivity habitat (mussel beds (*M. edulis*), saltmarsh, subtidal seagrass (*Z. marina*).
1% or more of any lower sensitivity habitat			Yes – The footprint of the modelled suspended sediment will affect 1% or more of lower sensitivity habitat (rocky shore, intertidal soft sediments like sand and mud, subtidal soft sediments like sand and mud).

*Note that the footprint has been determined via modelling to predict the plume deposition and dispersion.
Welsh Government (2026).

2.2.3 Biology – Fish

Table 2-3 Fish Risk Information – Transitional Water Bodies Only

Consider if your activity is:	Yes	No	Biology fish risk issue(s)
Erch Estuary (0.2km)			
Is in an estuary and could affect fish in the estuary, outside the estuary but could delay or prevent fish entering it or could affect fish migrating through the estuary	Requires impact assessment		Yes – Through increase suspended sediments. Dredging of material within the Pwllheli Harbour (within the Erch Estuary) has the potential to cause increased turbidity through suspended solids and therefore impact the potential for migratory species to migrate in or out of the Erch Estuary.

Consider if your activity is:	Yes	No	Biology fish risk issue(s)
Could impact on normal fish behaviour like movement, migration or spawning (for example creating a physical barrier, noise, chemical change or a change in depth or flow)	Requires impact assessment		Yes – Through temporary increased suspended sediment and potential chemical change. Suspended sediment through dredging of material within Erch Estuary is likely to have a temporary impact on normal fish behaviour such as migration through to the estuary, as well as general behaviour through the resuspension of contaminants such as lead, nickel and zinc, which were identified to exceed Cefas Action Level 1.
Could the proposal lead to changes to the composition, abundance and age structure of fish fauna.		Impact assessment not required	No – The Erch Estuary has historically had maintenance dredging for the Pwllheli harbour, and these dredging and disposal activities are unlikely to significantly affect fish fauna composition, abundance or age structure.
Could the proposal cause entrainment or impingement of fish	Requires impact assessment		Yes – The use of a cutter suction dredger has the potential to cause entrainment or impingement of fish or fish eggs.
Glaslyn Estuary (13.2km)			
Is in an estuary and could affect fish in the estuary, outside the estuary but could delay or prevent fish entering it or could affect fish migrating through the estuary.		Impact assessment not required	No – Operations are located 13.2km from the Glaslyn Estuary water body. Variables such as suspended solids will not significantly impact fish or migratory fish from utilising estuaries.
Could impact on normal fish behaviour like movement, migration or spawning (for example creating a physical barrier, noise, chemical change or a change in depth or flow)		Impact assessment not required	No – Operations are located 13.2km from the Glaslyn Estuary water body. Variables such as suspended solids will not significantly impact fish or migratory fish behaviours.
Could the proposal lead to changes to the composition, abundance and age structure of fish fauna.		Impact assessment not required	No – Operations are located 13.2km from the Glaslyn Estuary water body, therefore it is unlikely that the dredging or disposal activities will have any effect on composition, abundance and age structure of fish fauna.

Consider if your activity is:	Yes	No	Biology fish risk issue(s)
Could the proposal cause entrainment or impingement of fish		Impact assessment not required	No – Operations are located 13.2km from the Glaslyn Estuary water body.

2.2.4 Water Quality

Table 2-4 Water Quality Risk Information

Consider if your activity is:	Yes	No	Water quality risk issue(s)
Tremadog Bay (within)			
Could the proposal affect water clarity (turbidity or suspended particulate matter concentration), thermal conditions (including shading), oxygen levels – dissolved oxygen conditions, nutrients - dissolved inorganic nitrogen, microbial patterns, or salinity/conductivity continuously for longer than a spring neap tidal cycle (about 14 days).	Requires impact assessment		Yes – The corrective dredging activities (60,000 m^3) is estimated to take approximately 44 days. It is noted that the smaller annual dredging (10,000 – 20,000m^3) is expected to last 8 days. Modelled data predicts the majority of deposition would occur over a neap tidal period (~7 days). The disposal site is within the water body, and the zone of modelled suspended sediment extends across 191.53km^2 of the waterbody (80% of the water body). Activities are likely to have temporary effects on water clarity during operations.
Is the proposal in a water body with a phytoplankton or opportunistic macroalgae status of moderate, poor or bad		Impact assessment not required	No – Water body does not have a phytoplankton status of moderate, poor or bad.
Is the proposal in a water body with a history of harmful algae		Impact assessment not required	No – Water body has not recorded a history of harmful algae.
Erch Estuary (0.2km)			
Could the proposal affect water clarity (turbidity or suspended particulate matter concentration),	Requires impact assessment		Yes – The corrective dredging activities (60,000 m^3) is estimated to take approximately 44 days. It is noted that the smaller annual dredging (10,000 – 20,000m^3) is expected to last 8 days. Modelled

Consider if your activity is:	Yes	No	Water quality risk issue(s)
thermal conditions (including shading), oxygen levels – dissolved oxygen conditions, nutrients - dissolved inorganic nitrogen, microbial patterns, or salinity/conductivity continuously for longer than a spring neap tidal cycle (about 14 days).			data predicts the majority of deposition would occur over a neap tidal period (~7 days). The disposal site is within 200m of the water body and the zone of modelled suspended sediment extends across 0.50km^2 of the waterbody (98% of water body). Activities are likely to have temporary effects on water clarity during operations.
Is the proposal in a water body with a phytoplankton or opportunistic macroalgae status of moderate, poor or bad		Impact assessment not required	No – Water body does not have a phytoplankton status of moderate, poor or bad.
Is the proposal in a water body with a history of harmful algae		Impact assessment not required	No – Water body has not recorded a history of harmful algae.
Cardigan Bay North (9.8km)			
Could the proposal affect water clarity (turbidity or suspended particulate matter concentration), thermal conditions (including shading), oxygen levels – dissolved oxygen conditions, nutrients - dissolved inorganic nitrogen, microbial patterns, or salinity/conductivity continuously for longer than a spring neap tidal cycle (about 14 days).	Requires impact assessment		Yes – The corrective dredging activities (60,000 m^3) is estimated to take approximately 44 days. It is noted that the smaller annual dredging (10,000 – 20,000m^3) is expected to last 8 days. Modelled data predicts the majority of deposition would occur over a neap tidal period (~7 days). The disposal site is within 9.8km of the water body, and the zone of modelled suspended sediment extends across 16.07km^2 of the waterbody (2% of water body). Activities are likely to have temporary effects on water clarity during operations.
Is the proposal in a water body with a phytoplankton or opportunistic macroalgae status of moderate, poor or bad		Impact assessment not required	No – Water body does not have a phytoplankton status of moderate, poor or bad.

Consider if your activity is:	Yes	No	Water quality risk issue(s)
Is the proposal in a water body with a history of harmful algae		Impact assessment not required	No – Water body has not recorded a history of harmful algae.
Glaslyn Estuary (13.2km)			
Could the proposal affect water clarity (turbidity or suspended particulate matter concentration), thermal conditions (including shading), oxygen levels – dissolved oxygen conditions, nutrients - dissolved inorganic nitrogen, microbial patterns, or salinity/conductivity continuously for longer than a spring neap tidal cycle (about 14 days).	Requires impact assessment		Yes – The corrective dredging activities (60,000 m^3) is estimated to take approximately 44 days. It is noted that the smaller annual dredging (10,000 – 20,000m^3) is expected to last 8 days. Modelled data predicts the majority of deposition would occur over a neap tidal period (~7 days). The disposal site is within 13.2km of the water body, and the zone of modelled suspended sediment extends across 13.28km^2 of the waterbody (85% of water body). Activities are likely to have temporary effects on water clarity during operations.
Is the proposal in a water body with a phytoplankton or opportunistic macroalgae status of moderate, poor or bad		Impact assessment not required	No – Water body does not have a phytoplankton status of moderate, poor or bad.
Is the proposal in a water body with a history of harmful algae		Impact assessment not required	No – Water body has not recorded a history of harmful algae.

2.2.5 Chemicals

Table 2-5 Chemical Release Risk Information

If your activity uses or releases chemicals (for example through sediment disturbance or building works) consider if:	Yes	No	Water quality risk issue(s)
Tremadog Bay (within)			

If your activity uses or releases chemicals (for example through sediment disturbance or building works) consider if:	Yes	No	Water quality risk issue(s)
The chemicals are on the Environmental Quality Standards Directive (EQSD) list	Requires impact assessment		Yes – Multiple chemicals compounds that may be released from the dredging and deposition of materials are on the Environmental Quality Standards Directive (EQSD) list.
Actively disturbs sediment with contaminants above Cefas Action Level 1	Requires impact assessment		Yes – In the 2026 survey, Nickel (Ni), Lead (Pb), and Zinc (Zn) were all recorded above Cefas Action Level 1.
Erch Estuary (0.2km)			
The chemicals are on the Environmental Quality Standards Directive (EQSD) list	Requires impact assessment		Yes – Multiple chemicals that may be released from the dredging and deposition of materials are on the EQSD list.
Actively disturbs sediment with contaminants above Cefas Action Level 1	Requires impact assessment		Yes – In the 2026 survey Nickel (Ni), Lead (Pb), and Zinc (Zn) were all recorded above Cefas Action Level 1.
Cardigan Bay North (9.8km)			
The chemicals are on the Environmental Quality Standards Directive (EQSD) list		Impact assessment not required	No– while multiple chemicals that may be released from the dredging and deposition of materials are on the EQSD list the operations are located 9.8km away from the disposal site and therefore not likely to impact the chemical status of the water body.
Actively disturbs sediment with contaminants above Cefas Action Level 1		Impact assessment not required	No – Nickel (Ni), Lead (Pb), and Zinc (Zn) were all recorded above Cefas Action Level 1, however the operations are located 9.8km away from the disposal site and therefore not likely to impact the chemical status of the water body.
Glaslyn Estuary (13.2km)			

If your activity uses or releases chemicals (for example through sediment disturbance or building works) consider if:	Yes	No	Water quality risk issue(s)
The chemicals are on the Environmental Quality Standards Directive (EQSD) list		Impact assessment not required	No– while multiple chemicals that may be released from the dredging and deposition of materials are on the EQSD list the operations are located 13.2km away from the disposal site and therefore not likely to impact the chemical status of the water body.
Actively disturbs sediment with contaminants above Cefas Action Level 1		Impact assessment not required	No – Nickel (Ni), Lead (Pb), and Zinc (Zn) were all recorded above Cefas Action Level 1, however the operations are located 13.2km away from the disposal site and therefore not likely to impact the chemical status of the water body.

Table 2-6 Chemical (Mixing Zone) Risk Information

If your activity has a mixing zone (like a discharge pipeline or outfall) consider if:	Yes	No	Water quality risk issue(s)
Tremadog Bay (within)			
The chemicals are on the Environmental Quality Standards Directive (EQSD) list	Requires impact assessment		Yes – dredged material deposited via cutter suction dredger pipeline is likely to contain multiple chemicals (including lead) that are on the EQSD list.
Erch Estuary (0.2km)			
The chemicals are on the Environmental Quality Standards Directive (EQSD) list	Requires impact assessment		Yes – dredged material deposited via cutter suction dredger pipeline is likely to contain multiple chemicals (including lead) that are on the EQSD list.
Cardigan Bay North (9.8km)			

If your activity has a mixing zone (like a discharge pipeline or outfall) consider if:	Yes	No	Water quality risk issue(s)
The chemicals are on the Environmental Quality Standards Directive (EQSD) list		Impact assessment not required	No, while dredged material deposited via cutter suction dredger pipeline is likely to contain multiple chemicals (including lead) that are on the EQSD list the operations are located 9.8km away and not likely to impact the chemical status of the water body.
Glaslyn Estuary (13.2km)			
The chemicals are on the Environmental Quality Standards Directive (EQSD) list		Impact assessment not required	No – while dredged material deposited via cutter suction dredger pipeline is likely to contain multiple chemicals (including lead) that are on the EQSD list the operations are located 13.2km away and not likely to impact the chemical status of the water body.

2.2.6 WFD Protected Areas

Table 2-7 Protected Areas Risk Information

Consider if your activity is:	Yes	No	Protected areas risk issue(s)
Tremadog Bay (Within)			
Within 2km of any WFD protected area*	Requires impact assessment		Yes – The following protected areas are within 2km of the activities modelled impact area: Pen Llŷn a'r Sarnau SAC; West Wales Marine SAC; Morfa Harlech SAC; Morfa Dyffryn SAC; Northern Cardigan Bay SPA; Mynydd Cilan, Trwyn y Wylfa ac Ynysoedd Sant Tudwal SPA; Glannau Aberdaron ac Ynys Enlli / Aberdaron Coast and Bardsey Island SPA;

Consider if your activity is:	Yes	No	Protected areas risk issue(s)
			Pwllheli Bathing Water; Glan Don Beach Bathing Water; Abersoch Bathing Water; Criccieth Bathing Water; Craig du beach central Bathing Water; Harlech Bathing Water; Llan Danwg Bathing Water; Porth Neigwl Bathing Water; Aberdaron Bathing Water; Pwllheli UWWTR; Criccieth UWWTR; Morfa Abererch SSSI; Mynydd Tir y Cwmwd a'r Glannau at Garreg yr Imbill SSSI; Glannau Aberdaron SSSI; Wig Bach a'r Glannau i Borth Alwm SSSI; Cors Llyferin SSSI; Glanllynnau a Glannau Pen-ychain i Gricieth SSSI; Mynydd Penarfynydd SSSI; Pen Benar SSSI; Porth Ceiriad, Porth Neigwl ac Ynysoedd Sant Tudwal SSSI; Tiroedd a Glannau Rhwng Cricieth ac Afon Glaslyn SSSI; Morfa Harlech SSSI; and Morfa Dyffryn SSSI.

* Note that a regulator can extend the 2km boundary if your activity has an especially high environmental risk.

2.2.7 Invasive Non-native Species (INNS)

Table 2-8 INNS Risk Information

Consider if your activity could:	Yes	No	INNS risk issue(s)
Tremadog Bay (within)			
Introduce or spread INNS		Impact assessment not required	No – Deposition of dredged material will be within the vicinity of the dredge site. Therefore, any species introduced to the new site will be indicative of the current species at the disposal site.
Erch Estuary (0.2km)			
Introduce or spread INNS		Impact assessment not required	No – Deposition of dredged material will be within the vicinity of the dredge site. Therefore, any species introduced to the new site will be indicative of the current species at the disposal site.
Cardigan Bay North (9.8km)			
Introduce or spread INNS		Impact assessment not required	No – Deposition of dredged material will be within the vicinity of the dredge site. Therefore, any species introduced to the new site will be indicative of the current species at the disposal site.
Glaslyn Estuary (13.2km)			
Introduce or spread INNS		Impact assessment not required	No – Deposition of dredged material will be within the vicinity of the dredge site. Therefore, any species introduced to the new site will be indicative of the current species at the disposal site.

2.2.8 Summary

Table 2-9 Scoping Summary Table

Receptor	Potential risk to receptor?	Note the risk issue(s) for impact assessment
Hydromorphology	Yes	Dredging activity located within a HMWB.
Biology – Habitats	Yes	Footprint covers 225.3km^2 across the four stated waterbodies, in which are within 500m of a higher sensitivity habitat and covers more than 1% of lower sensitivity habitats.
Biology – Fish	Yes	Dredging and disposal activities may pose risk to fish and migratory fish through suspended sediment and chemical re-suspension which may affect migration, behaviours and impingement of fish or fish eggs.
Water Quality	Yes	Activities expected to take place over a 44-day period, in which short term water quality is likely to be affected through water clarity (due to resuspended sediments).
Chemicals	Yes	Activities may release multiple chemicals/trace metals that are on the Environmental Quality Standards Directive (EQSD) list, such as Nickel (Ni), Lead (Pb), and Zinc (Zn), which were all recorded above Cefas Action Level 1.
WFD Protected Areas	Yes	The dredging and disposal activities overlap, or are within 2km of multiple WFD protected areas (see Figure 1-2, and Table 2-7)
Invasive Non-Native Species (INNS)	No	N/A

2.3 Stage 3: Impact Assessment

2.3.1 Scoping summary

This section details the impact assessment of the proposed dredging and disposal activities on the following receptors identified during the Scoping Assessment as being at risk:

- Hydromorphology;
- Biology – Habitats;
- Biology – Fish;
- Water quality; and
- Chemicals.

2.3.2 Hydromorphology

The Erch Estuary, in which the Pwllheli Harbour is situated, has been identified as a Heavily Modified Water Body (HMWB) and therefore hydromorphological status is not assessed under the WFD. The scoping assessment identified potential pathways for hydromorphological impacts from the dredging and disposal operations. Therefore, an impact assessment is required in order to determine whether the project could significantly affect the morphological or hydrodynamic conditions.

The Erch Estuary waterbody was designated as a HMWD due to the presence of the operating harbour and the associated vessel infrastructure. The maintenance dredging is an already established activity within this waterbody (as stated in Section 1.1). The proposed dredging portion of the operations are not expected to create new dredged areas; therefore, the dredging footprint would not be increased from previous dredging campaigns.

Whilst hydromorphology has been scoped in due to the dredging operations occurring within a HMWB, the designation of the HMWB was due to the existing harbour, and no expansion of the modified footprint is expected, significant hydromorphological effects on the waterbody are not expected. It is also noted that the disposal site is located in the Tremadog Bay waterbody and will not have significant effects of the hydromorphology of the site.

2.3.3 Biology – Habitats

The scoping assessment identified receptors requiring further assessment. Whilst dredging and disposal activity is not larger than 0.5km^2, the modelled worst-case sediment deposition footprint (53.8km^2) and suspended sediment footprint (225.3km^2) overlap areas containing both higher and lower sensitivity habitats (Intertek, 2026a). Higher sensitivity habitats identified within 500m of the modelled footprint include intertidal and subtidal seagrass (*Z. marina*) beds, subtidal kelp beds, blue mussel (*M. edulis*) beds, polychaete reef (*S. alveolata*) reef and saltmarsh habitats. These habitats occur within the Tremadog Bay, Erch Estuary, Cardigan Bay North and Glaslyn Estuary water bodies.

The principal impact pathways are increased suspended sediment concentrations, sediment deposition and temporary smothering of benthic habitats. Physical changes to sediment characteristics may also occur where fine-grained dredged material settles on the seabed. However, dredge plume modelling predicts that the majority of deposited material remains relatively close to the disposal location, with sediment deposition depths decreasing rapidly away from the source. Most habitat receptors are predicted to experience less than 2mm of deposition, with only a small number of sensitive receptors predicted to receive greater levels of deposition.

Seagrass and kelp habitats are considered the most sensitive receptors due to their reliance on light availability and susceptibility to sediment burial. Modelling undertaken for the project predicted a maximum deposition depth of 18mm ('no wind' scenario) at one seagrass receptor site, with deposition at kelp habitats remaining lower. These predicted deposition depths are below levels reported in literature to result in significant impacts on seagrass. For example, Webster *et al.* (2025) found seagrass burial of up to 1cm generally results in limited effects, with negative impacts more apparent above 4cm. Similarly, Mills and Fonseca (2003) reported mortality of greater than 50% of *Z. marina* at burial depths of approximately 4cm. The predicted deposition depths therefore remain well below reported impact thresholds. Furthermore, deposition and elevated suspended sediment concentrations would be temporary and localised in nature. Consequently, significant effects on seagrass growth, survival or distribution are not anticipated. Predicted deposition at nearby kelp habitats is also substantially below the smothering benchmark of 5cm commonly applied to assess sensitivity to sediment burial (MarLIN, 2026). Whilst sediment deposition may temporarily affect recruitment on hard substrata, deposition levels are not expected to affect established kelp communities and significant impacts are therefore not anticipated. Furthermore, elevated suspended sediment concentrations are predicted to be temporary and reduce rapidly following cessation of disposal activities.

Mussel beds (*M. edulis*) and polychaete reefs (*S. alveolata*) are considered to occur naturally within dynamic coastal environments subject to regular changes in sediment levels and hydrodynamic conditions. Similarly, saltmarsh habitats are adapted to periodic sediment deposition and are unlikely to be significantly affected by the levels of deposition predicted by the modelling. It is also noted that under 5cm of deposition is expected Marine Life Information Network ((MarLIN), 2026).

The proposed disposal site lies within the same coastal sedimentary system as the dredge source material. Dredged sediments comprise predominantly silts and clays and will be redistributed within an environment already influenced by natural sediment transport processes. Whilst localised changes in sediment composition may occur within the immediate disposal area, the predicted thickness and extent of deposited material are insufficient to cause permanent habitat conversion or widespread alteration of seabed characteristics. Any changes are expected to be temporary and subject to natural reworking through tidal and wave action.

These findings are consistent with the Habitats Regulations Assessment (HRA), which concluded that sediment deposition, suspended sediments and associated changes to sediment characteristics would be localised, temporary and reversible, and would not adversely affect the extent, distribution, structure, function or supporting processes of qualifying habitats. No adverse effect on site integrity was identified (Intertek, 2026b).

Lower sensitivity habitats within the modelled footprint include subtidal rocky reef, rocky shore, subtidal boulder fields, cobble, gravel and shingle habitats, and intertidal and subtidal soft sediment habitats comprising sand and mud. These habitats are naturally subject to varying levels of sediment transport, deposition and resuspension associated with tidal currents and wave action. Predicted sediment deposition across the majority of these habitats is generally less than 2mm, with a maximum of 3.3mm for mud habitats. The sediment deposition is expected to be localised and temporary. Whilst some short-term sediment deposition may occur on hard and mixed substrata, the predicted deposition depths are unlikely to result in permanent habitat loss or substantial alteration of habitat structure and function. Similarly, soft sediment habitats are naturally adapted to local periodic sediment movement and deposition. Consequently, effects on lower sensitivity habitats are expected to be temporary and reversible, and significant impacts are not anticipated.

Overall, whilst temporary increases in suspended sediment concentrations and localised sediment deposition will occur, these effects are expected to be short-term, reversible and confined largely to the vicinity of the disposal site. Significant impacts on WFD biological quality elements or sensitive benthic habitats are therefore not anticipated.

2.3.4 Biology – Fish

The scoping assessment found that the dredging and disposal activities have the potential to cause negative impacts to fish within the Erch Estuary water body through suspended sediments, and entrainment or impingement, therefore an impact assessment is required to evaluate the potential impacts.

Due to the dredging operations within the Erch Estuary (Pwllheli Harbour), fish within, outside or entering the estuary have the potential to be affected by the resuspension of the dredged material, causing increased turbidity. This increased turbidity can affect migratory species entering or exiting the harbour, either through delaying or preventing migratory movement. Similarly, the dredging is likely to resuspend contaminants found within the disturbed sediment. In the 2026 survey (SOCOTEC & Ocean Ecology, 2026), it was identified in the survey samples that lead, nickel and zinc were identified to exceed Cefas Action Level 1.

However, the Erch Estuary water body has a history of regular dredging campaigns in order to maintain the Pwllheli Harbours original design depths which is required to maintain a safe and navigable harbour. Along with this, it is expected that the suspended sediment caused by the dredging operations will be temporary, only occurring during the dredging operations and a short period post-dredging operations. Modelled data predicted that the majority of deposition of the suspended solids will occur over a single neap tidal cycle (~7 days). Therefore, the dredging operations are likely to only have short term effects on migratory fish.

The resuspension of contaminants such as lead, nickel and zinc (which were surveyed to be above Cefas AL1) represents potential pathways for effects on fish behaviour. For example, migratory species, chemical and olfactory cues play a role in successful migration (National Oceanic and Atmospheric Administration (NOAA), 2026). However, due to the dredging being a temporary operation, elevated contaminants (lead, nickel and zinc) are expected to be temporary and localised and impacts on migratory fish, or other fish behaviour is therefore unlikely. It is also noted that whilst not specifically determined, elevated lead within the sediments is likely due to historical lead mining activity, as well as natural lead mineralisation within the wider Llŷn area may contribute to these elevated readings.

The dredging of the Pwllheli Harbour itself is to be undertaken using a cutter suction dredger, which has the potential to result in the entrainment of fish and fish eggs into the dredging system, or impingement of fish on the cutter head during the dredging activities. Whilst adult migratory fish are able to avoid the cutter suction dredger during the activities, juvenile and fish eggs are generally more susceptible to the impacts of the dredge equipment. It is noted that plaice, a section 7 species under species of principal importance in Wales, have been recorded in the coastal waters adjacent to the Pwllheli Harbour (Where's The Fish?, 2026). As an egg-laying species, plaice eggs occurring within the immediate vicinity of the dredging activities may be susceptible to entrainment into the dredging system or impingement on dredging equipment. However, for migratory species (such as salmon, sea trout and lamprey), entrainment or impingement is unlikely to occur as spawning happens upstream and is therefore fish eggs are unlikely to be present within the dredge area, and therefore unlikely to be impacted by the localised impact of the cutter suction dredger.

2.3.5 Water Quality

The Scoping Assessment identified water quality as a receptor requiring further assessment due to potential temporary increases in suspended sediment through resuspension throughout the dredging and disposal activities, therefore causing an effect on water clarity.

The deposition of dredged material was modelled to cover up to 53.8km^2 under a worst-case scenario, with the suspended sediment also covering a footprint of 225.3km^2, in which overlaps with all four of the water bodies mentioned in table 1-2. Of these results, the four water bodies are expected to be

affected by the suspended sediments to some degree. The two water bodies located within the immediate proximity of the dredging and disposal activities, Tremadog Bay and Erch Estuary, were modelled to have 80% and 98% of the water body affected by suspended sediments (as a worst-case). As stated in the modelling report, the large, corrective dredging and disposal activities (60,000m^3) are expected to take approximately 44 days, with the smaller annual dredging activities (10,000 – 20,000m^3) expecting to last up to 8 days. Modelled data predicts that the majority of the deposition would occur over a neap tidal period (~7 days). Therefore, whilst the water quality of the Tremadog Bay and Erch Estuary water bodies will be affected due to turbid conditions, the activities are only expected to have temporary effects and are expected to significantly settle over the course of a 7-day period.

Model results also show that the Cardigan Bay North and Glaslyn Estuary (located 9.8km and 13.2km from the disposal site) are also expected to be affected, with suspended sediment covering up to 2% and 85% of the water bodies, respectively. It is noted that whilst the Glaslyn Estuary has the potential to have 85% of the water body affected by the disposal activities, this is predominantly due to the low threshold (>0.1mg/l for suspended sediments and 0.1mm for deposition) stated within the modelling report. Due to this, both the Cardigan Bay North and Glaslyn Estuary water bodies are unlikely to be significantly affected by suspended sediments. To further this, model results indicate that suspended sediment concentrations decline significantly following the end of the disposal activities, noting majority of deposition occurring over a 7-day neap tidal period.

Overall, whilst temporary increases in suspended sediment concentrations is likely, the effects are expected to be temporary and not expected to occur for longer than a 14-day period.

2.3.6 Chemicals

The Scoping Assessment identified that chemicals as a receptor requiring further assessment due to the resuspension of sediments in which elevated concentrations of Nickel, lead and zinc were observed. All three of these chemical elements are recorded on the EQSD list of which all three chemical compounds have the potential to impact on water quality. During the 2026 survey, nickel, lead and zinc were recorded to be above the Cefas AL1 standards, although did not exceed Cefas AL2 thresholds. No chemicals are to be used during the dredging and disposal operations, and the only contaminants are to be released from the disturbing of sediment during the dredging and disposal activities.

The disturbance of sediments containing elevated nickel, lead and zinc may cause temporary environmental changes or chemical shifts within the water column. Whilst there is the potential for temporary effects on the environment, the large corrective dredging activities are expected to take place over a 44-day period (worst-case) and following the completion of operations, modelled data provides evidence that the majority of deposition (of suspended sediments, and therefore contaminants) is expected to occur over a 7-day period. Therefore, the effects of the identified chemicals elements (nickel, lead and zinc) are likely to dissipate relatively quickly and therefore effects are likely to be temporary and localised. It was found that based upon modelled data, the deposition is expected to cover multiple water bodies. It was found that the Tremadog Bay and Erch Estuary are to be the most effected water bodies, with suspended sediment coverage of 80% and 98% of the water bodies, respectively.

Due to the historic lead mining activity and the natural lead mineralisation that are known to occur within the wider Llŷn area, the sediment within the area is not uncommon to have elevated lead concentrations within the sediments although it is noted that the elevated lead concentrations recorded has not been specifically determined. Within the 2026 survey results, trace metal contaminants (such as nickel, lead and zinc) at the proposed disposal site having similar characteristics to that of the dredged material to be collected from within the Pwllheli Harbour and therefore is unlikely to cause a widespread change in seabed sediments.

2.3.7 WFD Protected Areas

The scoping assessment determined that the maintenance dredging and disposal activities may pose a risk to WFD protected areas due to their distance to the modelled plume and deposition footprint. Table 2-10 below lists all the WFD protected areas that overlap or are within 2km of the modelled plume and deposition footprint areas (see Figure 1-2 (Drawing Ref: P2843_PROT_002) for location of protected areas).

Table 2-10 WFD Protected Areas and Their Qualifying Features

WFD Protected Areas	Qualifying Features
Pen Llŷn a'r Sarnau (PLAS) SAC	**Annex I habitats (primary):** Sandbanks; Estuaries; Coastal lagoons; Large shallow inlets and bays; Reefs. **Annex I habitats (not primary):** Mudflats and sandflats; Salicornia habitats; Atlantic salt meadows; Sea caves. **Annex II species (not primary):** Bottlenose dolphin (*Tursiops truncatus*); Grey seal (*Halichoerus grypus*); Otter (*Lutra lutra*).
West Wales Marine SAC	**Annex II species:** Harbour porpoise (*Phocoena phocoena*).
Morfa Harlech SAC	**Annex I habitats (Primary):** Embryonic shifting dunes; Shifting dunes along the shoreline with Ammophila arenaria (White dunes); Fixed coastal dunes with herbaceous vegetation (grey dunes); Dunes with Salix repens ssp. argentea *(Salicion arenariae)*, Humid dune slacks. **Annex I species (primary):** Petalwort (*Petalophyllum ralfsii*).
Morfa Dyffryn SAC	
Northern Cardigan Bay SPA	**SPA features:** Red-throated diver (*Gavia stellata*).
Mynydd Cilan, Trwyn y Wylfa ac Ynysoedd Sant Tudwal SPA	**SPA features:** Chough (*Pyrrhocorax pyrrhocorax*).
Glannau Aberdaron ac Ynys Enlli / Aberdaron Coast and Bardsey Island SPA	**SPA features:** Manx shearwater (*Puffinus puffinus*); Chough (*Pyrrhocorax pyrrhocorax*).
Pwllheli Bathing Water	Water quality
Glan Don Beach Bathing Water	Water quality
Abersoch Bathing Water	Water quality
Criccieth Bathing Water	Water quality
Craig du beach central Bathing Water	Water quality
Harlech Bathing Water	Water quality
Llan Danwg Bathing Water	Water quality
Porth Neigwl Bathing Water	Water quality
Aberdaron Bathing Water	Water quality
Pwllheli UWWTR	N/A

WFD Protected Areas	Qualifying Features
Criccieth UWWTR	N/A
Morfa Abererch SSSI	Designated for: Sand dune system, including dune grassland, dune slack habitats and associated coastal vegetation communities.
Morfa Nefyn SSSI	Designated for: Sand dune habitats, including fixed and semi-fixed dunes, Dune grassland communities, Dune slack habitats, Associated coastal flora of conservation interest.
Mynydd Tir y Cwmwd a'r Glannau at Garreg yr Imbill SSSI	Designated for: Maritime cliff and slope vegetation, coastal heathland and associated coastal plant communities.
Glannau Aberdaron SSSI	Designated for: Maritime cliff habitats, coastal heath, grassland communities and associated breeding seabird interest.
Wig Bach a'r Glannau i Borth Alwm SSSI	Designated for: Sea cliffs and maritime heath vegetation, together with associated coastal bird and botanical interests.
Cors Llyferin SSSI	Designated for Fen and bog wetland habitats, associated marsh and wet heath vegetation and assemblage of flora and fauna.
Glanllynnau a Glannau Pen-ychain i Gricieth SSSI	Geological and marine biological interest, including nationally important glacial deposits and landform, moderately exposed mixed rock and sediment intertidal shoreline and habitats.
Mynydd Penarfynydd SSSI	Designated for: Upland heathland habitats, acid grassland, wet heath and associated mire/wetland communities.
Pen Benar SSSI	Maritime heath, coastal grassland, scrub and associated coastal habitats.
Porth Ceiriad, Porth Neigwl ac Ynysoedd Sant Tudwal SSSI	Designated for: coastal heath, maritime grassland, sea cliff vegetation, intertidal and subtidal habitats, bird interest (including chough feeding habitat), geological/coastal landform interests.
Tiroedd a Glannau Rhwng Cricieth ac Afon Glaslyn SSSI	Designated for: estuarine habitats, saltmarsh, mudflat, coastal grazing marsh, supporting bird assemblages.
Morfa Harlech SSSI	Designated for: embryonic dunes, foredunes, fixed dunes, dune slacks, rare dune flora and associated invertebrate communities.
Morfa Dyffryn SSSI	Designated for: dune habitats, humid dune slacks, dune grassland, rare dune plants, notable invertebrate assemblages.

*It is noted that no Shellfish water protected areas, drinking water protected areas or RAMSAR sites are within 2km of the activity's footprint.

The dredging and disposal activities could pose a risk to the WFD protected areas through the following impact pathways:

- Smothering and siltation rate changes;
- Physical change (to another sediment type);
- Changes in suspended solids (water clarity);
- Transition elements & organo-metal contamination;
- Introduction or spread of INNS;
- Underwater noise changes; and
- Barrier to species movement.

These pathways have been assessed within the HRA screening assessment for the dredging and disposal activities in which a source-pathway-receptor approach was undertaken to identify potential effects to SPA, SAC and supporting SSSI protected areas. This approach was used to screen out the potential for impact pathways for each of the protected areas and the relevant features. It is noted that for other WFD protected areas such as UWWTRs and Bathing waters, this was not covered under the aforementioned screening assessment.

UWWTRs have the potential to be affected by suspended sediment concentrations and the release of contaminants which may result in short-term deterioration in water quality of the protected area. However, the effects are expected to be temporary and localised and therefore the UWWTRs are unlikely to affect the protected areas objectives.

Bathing waters are also unlikely to be affected by the dredging and disposal activities. Where practicable, dredging and disposal activities will be scheduled outside the bathing water season (May to September) to minimise interactions with recreational users and temporary water quality effects during peak periods.

Within the HRA, the screening assessment concluded that Likely Significant Effects could not be ruled out for the PLAS SAC as a result of the proposed dredging and disposal activities. As a result, this needed to be taken forward and assessed under Appropriate Assessment (AA). The AA considered the potential effects of Smothering and siltation rate changes, Physical change (to another sediment type), Changes in suspended solids (water clarity), and Transition element and organo-metal contamination. The AA concluded that the dredging and disposal activities will not affect the extent or distribution of the qualifying habitats, nor will it adversely affect their structure, function or supporting processes. It was therefore concluded that the dredging and disposal activities will not result in adverse effects on the integrity of the PLAS SAC, either alone or in combination with other plans and projects.

Similarly, the proposed activities are not expected to pose significant risks to the WFD protected areas within 2km of the modelled footprint area.

3. CONCLUSION

This WFD assessment has been undertaken in accordance with EA Guidance (Environment Agency, 2017), NRW's WFD Regulations 2017 (Natural Resources Wales, 2024), along with NRW Guidance Notes GN 078 (Natural Resources Wales, 2026).

This assessment found that the proposed Pwllheli Harbour maintenance dredging and disposal activities are not expected to pose a significant risk to the environmental receptors of the four water bodies (Tremadog Bay, Erch Estuary, Cardigan Bay North and Glaslyn Estuary) referred to in this assessment.

It is therefore concluded that the proposed dredging and disposal activities will not cause or contribute to the deterioration of the status of the four water bodies, nor threaten compliance with the WFD objectives.

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