



Rhyl Harbour Maintenance Land Based Dredging

Water Framework Directive
Assessment
November 2021

Denbighshire County Council

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1. Introduction

1.1 Scheme Location

Rhyl Harbour (formerly known as Foryd Harbour) lies at the mouth of the estuary of the Afon Clwyd, which is located at the western gateway into Rhyl on the North Wales coast, at approximate NGR SH 994 810 (Figure 1). The centre of the Afon Clwyd forms the administrative boundary between the unitary authorities of Conwy and Denbighshire and the harbour area straddles this, with Rhyl to the east and Kinmel Bay to the west. Although nearly all the land within the proposed project area is owned by Denbighshire County Council (DCC), including the harbour basin, the west side of the site comes under the jurisdiction of the Conwy County Borough Council (CCBC). Rhyl Harbour provides a base for (amongst others) The Rhyl Fisherman's Association, Rhyl Charter Skippers Association, Rhyl Yacht Club and Rhyl Water Ski Club.

Figure 1: Site Location



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The northern boundary of the harbour area (from west to east) comprises the Rhyl Yacht Club building and boat yard, the Rhyl Harbour boat yard, car park and quay wall, the harbour building and public square and the extended quay wall. Horton's Nose Lane serves the northern area of the harbour. The southern boundary (from west to east) is formed by the inner and outer sea walls (West Parade road runs beyond and parallel to the sea walls), and the training wall guiding the navigable channel out to the north-east. The western boundary of the harbour basin is formed by the Rhyl Harbour Bridge (the Blue Bridge) and a recently constructed Pont y Ddraig bridge spans the harbour from the public square to the junction of West Parade and Quay Street for pedestrians and cyclists.

The wider site surroundings comprise:

- North: Remainder of Horton's Nose comprising dunes, shingle, intertidal sands and boardwalk with the coastal waters of Liverpool Bay beyond;
- East: Rhyl West Promenade (a business park and a car park beyond the road);
- South: The remainder of Rhyl Harbour and the estuarine Clwyd beyond Rhyl Harbour Bridge; and
- West: Sunnyvale Caravan Park is present beyond the boat yard (static caravans).

The site location is shown in the context of the wider area and designated sites on Drawing 10401/EI/09/01A in Appendix A.

1.2 Scheme Background

The development of the Rhyl Harbour area is part of Denbighshire County Council's (DCC's) long term plans to stimulate investment and growth in the West Rhyl area. The major works which have occurred within the Rhyl Harbour area to date include:

- The Initial Harbour Works Package (boat storage compound, car parking, quay wall raising, floating pontoon, boat hoist and environmental improvements completed 2009-2011);
- The West Rhyl Coastal Defence Scheme (Phase 1 upgrade to the River Clwyd training wall, Phase 2 improvement to the existing harbour wall and Phase 3 pre-cast concrete wall/revetment to the east of the training wall – completed 2013-2015);
- The Sustainable Transport Bridge (basculer type bridge spanning the Clwyd Estuary – completed 2013).

The most recent phase of re-development was the Rhyl Harbour Public Square and Extended Quay Wall Scheme, the details of which are summarised in Table 1 to aid understanding of the development history of the harbour.

Table 1: Rhyl Harbour Work Summary

Project	Works Included	Environmental Impact Assessment (EIA) Required	Status
Rhyl Harbour Public Square and Extended Quay Wall Scheme	• Construction of a new public square, extended quay wall with associated floating pontoon and multi-use harbour building. • Boat yard and car park Improvements. • Moorings reconfiguration and additional moorings creation, improvements to navigation aids. • Dredging* of the deep-water channel and harbour area. • Dune restoration and habitat creation. • Addition of 10 pontoon moorings in the centre of the river.	• Yes – Annex II • Screened under: – Town and Country Planning (EIA) (England and Wales) Regs 1999 (as amended). Part 2 Para 5. – Marine Works (EIA) Regs 2007. Schedule 2 Para 1. • Also required Marine Licence. • ES Completed December 2011.	Complete (all facilities were completed by May 2014) The planning application included a need for forward dredging* to maintain navigation channels and moorings.

The completed Rhyl Harbour Public Square and Extended Quay Wall Scheme included dredging, which comprised the following (shown on Drawing 10401/EI/05/01 in Appendix B):

- Excavation of silt from Horton's Nose and backfill with sands and gravels;
- Excavation of a channel and reuse of sediment within dune area around Horton's Nose;
- Use of some excavated sands and gravels at Marine Lake where appropriate; and
- Dredging of the harbour area.

Since development of the harbour was completed in 2014 the harbour has been subject to maintenance dredging. The first marine licence (BUML1472) was issued in 2014 for the dredging of 22,000 tonnes of sediment a year. This was renewed in 2018 (licence DML1840) for 17,000 tonnes per year. The application to renew the licence for a further period is for 16,000 tonnes per year.

1.3 Scheme Proposals

Note: While the term 'dredging' is used within this report, the sand/silt excavation process that will take place will be small-scale and highly localised in nature and will be completed by land-based plant at low tide. No specialist dredging equipment will be required (barges for example) and the vast majority of material will be dredged above low water level. The exception will be the dredging of the main navigable channel which will require some limited excavation below the low water level, this was included in the original 2011 ES¹.

1.3.1 Maintenance Dredging Proposals

Following the completion of works in May 2014, the long-term future management of the Rhyl Harbour area is currently being arranged, including the creation of a Harbour Authority via a Harbour Empowerment Order (HEO). In advance of the Harbour Authority creation there is a requirement for the organisation of on-going harbour maintenance. This maintenance includes small-scale dredging which incorporates the area of the harbour originally dredged as part of the public square and extended quay wall construction process, along with an additional area to the south-west in the vicinity of the main moorings area.

Regular maintenance dredging of Rhyl Harbour is essential in order to maintain navigable channels and a suitable working depth for the remainder of the harbour area. The existing channels are becoming infilled with sediments resulting in them being too shallow for navigation. The extent of the area to be dredged along with intended quantities is detailed on Drawing H4/14409/D/04E provided within Appendix C.

It is expected that this maintenance dredging will be undertaken in March 2022 and then annually each year, with additional dredging activities occurring as required in October if siltation problems are encountered in specific areas.

Lessons learned during the dredging over the course of the previous Marine Licence have been taken into account, with timings changed to suit ecological requirements and the extent and areas of sand removal reduced with seasonal river flows being utilised to transport sediment within the inner harbour. Monitoring over the term of the previous dredging licence and consultation with the Harbour Forum and Harbour Master has identified where dredging works are required.

1.3.2 Maintenance Dredging Methodology

It is anticipated that up to 16,000 tonnes of material will require removal from the harbour and approach channel every year based on the amount of dredging undertaken during the previous licence period. The dredging will take place over two two-week periods, in March and October.

The proposed finished levels for the area have not been altered from the original 2011 ES, these being:

- In the vicinity of the quay wall, the finished level is to be +0.5m AOD to allow for the exposure of mud habitat at low tide (ecological requirements);
- In the area of the outer channel adjacent to the training wall, the finished level is to be -1.8mAOD;
- In the inner area between the floating pontoon and West Rhyl Defences it is to be at -1.5mAOD;

¹ Foryd Harbour Public Square and Extended Quay Wall Environmental Statement Volumes 1-2, Denbighshire County Council (2011)

and

- In the vicinity of the slipways and the inner harbour the finished level is to be -0.5mAOD.
- Trimming of banks will be undertaken to a 1 in 3 slope with no trimming undertaken within the vicinity of the Clwyd flood Embankments.

The dredging will be undertaken during daytime working hours at low tide using a 30t long reach 360° excavator operating from the adjacent quay. This will load 10t dumpers which will access the harbour via the boat slipway. This will minimise the risks associated with potential for surface water contamination and also reduce disruption to existing harbour users. All plant will be stored in the secure site compound when not in use. Careful consideration and planning will be given to timings of high and low tide each day.

Depending on the height and timing of low tide it is anticipated that up to 1,000t will be removed per tide with works lasting between 8 and 10 days. Dumpers will be filled to their full capacity to ensure maximum effectiveness. Banksmen will be employed to make sure the operation is run safely and efficiently.

Material will be removed by excavating in cells to reduce the generation of suspended sediments resulting in minimum disturbance to the marine environment. The material will then be temporarily stored at the picnic area (shown on the drawing in Appendix D). It is expected that the maximum stockpile size at any one time will be 1,000 tonnes and will spend a maximum of two days in the stockpile before transportation off-site.

Material stored temporarily in the picnic area will be collected and road transported off-site by HGVs. This will be organised in order to avoid peak traffic periods to minimise disruption to the local population and reduce emissions.

Anticipated future use of the excavated material will be for processing as construction material.

The site layout including the proposed temporary stockpile area and cross-sectional detail for the small-scale land-based dredging measures is detailed on Drawing H4/14409/D/03C provided in Appendix D.

2 WFD Assessment Methodology

2.1 The Water Framework Directive (WFD) Regulations

The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017² (the WFD Regulations) requires the Welsh Government to identify and set objectives for protecting and improving 'waterbodies'. These include rivers, streams, lakes, reservoirs, estuaries, coastal waters, canals and groundwaters. The standard objective is to **achieve 'good status'**, or **'good potential'** (if the waterbody is artificial or has been extensively modified), and to protect the waterbody by **preventing any deterioration in status**. Good 'status' or 'potential' is made up of ecological and chemical components in surface waters. Ecological status consists of biological quality elements, physico-chemical supporting elements and hydromorphological supporting conditions. For groundwater, status consists of quantitative and qualitative elements.

2.2 Methodology of WFD Regulations assessment

The assessment has been completed in accordance with the WFD assessment: estuarine and coastal waters guidance³, which provides information on completing WFD assessments within estuarine and coastal waters. Reference was also made to NRW Advice Note on the WFD⁴. This guidance recommends that WFD assessments are completed in a 3-stage approach:

2.2.1 Stage 1 (WFD Screening)

Stage 1 is an initial assessment to determine if there are any activities associated with the proposed maintenance dredging operations which may impact waterbodies within the vicinity.

2.2.2 Stage 2 (WFD scoping)

Stage 2 comprises a more detailed assessment to identify risks from the proposed development to receptors (within the study area) based on the relevant waterbodies and their quality elements. The aim of this assessment is to identify if any waterbodies will require further detailed assessment.

2.2.3 Stage 3 (WFD impact assessment)

Stage 3 is a detailed assessment of waterbodies and activities carried forward from the screening stage. It must include identification of waterbodies, description of the proposed development, methods used to determine impacts, risk of deterioration, and mitigation required.

2.3 Scope of this assessment

This report will cover the stages of the assessment in turn, as outlined above. The assessment completed will allow the identification of impacts the maintenance dredging may have on adjacent waterbodies and any linked waterbodies and whether the activity complies with the western Wales River Basin Management Plan (RBMP).

3 Screening Assessment (Stage 1)

² Water Environment (WFD) (England and Wales) Regulations 2017, 2017/407

³ Environment Agency (2017) WFD assessment: estuarine and coastal waters [online] available at: <https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters> (last accessed April 2018).

⁴ NRW Updated Local Authority services and the water environment: Advice note on the Water Framework Directive (2017)

3.1 Scope of Assessment

The following elements of the maintenance dredging have the potential to impact upon the water environment and have been screened into the assessment:

- Dredging of 16,000t of material from the harbour and approach channel each year, and specifically:
 - o Excavation of sediments/silts using a long-reach land-based excavator;
 - o Removal of sediments/silts by dumper trucks; and
 - o Temporary storage of material in stockpiles in picnic area adjacent to the harbour.

Removal of dredged material from stockpile area via road is not deemed to significantly impact the water environment and is therefore not considered further.

3.2 Identifying Waterbodies

In order to establish a baseline for water quality at Rhyl Harbour, it is necessary to consider both ecological and chemical quality indicators. There are a number of rivers, estuarine waters, coastal waters and bathing waters which may impact on the quality of water at the site. Water quality data has been obtained from the NRW Water Watch Wales website⁵ in addition to the RBMP for the Western Wales River Basin District.⁶

The full extent of dredging activities lies within the:

- Clwyd Estuary Transitional Waterbody (ID: GB541006608000) which extends from the mouth of the Clwyd Estuary to approximately 6.6km upstream to the tidal limit of the River Clwyd and Elwy.

They also just encroach into the:

- North Wales Coastal Waterbody which extends over 40km in length from the Great Ormes Head in the west to the centre of the Dee Estuary in the east and over 3km out to sea to the north (ID: GB641011650000).

Three rivers lie downstream of the River Clwyd tidal limit and discharge into the Clwyd Estuary, although all have structures present at their outfalls which limit upstream intrusion of saline waters, these comprise the:

- Afon Gele Waterbody (ID: GB110066059980);
- Glanfyddion Cut Waterbody (ID: GB110066059990); and
- Pont Robin Cut Waterbody (ID: GB110066059970).

The whole area from Old Colwyn in the west to Prestatyn in the east, and generally following the Clwyd and Elwy river catchments to the south is underlain by the Clwyd Permo-Triassic Sandstone Groundwater Body (ID: GB41001G202100).

3.3 Potential Impact Pathways: Screening Assessment

Table 2 identifies which waterbodies within the study area (taken to be the catchments of the estuarine Clwyd and tributaries up to the tidal limit, along with receiving coastal waters and underlying groundwater bodies) are considered to have a potential impact pathway with the maintenance dredging and are therefore screened for Stage 2 Assessment.

Table 2: Rhyl Harbour Work Summary

⁵ Data taken from www.waterwatchwales.naturalresourceswales.gov.uk, accessed 11/08/18

⁶ West Wales River Basin Management Plan (2015-2021), <https://naturalresources.wales/evidence-and-data/research-and-reports/water-reports/river-basin-management-plans-published/?lang=en>, accessed 11/08/18

WFD Waterbody Name	Type	ID	Relationship to Scheme	Potential Impact Pathway	Screen into Scoping (Stage 2)
Pont Robin Cut	River	GB110066059970	Maintenance Dredging Area located approximately 3.1 km downstream on estuarine Clwyd.	No – Given distance upstream from the harbour and structures present limiting saline intrusion upstream.	x
Glanfyddion Cut	River	GB110066059990	Maintenance Dredging Area located approximately 2.7 km downstream on estuarine Clwyd.		x
Afon Gele	River	GB110066059980	Maintenance Dredging Area located approximately 1.6 km downstream on estuarine Clwyd.		x
Clwyd Estuary	Transitional	GB541006608000	Maintenance Dredging Area located within waterbody.	Yes – maintenance dredging area directly within waterbody.	✓
North Wales	Coastal	GB641011650000	Maintenance Dredging Area just encroaches into waterbody.	Yes – maintenance dredging area encroaching into and receiving water from Clwyd transitional waters.	✓
Clwyd Permo Triassic Sandstone	Groundwater	GB41001G202100	Maintenance Dredging Area located over groundwater body.	No – maintenance dredging works are not anticipated to impact groundwaters.	x

Dredging for navigational purposes is not one of the low-risk activities that can be excluded from scoping³.

4 Scoping Assessment (Stage 2)

4.1 Baseline Status of Screened-in Waterbodies

The Clwyd Estuary and North Wales Coastal waterbodies are the only ones considered to have a potential impact pathway with the proposed dredging. Information on the status and objectives of each waterbody is provided within Table 3.

Table 3: Status of Screened in Waterbodies

WFD Waterbody	Clwyd Estuary		North Wales	
River Basin District	Western Wales			
Waterbody ID	GB541006608000		GB641011650000	
Waterbody Type	Transitional Partly mixed, macrotidal		Coastal Moderately exposed, macrotidal	
Waterbody Total Area	0.64 km ²		146.25 km ²	
Hydromorphological Designation	Heavily Modified Water Body – Coastal Protection		Heavily Modified Water Body – Coastal Protection	
Status/Objectives	2015 Status	Objectives	2015 Status	Objectives
Overall Status	Moderate	Good by 2027	Moderate	Good by 2021
Ecological Status	Moderate	Good by 2027	Moderate	Good by 2021
Failing WFD Elements	Angiosperms, Mitigation Measures Assessment, Saltmarsh		Dissolved Inorganic Nitrogen, Mercury and its Compounds	
Chemical Status	Good	Good by 2015	Fail	Good by 2021
Protected Area	Yes		Yes	
Bathing Water	Yes		Yes	
Shellfish Water	-		Yes	

4.2 Protected Areas

Wider environmental legislation must be considered when assessing the compliance of proposals under the WFD Regulations. Proposals cannot be WFD compliant if they adversely affect the integrity of protected areas and the relevant standards or objectives must be achieved for these sites.

4.2.1 UK National Network of protected sites (previously Natura 2000 Sites) and Sites of Special Scientific Interest

The UK National Network of protected sites (hereafter referred to as 'designated sites') that need to be considered under the WFD are:

- Special Areas of Conservation (SACs); and
- Special Protection Areas.

The Liverpool Bay SPA is located within the North Wales Coastal Waterbody. The SPA extends from Moelfre in north-east Anglesey, to the west of the proposed maintenance dredging area, to Rossall Point near Fleetwood, to the east. The SPA lies entirely within the 12-mile limit of English and Welsh territorial waters and the landward boundary is formed by the mean low water mark. The SPA is designated for the over-wintering populations of red-throated diver *Gavia stellata* and common scoter *Melanitta nigra*. At its closest point it is

located approximately 800m to the north-west of the northern dredging extent (see Drawing 10401/EI/09/01A in Appendix A).

The Dee Estuary Site of Special Scientific Interest (SSSI), SPA and SAC is located over 7km to the east along the coast, while Traeth Pensarn SSSI is located over 5.5km along the coast to the west.

The maintenance dredging area is not located within the SSSI impact risk zones, and over 7km from the Dee Estuary SPA and SAC, therefore the SSSIs and Dee Estuary Designations are not considered further.

4.2.2 Local Designations

The baseline for locally designated nature conservations sites and species as described in the 2011 ES is summarised in Table 4. The works completed since the 2011 ES (public square and extended quay wall) are not considered to have changed the baseline significantly.

Table 4: Local Designated Sites

Ecological Feature	Description	Distance from Construction/ Operational Footprint	Importance and Value
Clwyd Estuary and Adjacent Fields Wildlife Site.	This includes the sand bars and intertidal mudflats at the river's mouth, the lower sections of the river and its flood meadows, and Brickfield Pond and Marine Lake. The site is designated for its 50ha of saltmarsh along with its populations of wildfowl and wading birds; with lapwing (<i>Vanellus vanellus</i>) and curlew (<i>Numenius arquata</i>) being of primary interest.	Within the proposed dredging area	County
Kimnel Dunes Local Nature Reserve and candidate wildlife site	The site is a rare habitat in the locality and supports a variety of native maritime plants and bird species including skylark (<i>Alauda arvensis</i>), kestrel (<i>Falco tinnunculus</i>) and ringed plover (<i>Charadrius hiaticula</i>).	Approximately 500 m west of the Clwyd Estuary.	County
Horton's Nose and Foryd Junction Grassland Wildlife Sites (candidate sites)	A Local Priority Habitat within Conwy (coastal sand dunes and vegetated shingle).	In the vicinity of the proposed dredging area	County
Afon Clwyd Saltmarsh (candidate site)	12.24ha of saltmarsh on the west side of the Clwyd River.	Approximately 450m south-east of the proposed dredging area	County

Ecological Feature	Description	Distance from Construction/ Operational Footprint	Importance and Value
Afon Clwyd/Clwyd Estuary	Otters are known to be widespread along the Afon Clwyd and the River Dee to the east. The Afon Clwyd supports populations of salmonids and other fish and shellfish species of value to Foraging otter. No evidence of otter activity was found within the survey area. Habitats within the survey area offer little in the way of cover for otter to remain undetected with the exposed sandy/muddy banks and the built-up nature of the area. Notable fish species recorded in the Afon Clwyd are Atlantic salmon, sea trout and European eel.	Passes through the proposed dredging area	Otter: within the study area, Parish value. The migratory populations of Atlantic salmon within the Clwyd Estuary are considered to be of International importance. The populations of sea trout and European eel are considered to be of National importance.

4.2.3 Other WFD Protected Areas and Sensitive Habitats

The WFD Assessment process considers the potential impact of an activity on protected areas and sensitive habitats which are a qualifying feature of a designated site described as Features of Conservation Interest (FOCI) and broad scale habitats which could be qualifying features of Marine Conservation Zones (MCZs).

While Shellfish Waters are recorded as being present within the North Wales Coastal Waterbody, according to MAGIC Mapping⁷, the closest to the Maintenance Dredging Area is located over 8km to the west at Llanddulas.

The Marine SPA Supporting Habitat of 'Mudflats and Sandflats not covered by seawater at low tide' are present approximately 180m north-east from the northernmost extent of dredging on the opposite side of the Training Wall (breakwater).

NRW⁸ record four bathing water quality monitoring points in close proximity to the Maintenance Dredging Area:

- Marine Lake: Sufficient (approximately 75m south-west, although inland from the Clwyd Estuary, the bathing water is not directly linked to the sea, although it can be topped up during high tide and abstractions can be prevented during dredging works in the Clwyd Estuary);
- Kinnel Bay: Sufficient (approximately 2.1km west);
- Rhyl: Good (approximately 1.5km north-east); and
- Rhyl East: Good (approximately 1.5km east).

There are a number of WFD Habitats⁷ located within the Clwyd Transitional and North Wales Coastal Waterbodies which will be directly impacted by the dredging works:

- WFD Habitats: Lower Sensitivity
 - o Gravel & Cobbles (intertidal & subtidal coarse sediment A2.1, A5.1);
 - o Intertidal Soft Sediment (Sand, Mud & Mixed A2.2, A2.3, A2.4); and some very limited areas of
 - o Rocky Shore (Intertidal rock A1).
- WFD Habitats: Higher Sensitivity
 - o Three discrete areas of Saltmarsh (A2.5) within the Rhyl Harbour; and
 - o Some limited areas of Mussel Beds (*Modiolus modiolus*, *Mytilus edulis* & others) (A1.22, A2.72, A5.62, A4.24, A3.361) are recorded along the eastern boundary of the harbour and along the training wall.

⁷ Data taken from www.magic.defra.gov.uk, accessed October 2021

⁸ Data taken from <https://environment.data.gov.uk/wales/bathing-waters/profiles/>, accessed October 2021

4.3 Identifying Risks to Receptors

The proposed maintenance dredging may present potential risks to a number of receptors within the study area, based on the screened in waterbody's quality elements. These include:

- Hydromorphology;
- Biology – habitats;
- Biology – fish;
- Water quality; and
- Protected areas.

Table 5 summarises the potential risk from the proposed maintenance dredging operations to each of these receptors, and determines which receptors are at risk requiring a full assessment.

Table 5: Identifying Risks to Receptors

Receptors	Potential Risk?	Impact Assessment Required?
Hydromorphology	No – Dredging operations occur on a bi-annual basis and have done since the public square and extended quay wall was construction in 2014. The dredging operations are intended to 'maintain' the harbour for navigational purposes with no significant change in hydromorphological conditions in the long term. Both the Clwyd Transitional Waterbody and North Wales Coastal Waterbody are designated as Heavily Modified for coastal protection. The Scheme is not related to coastal protection.	No
Biology – Habitats	The footprint of the activity is <0.5 km², <1% of the North Wales Coastal Waterbody area but >1% of the Clwyd Transitional Waterbody area. It is within 500m of higher sensitivity habitat (Saltmarsh and Mussel Beds) but does not take >1% of lower sensitivity habitat (Gravel & Cobbles, Intertidal Soft Sediment and Rocky Shore) when considering the wider Coastal Waterbody area.	Yes
Biology – Fish	The Maintenance Dredging Area is located within an estuarine environment which supports species such as Atlantic salmon, sea trout and European eel, however the dredging works will not result in the creation of any permanent physical barriers to movement, migration or spawning. The dredging operations are designated only to maintain the navigable channels and so there will be no significant changes to depth or flow over the long term. There will be a temporary increase in noise and the amount of suspended sediment within the dredging area and surroundings during the dredging works.	Yes (temporary impacts during dredging period only)
Water Quality	There will be a temporary decrease in water clarity and increase in suspended sediments for the duration of the maintenance dredging operations. The Maintenance Dredging period may take slightly longer than the 8 – 10 days depending on weather and tidal conditions. Recent sediment quality testing has shown that the sediments do not contain contaminants exceeding CEFAS Action level 1 for the contaminants tested (Appendix E), however there is to be no disposal of dredgings to sea and other criteria will be more applicable for the future use of the sediment on land.	Yes (temporary impacts during dredging period only)

Receptors	Potential Risk?	Impact Assessment Required?
Protected Areas	The Maintenance Dredging Area is located approximately 800 m from the Liverpool Bay SPA and approximately 180 m from the Marine SPA Supporting Habitat of Mudflats and Sandflats. It is also located adjacent to Bathing Water areas. The nearest Shellfish waters are located over 8km away and are not considered likely to be affected. The Clwyd Estuary and Adjacent Fields Wildlife Site, Horton's Nose Wildlife Site and Afon Clwyd/Clwyd Estuary are all located within the vicinity of the dredging works, however these are all locally designated sites.	Yes (temporary impacts during dredging period only)
Non-Native Species	The introduction of invasive non-native species (INNS) is not considered to be a risk for this dredging activity as no foreign material is to be introduced. Dredged materials are to be re-used on land and not disposed of to sea elsewhere.	No

5 Impact Assessment (Stage 3)

Four principal receptors were identified as being at risk from the proposed maintenance dredging operations as summarised in Table 6.

Table 6: Identifying Risks to Receptors

Receptors	Risks
Biology – Habitats	- Potential impacts on higher sensitivity Saltmarsh and Mussel Beds; and - Loss of lower sensitivity habitat Gravel & Cobbles, Intertidal Soft Sediment and Rocky Shore.
Biology – Fish	Temporary impacts during dredging period only.
Water Quality	Temporary impacts during dredging period only.
Protected Areas	- Liverpool Bay SPA and Supporting Habitat; and - Bathing Water areas.

An impact assessment has been carried out for each receptor as shown in Table 7.

Rhyl Harbour Maintenance Dredging WFD Assessment

Table 7: Assessment of Effects Including Incorporated Mitigation

Receptor	Summary of Impacts & Resulting Effects	Mitigation Measures	Following Mitigation will the Scheme result in Deterioration of WFD Quality Element?
Biology – Habitats	Several discrete areas of saltmarsh are recorded on MAGIC mapping within the harbour area and some limited areas of Mussel Beds are recorded along the eastern boundary of the harbour and along the training wall, with additional clusters to the east and west of the Clwyd Estuary mouth. Of the areas of saltmarsh indicated on MAGIC mapping, one in the vicinity of Horton's Nose is no longer present. The others lie outside the maintenance Dredging Area – with the closest adjacent to Rhyl Yacht Club and to the south-west of the 'Blue Bridge' (Ffordd Wellington). More areas are located upstream to the south. The Mussel beds are recorded predominantly in an area along the eastern side of the harbour where dredging will not be taking place due to the presence of a historic wreck site.	The areas of Saltmarsh will not be used by dredging plant for manoeuvring and operators and banksmen will have the importance of these areas highlighted in toolbox talks prior to commencement on-site. The saltmarsh areas are still present despite dredging operations having taken place since 2014 and would therefore appear to be relatively resilient to the annual dredging level changes proposed. The Mussel Beds are on rocky substrate located along the training wall. The training wall materials will not be affected by dredging activities and therefore the principal mitigation measure will be to avoid smothering any mussel beds while moving dredged sediments. The contractor performing the works will be required to provide a method statement detailing the working methods to be used on-site for the protection of both the saltmarsh and mussel beds.	No – Impacts of the maintenance dredging operations on biology (habitats) are not considered to be significant. A deterioration of this WFD quality element is not anticipated.
Biology – fish	Note: Will be temporary in nature. The maintenance dredging area is located within an estuarine environment which supports species such as Atlantic salmon, sea trout and European eel, there will be a temporary increase in noise and the amount of suspended sediment within the dredging area and in close proximity during the dredging works.	As for Water Quality below. The proposed methodology of working at low tide and excavating in cells will help to minimise the temporary disturbance. The timing of the works will avoid the salmon migration period.	No – Impacts of the maintenance dredging operations on biology (fish) are not considered to be significant. A permanent deterioration of this WFD quality element is not anticipated.

Rhyl Harbour Maintenance Dredging WFD Assessment

Receptor	Summary of Impacts & Resulting Effects	Mitigation Measures	Following Mitigation will the Scheme result in Deterioration of WFD Quality Element?
Water Quality	Note: Will be temporary in nature. Dredging operations may result in disturbance of sediment or previously unidentified contaminants under the water table and temporarily increase the suspended solids levels. Increased levels of suspended solids can reduce dissolved oxygen levels, reduce chemical quality and increase bacterial concentrations. This may affect the status of the WFD waterbodies, specifically the Clwyd Estuary. Site surface water runoff from the sediment storage area has the potential to enter the surface waters in the harbour.	Works will be programmed to take place at low tide as a necessity for the use of land-based dredging plant. This will minimise the suspension of sediments into the water column. Careful consideration and planning will be given to timings of high and low tide each day using a tide timetable. Sediment transportation vehicles will be filled to their full capacity to ensure maximum effectiveness. Material will be removed from the area by excavating in cells to reduce suspended sediments to allow minimum disturbance to the marine environment. A CEMP is to be implemented on a site-wide basis during maintenance dredging operations detailing the reasonable and practicable steps to be undertaken to ensure the protection of the water environment, including the best practice management of plant and materials.	No – Impacts of the maintenance dredging operations on water quality are not considered to be significant. A permanent deterioration of this WFD quality element is not anticipated.
Protected Areas – Bathing Waters	Note: Will be temporary in nature. Construction works have the potential to increase contaminant and suspended solid concentrations in the Clwyd Estuary which discharges to the sea in proximity to Kinmel Bay and Rhyl Beach Bathing Waters. Waters are also taken from the Clwyd Estuary at high tide to top up levels at Marine Lake.	As for water quality above. Dredging will be undertaken outside the bathing water season (15th May-30th September inclusive). No abstractions will be taken from the Clwyd Estuary into Marine Lake during dredging operations.	No – Impacts of the maintenance dredging operations on protected areas – bathing waters are not considered to be significant. A permanent deterioration of this WFD quality element is not anticipated.

Rhyl Harbour Maintenance Dredging WFD Assessment

Receptor	Summary of Impacts & Resulting Effects	Mitigation Measures	Following Mitigation will the Scheme result in Deterioration of WFD Quality Element?
Protected Areas – Liverpool Bay SPA and SPA supporting habitat	Note: Will be temporary in nature. The maintenance dredging area is located approximately 800m from the Liverpool Bay SPA and approximately 180m from the Marine SPA Supporting Habitat of Mudflats and Sandflats. The application to renew the licence in 2018 was accompanied by a HRA report prepared by NRW which concluded that the project was not likely to have a significant effect on any designated sites/Ramsar site, either alone or in combination. Given the reduced scale of the project with only half the volume of sediment to be dredged each year it is considered that this assessment remains valid (no significant adverse effects on Designated Sites).	As for water quality above. Dredging works will be completed outside of the principal overwintering bird season for which the Liverpool Bay SPA is designated.	No – Impacts of the maintenance dredging operations on water quality are not considered to be significant. A permanent deterioration of this WFD quality element is not anticipated.

6 Outcomes and Conclusions

6.1 Assessment Outcomes

In accordance with NRW Guidance, Stages 1-3 of the 3-stage approach to WFD assessment have been completed for the proposed ongoing Maintenance Dredging Operations at Rhyl Harbour in support of a Marine Licence application.

The **Stage 1** screening assessment found the Clwyd Transitional (Waterbody ID. GB541006608000) and North Wales Coastal (Waterbody ID. GB641011650000) waterbodies to be the only ones likely to be impacted as a result of the Maintenance Dredging Operations. It is acknowledged that both of these waterbodies are currently classified as 'Heavily Modified' as a result of existing coastal defences. The remaining waterbodies located within the study area were screened out of the assessment at this stage, due to no adverse effects anticipated to occur from the works.

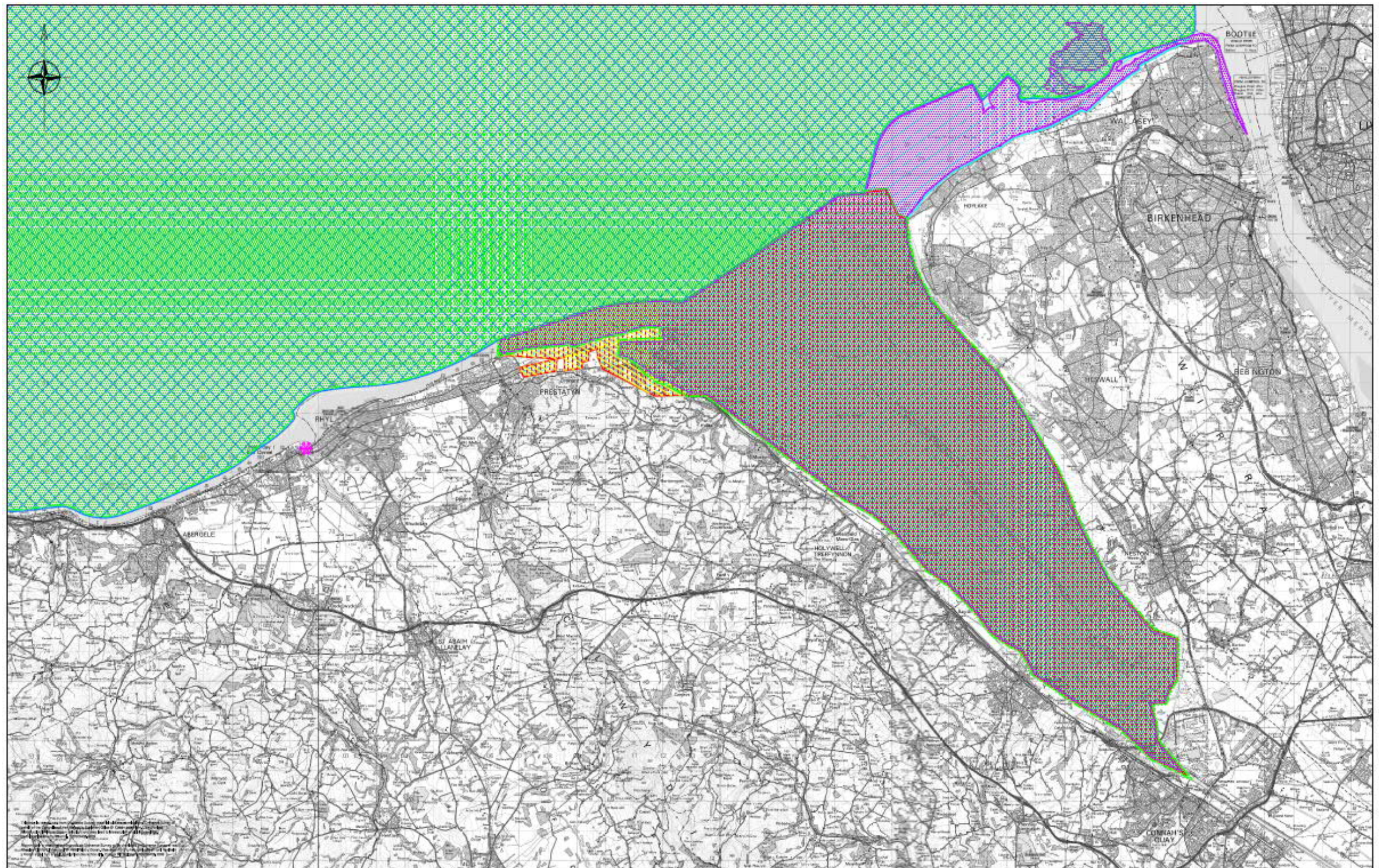
Stage 2 of the assessment identified that the Maintenance Dredging Operations could potentially impact upon four receptors associated with the WFD waterbody, comprising biology (habitats), biology (fish), water quality, and protected areas – with all impacts being temporary in nature. Protected areas included the Liverpool Bay SPA and associated habitat and local bathing waters at Kinmel Bay, Rhyl and Marine Lake. These receptors were subject to an impact assessment as part of Stage 3.

The **Stage 3** assessment found that following the incorporation of appropriate mitigation measures, given the temporary and relatively small scale of works in the context of the two WFD waterbodies as a whole, impacts on all receptors were not considered to be significant. It is not anticipated that there will be any deterioration in the WFD quality elements of the waterbodies as a result of the Maintenance Dredging Operations. In addition, the mitigation measures for either waterbody will not be jeopardised.

6.2 Conclusions

The 3-stage assessment found that the potential impact pathways present are very low risk due to temporary nature of the works, and the Maintenance Dredging Operations going forward are very unlikely to permanently affect the WFD status or cause deterioration of either the Clwyd Transitional or North Wales Coastal waterbodies.

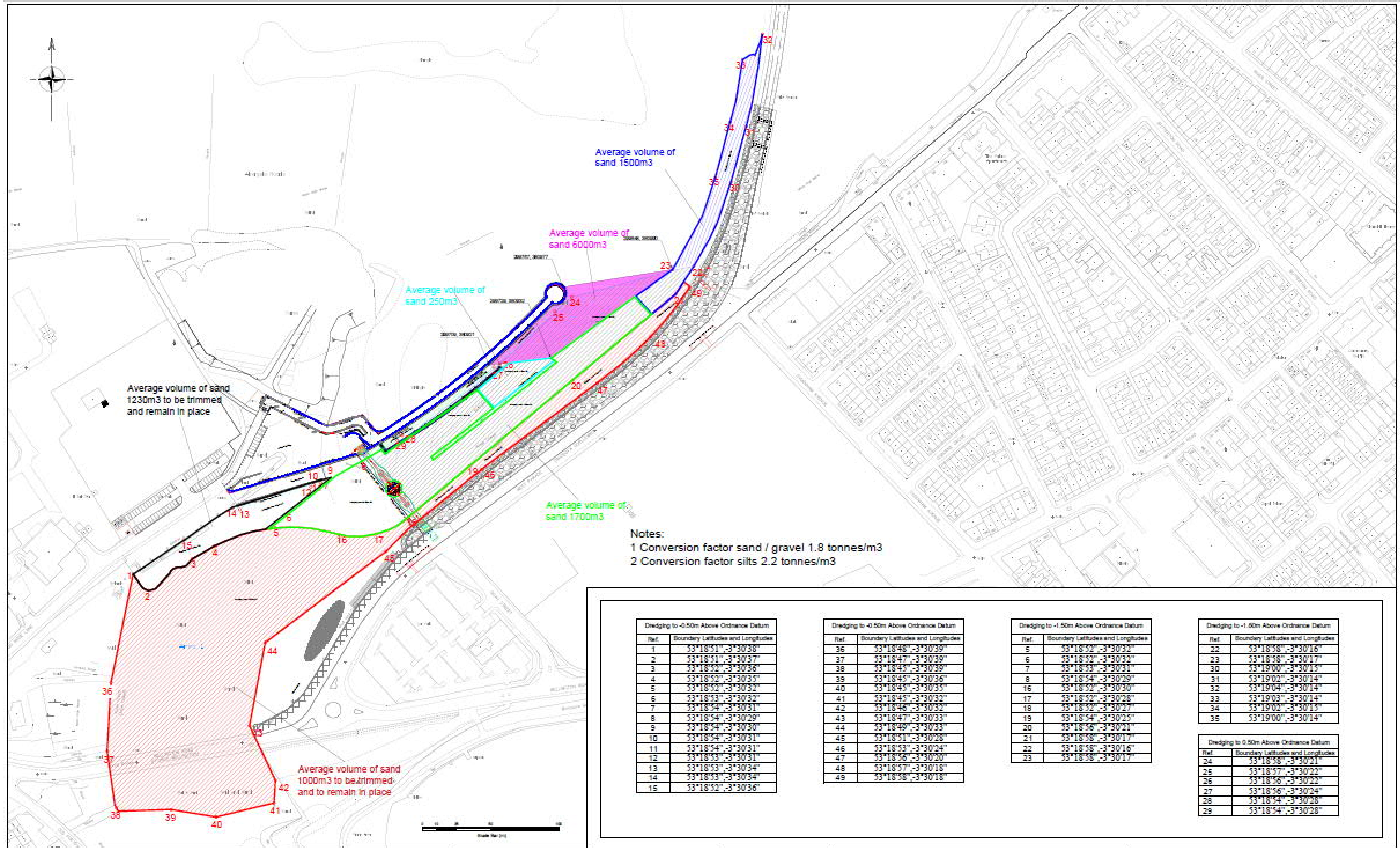
Appendix A - Location in Context of the Wider Area and Protected Sites



10401/EI/09/01A	 CONWY SYNGOR SYNGORFF 3RD COUNTY BOROUGH COUNCIL Penndeth Prifffyrdd ac Isadeiledd Conwy a Sir Ddinbych Head of Highways & Infrastructure Conwy & Denbighshire ADRAN PRIFFFYRDD AC ISADEILEDD DEPARTMENT OF HIGHWAYS AND INFRASTRUCTURE  CYNGOR Sir Ddinbych Denbighshire COUNTY COUNCIL Cooperation Effortion maen Ffynfynfyn Effortion Service in Partnership <td>  Proposed Foryd Harbour Public Square  Liverpool Bay SPA  Breesholme & Telford Warren SSSI  Dun Eithery Plasau  Dun Eithery SAC  Dun Eithery SSSI  Dun Eithery SPA </td> <td> JOB NUMBER 10401 DRAWING SCALE NTS NATIONAL GRID REFERENCE SH9980 DRAWN BY APS APPROVED BY EP </td> <td> REVISIONS <table><tr><td>A</td><td>Original Drawing</td><td></td><td></td><td>07.12.12</td></tr></table> ISSUE LAST EDIT DATE 07.12.12 </td> <td> SCHEME FORYD HARBOUR PHASE 2 RHYL DRAWING TITLE ENVIRONMENTAL IMPACT ASSESSMENT STATUTORY DESIGNATED NATURE CONSERVATION SITES (FIGURE 9.1) DRAWING NUMBER 10401/EI/09/01A </td>	 Proposed Foryd Harbour Public Square  Liverpool Bay SPA  Breesholme & Telford Warren SSSI  Dun Eithery Plasau  Dun Eithery SAC  Dun Eithery SSSI  Dun Eithery SPA	JOB NUMBER 10401 DRAWING SCALE NTS NATIONAL GRID REFERENCE SH9980 DRAWN BY APS APPROVED BY EP	REVISIONS <table><tr><td>A</td><td>Original Drawing</td><td></td><td></td><td>07.12.12</td></tr></table> ISSUE LAST EDIT DATE 07.12.12	A	Original Drawing			07.12.12	SCHEME FORYD HARBOUR PHASE 2 RHYL DRAWING TITLE ENVIRONMENTAL IMPACT ASSESSMENT STATUTORY DESIGNATED NATURE CONSERVATION SITES (FIGURE 9.1) DRAWING NUMBER 10401/EI/09/01A
		A	Original Drawing			07.12.12				

Appendix B - Original Rhyl Harbour Dredging Proposals

Appendix C - Revised Rhyl Harbour Dredging Proposals



Ref.	Boundary Latitudes and Longitudes
1	53°18'51"-3°30'38"
2	53°18'51"-3°30'37"
3	53°18'52"-3°30'36"
4	53°18'52"-3°30'35"
5	53°18'52"-3°30'32"
6	53°18'53"-3°30'32"
7	53°18'54"-3°30'31"
8	53°18'54"-3°30'29"
9	53°18'54"-3°30'30"
10	53°18'54"-3°30'31"
11	53°18'54"-3°30'31"
12	53°18'53"-3°30'31"
13	53°18'53"-3°30'34"
14	53°18'53"-3°30'34"
15	53°18'52"-3°30'36"

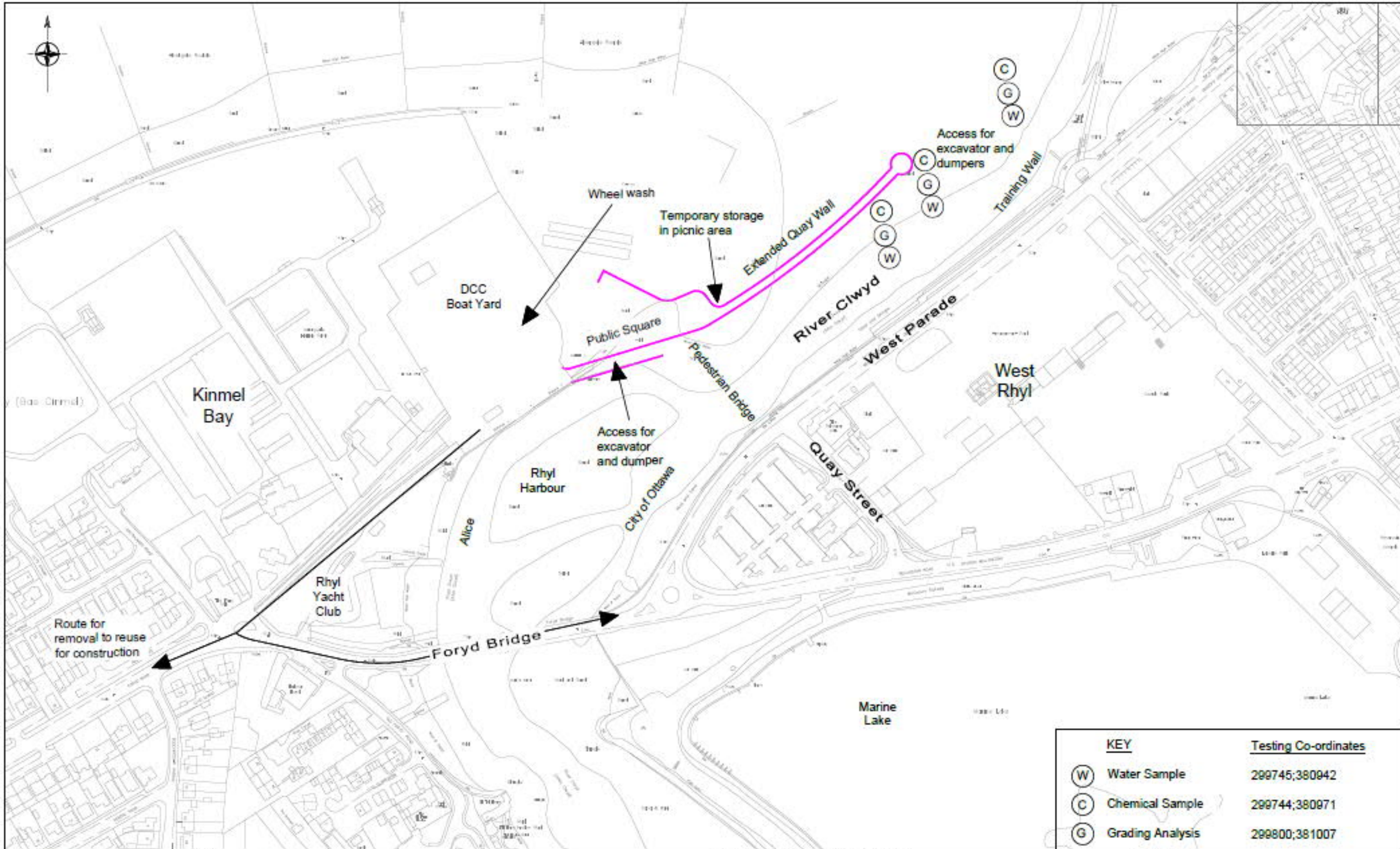
Ref.	Boundary Latitudes and Longitudes
36	53°18'48"-3°30'39"
37	53°18'47"-3°30'39"
38	53°18'45"-3°30'39"
39	53°18'45"-3°30'36"
40	53°18'45"-3°30'35"
41	53°18'45"-3°30'32"
42	53°18'46"-3°30'32"
43	53°18'47"-3°30'33"
44	53°18'49"-3°30'33"
45	53°18'51"-3°30'28"
46	53°18'53"-3°30'24"
47	53°18'56"-3°30'20"
48	53°18'57"-3°30'18"
49	53°18'58"-3°30'18"

Ref.	Boundary Latitudes and Longitudes
5	53°18'52"-3°30'32"
6	53°18'52"-3°30'32"
7	53°18'53"-3°30'31"
8	53°18'54"-3°30'29"
16	53°18'52"-3°30'30"
17	53°18'52"-3°30'28"
18	53°18'52"-3°30'27"
19	53°18'54"-3°30'25"
20	53°18'56"-3°30'21"
21	53°18'58"-3°30'17"
22	53°18'58"-3°30'16"
23	53°18'58"-3°30'17"

Ref.	Boundary Latitudes and Longitudes
22	53°18'58"-3°30'16"
23	53°18'58"-3°30'17"
30	53°19'00"-3°30'15"
31	53°19'02"-3°30'14"
32	53°19'04"-3°30'14"
33	53°19'03"-3°30'14"
34	53°19'02"-3°30'13"
35	53°19'00"-3°30'14"

Ref.	Boundary Latitudes and Longitudes
24	53°18'58"-3°30'21"
25	53°18'57"-3°30'22"
26	53°18'56"-3°30'22"
27	53°18'56"-3°30'24"
28	53°18'54"-3°30'28"
29	53°18'54"-3°30'28"

Appendix D - Proposed Site Layout displaying Vehicle Movements, Stockpile Area



KEY	Testing Co-ordinates
(W) Water Sample	299745;380942
(C) Chemical Sample	299744;380971
(G) Grading Analysis	299800;381007

Appendix E – Sediment Testing Data 2018



Denbighshire County Council
County Offices
Wynnstay Road
Ruthin
LL15 1YN

Date: 15 March 2018
Test Report Ref: STR 581126

Order No: PO2168703

Page 1 of 2

Contract: Foryd Harbour, Rhyl

LABORATORY TEST REPORT

TEST REQUIREMENTS:

To determine the chemical analysis of a sample as per client request.

SAMPLE DETAILS:

Certificate of sampling received:	No
Laboratory Ref. No:	S71094
Client Ref. No:	Location 1 Water
Date and Time of Sampling:	Unknown
Date of Receipt at Lab:	14/02/2018
Date of Start of Test:	05/03/2018
Sampling Location:	Location 1
Name of Source:	Foryd Harbour, Rhyl
Method of Sampling:	Unknown
Sampled By:	Client
Material Description:	Water
Target Specification:	N/A

Results:

See Attached

Comments:

The work was carried out by our competent, sub contracted laboratory.

Report checked and approved by:

S Parry-Didcote

Sharon Parry-Didcote

Aggregate Team Coordinator

STR Ref: Test Report Ref: STR 581126Page 2 of 2

Total Metals		
Iron	ug/l	2100
Dissolved Metals		
Arsenic	ug/l	< 5
Cadmium	ug/l	< 1
Chromium	ug/l	< 5
Copper	ug/l	< 5
Mercury	ug/l	< 0.1
Nickel	ug/l	< 5
Lead	ug/l	< 1
Selenium	ug/l	7
Zinc	ug/l	6
Anions		
Chloride	mg/l	1370
Inorganics		
Ammoniacal Nitrogen as N	mg/l	0.3
Miscellaneous		
pH	pH units	7.7
Phenols		
Total Phenols	ug/l	< 1
Polyaromatic hydrocarbons		
Naphthalene GCMS	ug/l	0.02
Acenaphthylene GCMS	ug/l	0.01
Acenaphthene GCMS	ug/l	0.02
Fluorene GCMS	ug/l	0.01
Phenanthrene GCMS	ug/l	0.04
Anthracene GCMS	ug/l	< 0.01
Fluoranthene GCMS	ug/l	0.07
Pyrene GCMS	ug/l	0.06
Benzo (a) anthracene GCMS	ug/l	0.03
Chrysene GCMS	ug/l	0.04
Benzo (b) fluoranthene GCMS	ug/l	0.05
Benzo (k) fluoranthene GCMS	ug/l	0.05
Benzo (a) pyrene GCMS	ug/l	0.05
Indeno (1,2,3-cd) pyrene GCMS	ug/l	0.04
Dibenzo(a,h)anthracene GCMS	ug/l	0.02
Benzo(ghi)perylene GCMS	ug/l	0.05
Total PAH(16) GCMS	ug/l	0.58
BTEX		
Benzene	ug/l	< 1.00
Toluene	ug/l	< 1.00
Ethylbenzene	ug/l	< 1.00
Xylenes	ug/l	< 1.00
MTBE	ug/l	< 1.00

STR REF - Test Report Ref: STR 581126 Page 3 of 3

TPH CWG		
>C5-C6 Aliphatic	ug/l	< 1.0
>C6-C8 Aliphatic	ug/l	< 1.0
>C8-C10 Aliphatic	ug/l	< 5.0
>C10-C12 Aliphatic	ug/l	< 5.0
>C12-C16 Aliphatic	ug/l	< 5.0
>C16-C21 Aliphatic	ug/l	< 5.0
>C21-C35 Aliphatic	ug/l	< 5.0
>C35-C40 Aliphatic	ug/l	< 5.0
Total (>C5-C40) Aliphatic	ug/l	< 5.0
>C5-C7 Aromatic	ug/l	< 1.0
>C7-C8 Aromatic	ug/l	< 1.0
>C8-C10 Aromatic	ug/l	< 5.0
>C10-C12 Aromatic	ug/l	< 5.0
>C12-C16 Aromatic	ug/l	< 5.0
>C16-C21 Aromatic	ug/l	< 5.0
>C21-C35 Aromatic	ug/l	< 5.0
>C35-C40 Aromatic	ug/l	< 5.0
Total (>C5-C40) Aromatic	ug/l	< 5.0
Total (>C5-C40) Ali/Aro	ug/l	< 5.0

Denbighshire County Council
County Offices
Wynnstay Road
Ruthin
LL15 1YN

Date: 06 March 2018
Test Report Ref: STR 581127

Order No: PO2168703

Page 1 of 1

Contract: Foryd Harbour , Rhyl

LABORATORY TEST REPORT

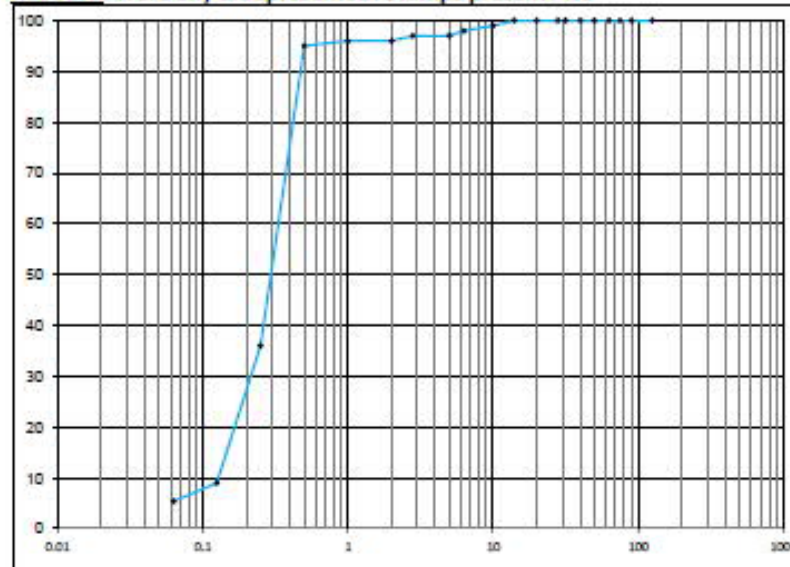
TEST REQUIREMENTS:

To determine the Particle Size Distribution (PSD) of a aggregate sample- washing and sieving method in accordance with BS EN 933-1: 2012.

SAMPLE DETAILS:

Certificate of sampling received:	No	Name of Source:	Foryd Harbour, Rhyl
Laboratory Ref. No:	S71094	Method of Sampling:	Unknown
Client Ref. No:	Location 1 Sand / Sc	Sampled By:	Client
Date and Time of Sampling:	Unknown		
Date of Receipt at Lab:	14/02/2018		
Date of Start of Test:	28/02/2018		
Sampling Location:	Location 1		
Material Description	Sand / Soil		

RESULTS: Were any unrepresentative lumps present? No



BS Test Sieve Size	Percentage By Mass Passing	Specification Limit
125.0 mm	100	
90.0 mm	100	
75.0 mm	100	
63.0 mm	100	
50.0 mm	100	
40.0 mm	100	
31.5 mm	100	
28.0 mm	100	
20.0 mm	100	
14.0 mm	100	
10.0 mm	99	
6.3 mm	98	
5.0 mm	97	
2.8 mm	97	
2.0 mm	96	
1.0 mm	96	
0.500 mm	95	
0.250 mm	36	
0.125 mm	9	
0.063 mm	5.4	

Comments:

None

Report checked and approved by:

S Parry-Didcote

Sharon Parry-Didcote

Aggregate Team Coordinator

Denbighshire County Council
County Offices
Wynnstay Road
Ruthin
LL15 1YN

Date: 15 March 2018
Test Report Ref: STR 581135

Order No: PO2168703

Page 1 of 1

Contract: Foryd Harbour, Rhyl

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Water Content of aggregates by – drying in a ventilated oven according to BS EN 1097-5: 2008

SAMPLE DETAILS:

Certificate of sampling received:	No
Laboratory Ref. No:	S71094
Client Ref. No:	Location 1 Sand / Soil
Date and Time of Sampling:	Unknown
Date of Receipt at Lab:	14/02/2018
Date of Start of Test:	28/02/2018
Sampling Location:	Location 1
Name of Source:	Foryd Harbour, Rhyl
Method of Sampling:	Unknown
Sampled By:	Client
Material Description:	Sand / Soil
Target Specification:	N/A

RESULTS:

Water Content (%) = 20.5

Comments:

None

Report checked and approved by:

S Parry-Didcote

Sharon Parry-Didcote

Aggregate Team Coordinator

Denbighshire County Council
County Offices
Wynnstay Road
Ruthin
LL15 1YN

Date: 15 March 2018
Test Report Ref: STR 581140

Order No: PO2168703

Page 1 of 1

Contract: Foryd Harbour , Rhyl

LABORATORY TEST REPORT

TEST REQUIREMENTS:

To determine the Permeability of a sample by the Constant Head
Method in accordance with BS 1377: 1990: Part 5.

SAMPLE DETAILS:

Certificate of sampling received:	No
Laboratory Ref. No:	S71094
Client Ref. No:	Location 1 Sand / Soil
Date and Time of Sampling:	Unknown
Date of Receipt at Lab:	14/02/2018
Date of Start of Test:	07/03/2018
Sampling Location:	Location 1
Name of Source:	Foryd Harbour, Rhyl
Method of Sampling:	Unknown
Sampled By:	Client
Material Description:	Sand / Soil
Target Specification:	N/A

RESULTS:

Diameter of Permeameter Cell:	115 mm
Height of Permeameter Cell:	450mm
De aerated water used?	Yes / No
Proportion and size of material removed before preparing test sample:	21% >10mm
Method of placing and compacting:	Hand tamping / Placing under water
Dry Density:	1.557Mg/m ³
Coefficient of Permeability k at 20°C:	2.780x10 ⁻⁰⁵ m/sec

<u>Comments:</u> None	Report checked and approved by: <i>S Parry-Didcote</i> Sharon Parry-Didcote Aggregate Team Coordinator
---------------------------------	---

Denbighshire County Council
County Offices
Wynnstay Road
Ruthin
LL15 1YN

Date: 15 March 2018
Test Report Ref: STR 581141

Order No: PO2168703

Page 1 of 1

Contract: Foryd Harbour, Rhyl

LABORATORY TEST REPORT

TEST REQUIREMENTS:

To determine the Dry Density and Moisture Content Relationship of soil
2.5kg Rammer Method in accordance with BS 1377: 4: 1990 Clause 3.3

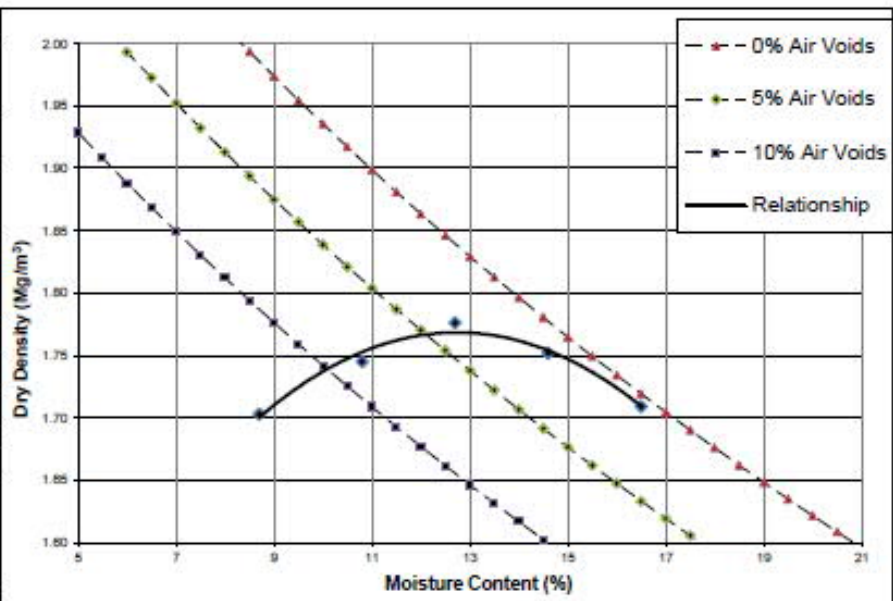
SAMPLE DETAILS:

Certificate of sampling received:	No	Name of Source:	Foryd Harbour, Rhyl
Laboratory Ref. No:	S71094	Method of Sampling:	Unknown
Client Ref. :	Location 1 Sand / Soil	Sampled By:	Client
Date and Time of Sampling:	Unknown	Unrepresentative lumps present?	No
Date of Receipt at Lab:	14/02/2018	Sample Preparation Procedure:	3.3.4.1
Date of Start of Test:	05/03/2018	Sample Preparation Method:	Single
Sampling Location:	Location 1		
Soil Description:	Sand / Soil		

RESULTS:

Particle Density: 2.4Mg/m³
(Assumed)

Retained on 37.5mm Sieve:	0 %
Retained on 20mm Sieve:	0 %
Moisture Content (%)	Dry Density Mg/m ³
8.7	1.70
10.8	1.75
12.7	1.78
14.6	1.75
16.5	1.71
Optimum Moisture Content (%)	Maximum Dry Density Mg/m ³
13	1.78



Comments:

None

Report checked and approved by:

S Parry-Didcote
Sharon Parry-Didcote
Aggregate Team Coordinator

Denbighshire County Council
County Offices
Wynnstay Road
Ruthin
LL15 1YN

Date: 15 March 2018
Test Report Ref: STR 581123

Order No: PO2168703

Page 1 of 2

Contract: Foryd Harbour, Rhyl

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the chemical analysis of a sample as per client request.

SAMPLE DETAILS:

Certificate of sampling received:	No
Laboratory Ref. No:	S71094
Client Ref. No:	Location 1 Sand/Soil
Date and Time of Sampling:	Unknown
Date of Receipt at Lab:	14/02/2018
Date of Start of Test:	05/03/2018
Sampling Location:	Location 1
Name of Source:	Foryd Harbour, Rhyl
Method of Sampling:	Unknown
Sampled By:	Client
Material Description:	Sand/Soil
Target Specification:	N/A

Results:
See Attached

Comments:

The work was carried out by our competent, sub contracted laboratory.

Report checked and approved by:

S Parry-Didcote

Sharon Parry-Didcote
Aggregate Team Coordinator

Metals		
Arsenic	mg/kg	10.6
Cadmium	mg/kg	< 0.5
Chromium	mg/kg	17.0
Copper	mg/kg	7.7
Lead	mg/kg	14.1
Mercury	mg/kg	< 0.5
Nickel	mg/kg	10.5
Selenium	mg/kg	< 1.0
Vanadium	mg/kg	31.9
Zinc	mg/kg	51.9
Anions		
Water Soluble Sulphate	mg/l	198
Inorganics		
Hexavalent Chromium	mg/kg	< 0.8
Total Sulphur	%	0.02
Total Potential Sulphate	%	0.06
Oxidisable sulphide (SO4)	% SO4	< 0.01
Acid Soluble Sulphate (SO4)	%	0.08
Water Soluble Boron	mg/kg	1.1
Miscellaneous		
Moisture Content	%	19.2
pH	pH units	8.5
Phenols		
Total Phenols	mg/kg	< 6
Polyaromatic hydrocarbons		
Naphthalene	mg/kg	< 0.1
Acenaphthylene	mg/kg	< 0.1
Acenaphthene	mg/kg	< 0.1
Fluorene	mg/kg	< 0.1
Phenanthrene	mg/kg	0.2
Anthracene	mg/kg	< 0.1
Fluoranthene	mg/kg	0.2
Pyrene	mg/kg	0.1
Benzo[a]anthracene	mg/kg	0.2
Chrysene	mg/kg	< 0.1
Benzo (b) fluoranthene	mg/kg	0.2
Benzo(k)fluoranthene	mg/kg	< 0.1
Benzo (a) pyrene	mg/kg	0.2
Indeno (1,2,3-cd) pyrene	mg/kg	< 0.1
Dibenzo[a,h]anthracene	mg/kg	< 0.1
Benzo[g,h,i]perylene	mg/kg	< 0.1
Total PAH(16)	mg/kg	1.3
BTEX		
Benzene	ug/kg	< 10.0
Toluene	ug/kg	< 10.0
Ethylbenzene	ug/kg	< 10.0
Xylenes	ug/kg	< 10.0
MTBE	ug/kg	< 10.0
TPH CWG		
>C5-C6 Aliphatic	mg/kg	< 0.01
>C6-C8 Aliphatic	mg/kg	< 0.01
>C8-C10 Aliphatic	mg/kg	< 1.0
>C10-C12 Aliphatic	mg/kg	< 1.0
>C12-C16 Aliphatic	mg/kg	< 1.0
>C16-C21 Aliphatic	mg/kg	< 1.0
>C21-C35 Aliphatic	mg/kg	< 1.0
>C35-C40 Aliphatic	mg/kg	< 1.0

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Denbighshire County Council
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Wynnstay Road
Ruthin
LL15 1YN

Date: 06 March 2018
Test Report Ref: STR 581128

Order No: PO2168703

Page 1 of 1

Contract: Foryd Harbour , Rhyl

LABORATORY TEST REPORT

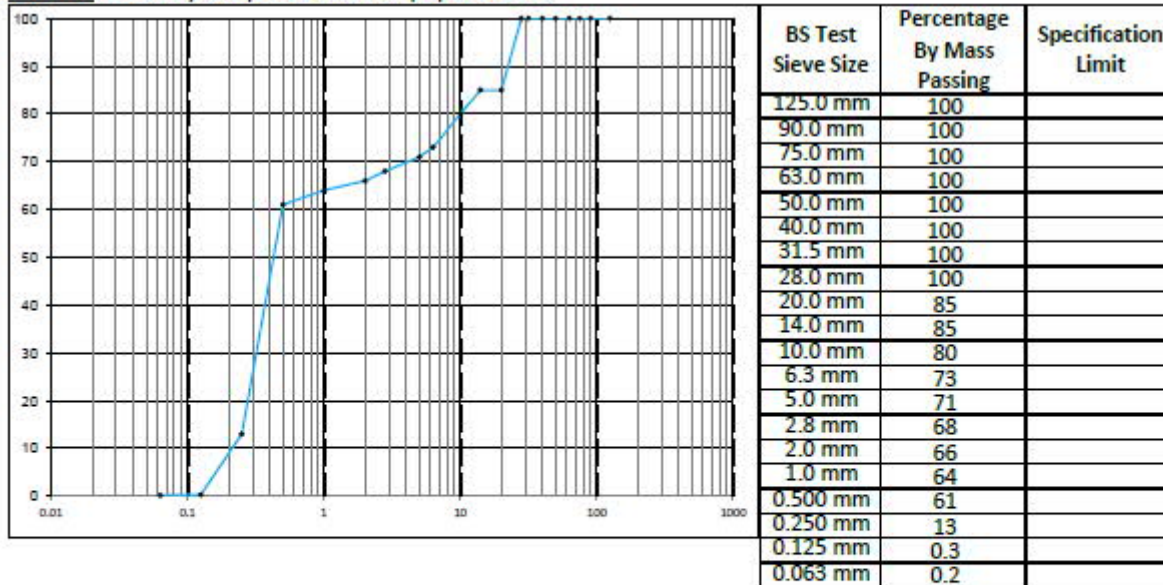
TEST REQUIREMENTS:

To determine the Particle Size Distribution (PSD) of a aggregate sample-
washing and sieving method in accordance with BS EN 933-1: 2012.

SAMPLE DETAILS:

Certificate of sampling received:	No	Name of Source:	Foryd Harbour, Rhyl
Laboratory Ref. No:	S71094	Method of Sampling:	Unknown
Client Ref. No:	Location 2 Sand / Sc	Sampled By:	Client
Date and Time of Sampling:	Unknown		
Date of Receipt at Lab:	14/02/2018		
Date of Start of Test:	28/02/2018		
Sampling Location:	Location 2		
Material Description	Sand / Soil		

RESULTS: Were any unrepresentative lumps present? No



Comments:

None

Report checked and approved by:

S Parry-Didcote

Sharon Parry-Didcote

Aggregate Team Coordinator

Denbighshire County Council
County Offices
Wynnstay Road
Ruthin
LL15 1YN

Date: 15 March 2018
Test Report Ref: STR 581129

Order No: PO2168703

Page 1 of 3

Contract: Foryd Harbour , Rhyl

LABORATORY TEST REPORT

TEST REQUIREMENTS:

To determine the chemical analysis of a sample as per client request.

SAMPLE DETAILS:

Certificate of sampling received:	No
Laboratory Ref. No:	571094
Client Ref. No:	Location 2 Sand / Soil
Date and Time of Sampling:	Unknown
Date of Receipt at Lab:	14/02/2018
Date of Start of Test:	05/03/2018
Sampling Location:	Location 2
Name of Source:	Foryd Harbour, Rhyl
Method of Sampling:	Unknown
Sampled By:	Client
Material Description:	Sand / Soil
Target Specification:	N/A

Results:

See Attached

Comments:

The work was carried out by our competent, sub contracted laboratory.

Report checked and approved by:

S Parry-Didcote

Sharon Parry-Didcote

Aggregate Team Coordinator

STR Ref: Test Report Ref: STR 581129Page 2 of 3

Metals		
Arsenic	mg/kg	10.4
Cadmium	mg/kg	< 0.5
Chromium	mg/kg	12.7
Copper	mg/kg	< 5.0
Lead	mg/kg	8.2
Mercury	mg/kg	< 0.5
Nickel	mg/kg	6.2
Selenium	mg/kg	< 1.0
Vanadium	mg/kg	27.3
Zinc	mg/kg	28.3
Anions		
Water Soluble Sulphate	mg/l	49
Inorganics		
Hexavalent Chromium	mg/kg	< 0.8
Total Sulphur	%	< 0.01
Total Potential Sulphate	%	0.02
Oxidisable sulphide (SO4)	% SO4	< 0.01
Acid Soluble Sulphate (SO4)	%	0.03
Water Soluble Boron	mg/kg	< 0.5
Miscellaneous		
Moisture Content	%	10.5
pH	pH units	8.9
Phenols		
Total Phenols	mg/kg	< 6
Polyaromatic hydrocarbons		
Naphthalene	mg/kg	< 0.1
Acenaphthylene	mg/kg	< 0.1
Acenaphthene	mg/kg	< 0.1
Fluorene	mg/kg	< 0.1
Phenanthrene	mg/kg	< 0.1
Anthracene	mg/kg	< 0.1
Fluoranthene	mg/kg	< 0.1
Pyrene	mg/kg	< 0.1
Benzo(a)anthracene	mg/kg	< 0.1
Chrysene	mg/kg	< 0.1
Benzo (b) fluoranthene	mg/kg	< 0.1
Benzo(k)fluoranthene	mg/kg	< 0.1
Benzo (a) pyrene	mg/kg	< 0.1
Indeno (1,2,3-cd) pyrene	mg/kg	< 0.1
Dibenzo(a,h)anthracene	mg/kg	< 0.1
Benzo(g,h,i)perylene	mg/kg	< 0.1
Total PAH(16)	mg/kg	< 0.4
BTEX		
Benzene	ug/kg	< 10.0
Toluene	ug/kg	< 10.0
Ethylbenzene	ug/kg	< 10.0
Xylenes	ug/kg	< 10.0
MTBE	ug/kg	< 10.0
TPH CWG		
>C5-C6 Aliphatic	mg/kg	< 0.01
>C6-C8 Aliphatic	mg/kg	< 0.01
>C8-C10 Aliphatic	mg/kg	< 1.0
>C10-C12 Aliphatic	mg/kg	< 1.0
>C12-C16 Aliphatic	mg/kg	< 1.0
>C16-C21 Aliphatic	mg/kg	< 1.0
>C21-C35 Aliphatic	mg/kg	< 1.0
>C35-C40 Aliphatic	mg/kg	< 1.0

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LL15 1YN

Date: 15 March 2018
Test Report Ref: STR 581142

Order No: PO2168703

Page 1 of 1

Contract: Foryd Harbour, Rhyl

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Water Content of aggregates by – drying in a ventilated oven according to BS EN 1097-5: 2008

SAMPLE DETAILS:

Certificate of sampling received:	No
Laboratory Ref. No:	S71094
Client Ref. No:	Location 2 Sand / Soil
Date and Time of Sampling:	Unknown
Date of Receipt at Lab:	14/02/2018
Date of Start of Test:	28/02/2018
Sampling Location:	Location 2
Name of Source:	Foryd Harbour, Rhyl
Method of Sampling:	Unknown
Sampled By:	Client
Material Description:	Sand / Soil
Target Specification:	N/A

RESULTS:

Water Content (%) = 7.9

<u>Comments:</u> None	Report checked and approved by: <i>S Parry-Didcote</i> Sharon Parry-Didcote Aggregate Team Coordinator
---	---

Denbighshire County Council
County Offices
Wynnstay Road
Ruthin
LL15 1YN

Date: 15 March 2018
Test Report Ref: STR 581147

Order No: PO2168703

Page 1 of 1

Contract: Foryd Harbour, Rhyl

LABORATORY TEST REPORT

TEST REQUIREMENTS:

To determine the Permeability of a sample by the Constant Head
Method in accordance with BS 1377: 1990: Part 5.

SAMPLE DETAILS:

Certificate of sampling received:	No
Laboratory Ref. No:	S71094
Client Ref. No:	Location 2 Sand / Soil
Date and Time of Sampling:	Unknown
Date of Receipt at Lab:	14/02/2018
Date of Start of Test:	09/03/2018
Sampling Location:	Location 2
Name of Source:	Foryd Harbour, Rhyl
Method of Sampling:	Unknown
Sampled By:	Client
Material Description:	Sand / Soil
Target Specification:	N/A

RESULTS:

Diameter of Permeameter Cell:	115 mm
Height of Permeameter Cell:	450mm
De aerated water used?	Yes / No
Proportion and size of material removed before preparing test sample:	14% >10mm
Method of placing and compacting:	Hand tamping / Placing under water
Dry Density:	1.592Mg/m ³
Coefficient of Permeability k at 20°C:	3.336x10 ⁻⁰⁵ m/sec

Comments:

None

Report checked and approved by:

S Parry-Didcote

Sharon Parry-Didcote
Aggregate Team Coordinator

Denbighshire County Council
County Offices
Wynnstay Road
Ruthin
LL15 1YN

Date: 15 March 2018
Test Report Ref: STR 581148

Order No: PO2168703

Page 1 of 1

Contract: Foryd Harbour, Rhyl

LABORATORY TEST REPORT

TEST REQUIREMENTS:

To determine the Dry Density and Moisture Content Relationship of soil
2.5kg Rammer Method in accordance with BS 1377: 4: 1990 Clause 3.3

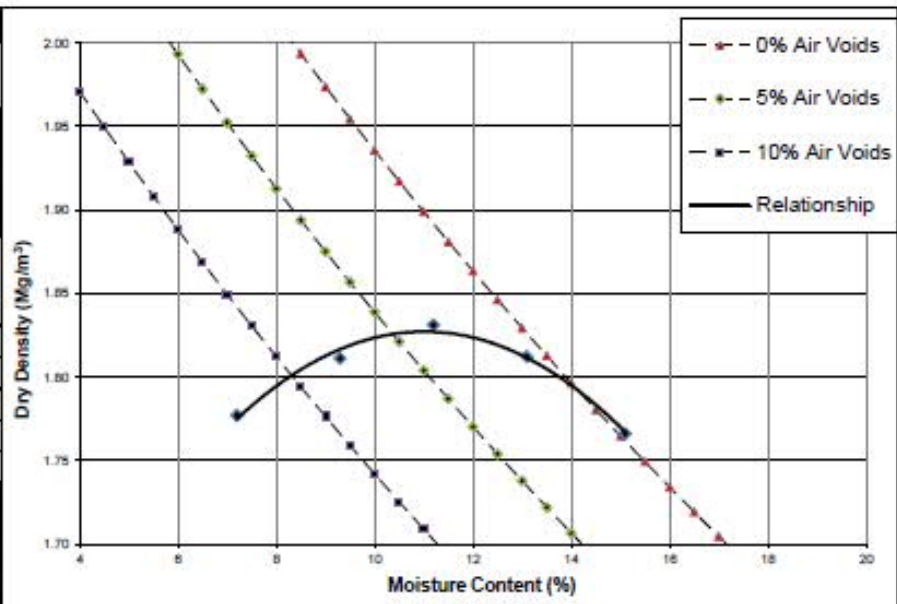
SAMPLE DETAILS:

Certificate of sampling received:	No	Name of Source:	Foryd Harbour, Rhyl
Laboratory Ref. No:	S71094	Method of Sampling:	Unknown
Client Ref. :	Location 2 Sand / Soil	Sampled By:	Client
Date and Time of Sampling:	Unknown	Unrepresentative lumps present?	No
Date of Receipt at Lab:	14/02/2018	Sample Preparation Procedure:	3.3.4.1
Date of Start of Test:	09/03/2018	Sample Preparation Method:	Single
Sampling Location:	Location 2		
Soil Description:	Sand / Soil		

RESULTS:

Particle Density: 2.4Mg/m³
(Assumed)

Retained on 37.5mm Sieve:	0 %
Retained on 20mm Sieve:	0
Moisture Content (%)	Dry Density Mg/m ³
7.2	1.78
9.3	1.81
11.2	1.83
13.1	1.81
15.1	1.77
Optimum Moisture Content (%)	Maximum Dry Density Mg/m ³
11	1.83



Comments:

None

Report checked and approved by:

S Parry-Didcote
Sharon Parry-Didcote
Aggregate Team Coordinator

Denbighshire County Council
County Offices
Wynnstay Road
Ruthin
LL15 1YN

Date: 15 March 2018
Test Report Ref: STR 581124

Order No: PO2168703

Page 1 of 3

Contract: Foryd Harbour, Rhyl

LABORATORY TEST REPORT

TEST REQUIREMENTS:

To determine the chemical analysis of a sample as per client request.

SAMPLE DETAILS:

Certificate of sampling received:	No
Laboratory Ref. No:	571094
Client Ref. No:	Location 2 Water
Date and Time of Sampling:	Unknown
Date of Receipt at Lab:	14/02/2018
Date of Start of Test:	05/03/2018
Sampling Location:	Location 2
Name of Source:	Foryd Harbour, Rhyl
Method of Sampling:	Unknown
Sampled By:	Client
Material Description:	Water
Target Specification:	N/A

Results:

See Attached

Comments:

The work was carried out by our competent, sub contracted laboratory.

Report checked and approved by:

S Parry-Didcote

Sharon Parry-Didcote

Aggregate Team Coordinator

STR Ref: Test Report Ref: STR 581124Page 2 of 3

Total Metals		
Iron	ug/l	3140
Dissolved Metals		
Arsenic	ug/l	< 5
Cadmium	ug/l	< 1
Chromium	ug/l	< 5
Copper	ug/l	< 5
Mercury	ug/l	< 0.1
Nickel	ug/l	< 5
Lead	ug/l	< 1
Selenium	ug/l	6
Zinc	ug/l	< 5
Anions		
Chloride	mg/l	1040
Inorganics		
Ammoniacal Nitrogen as N	mg/l	0.2
Miscellaneous		
pH	pH units	7.7
Phenols		
Total Phenols	ug/l	< 1
Polyaromatic hydrocarbons		
Naphthalene GCMS	ug/l	0.02
Acenaphthylene GCMS	ug/l	< 0.01
Acenaphthene GCMS	ug/l	0.02
Fluorene GCMS	ug/l	< 0.01
Phenanthrene GCMS	ug/l	0.04
Anthracene GCMS	ug/l	0.01
Fluoranthene GCMS	ug/l	0.06
Pyrene GCMS	ug/l	0.05
Benzo (a) anthracene GCMS	ug/l	0.02
Chrysene GCMS	ug/l	0.03
Benzo (b) fluoranthene GCMS	ug/l	0.03
Benzo (k) fluoranthene GCMS	ug/l	0.03
Benzo (a) pyrene GCMS	ug/l	0.02
Indeno (1,2,3-cd) pyrene GCMS	ug/l	0.02
Dibenzo(a,h)anthracene GCMS	ug/l	< 0.01
Benzo(ghi)perylene GCMS	ug/l	0.03
Total PAH(16) GCMS	ug/l	0.39
BTEX		
Benzene	ug/l	< 1.00
Toluene	ug/l	< 1.00
Ethylbenzene	ug/l	< 1.00
Xylenes	ug/l	< 1.00
MTBE	ug/l	< 1.00

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Denbighshire County Council
County Offices
Wynnstay Road
Ruthin
LL15 1YN

Date: 06 March 2018
Test Report Ref: STR 581130

Order No: PO2168703

Page 1 of 1

Contract: Foryd Harbour , Rhyl

LABORATORY TEST REPORT

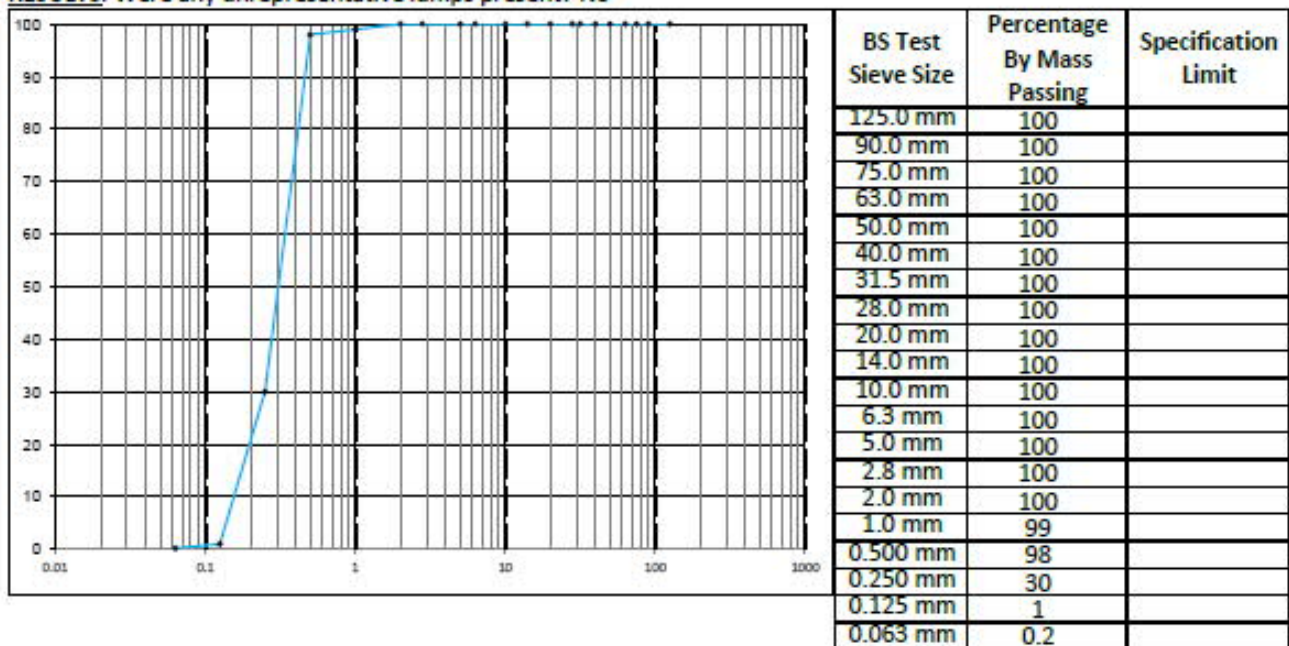
TEST REQUIREMENTS:

To determine the Particle Size Distribution (PSD) of a aggregate sample-
washing and sieving method in accordance with BS EN 933-1: 2012.

SAMPLE DETAILS:

Certificate of sampling received:	No	Name of Source:	Foryd Harbour, Rhyl
Laboratory Ref. No:	S71094	Method of Sampling:	Unknown
Client Ref. No:	Location 3 Sand / Sc	Sampled By:	Client
Date and Time of Sampling:	Unknown		
Date of Receipt at Lab:	14/02/2018		
Date of Start of Test:	28/02/2018		
Sampling Location:	Location 3		
Material Description	Sand / Soil		

RESULTS: Were any unrepresentative lumps present? No



Comments:

None

Report checked and approved by:

S Parry-Didcote

Sharon Parry-Didcote

Aggregate Team Coordinator

Denbighshire County Council
County Offices
Wynnstay Road
Ruthin
LL15 1YN

Date: 15 March 2018
Test Report Ref: STR 581131

Order No: PO2168703

Page 1 of 3

Contract: Foryd Harbour, Rhyll

LABORATORY TEST REPORT

TEST REQUIREMENTS:

To determine the chemical analysis of a sample as per client request.

SAMPLE DETAILS:

Certificate of sampling received:	No
Laboratory Ref. No:	571094
Client Ref. No:	Location 3 Sand / Soil
Date and Time of Sampling:	Unknown
Date of Receipt at Lab:	14/02/2018
Date of Start of Test:	05/03/2018
Sampling Location:	Location 3
Name of Source:	Foryd Harbour, Rhyll
Method of Sampling:	Unknown
Sampled By:	Client
Material Description:	Sand / Soil
Target Specification:	N/A

Results:

See Attached

Comments:

The work was carried out by our competent, sub contracted laboratory.

Report checked and approved by:

S Parry-Didcote

Sharon Parry-Didcote
Aggregate Team Coordinator

STR Ref: Test Report Ref: STR 581131Page 2 of 3

Metals		
Arsenic	mg/kg	13.3
Cadmium	mg/kg	< 0.5
Chromium	mg/kg	16.9
Copper	mg/kg	< 5.0
Lead	mg/kg	10.2
Mercury	mg/kg	< 0.5
Nickel	mg/kg	7.8
Selenium	mg/kg	< 1.0
Vanadium	mg/kg	32.3
Zinc	mg/kg	40.5
Anions		
Water Soluble Sulphate	mg/l	60
Inorganics		
Hexavalent Chromium	mg/kg	< 0.8
Total Sulphur	%	0.01
Total Potential Sulphate	%	0.04
Oxidisable sulphide (SO4)	% SO4	< 0.01
Acid Soluble Sulphate (SO4)	%	0.04
Water Soluble Boron	mg/kg	< 0.5
Miscellaneous		
Moisture Content	%	19.0
pH	pH units	8.8
Phenols		
Total Phenols	mg/kg	< 6
Polyaromatic hydrocarbons		
Naphthalene	mg/kg	< 0.1
Acenaphthylene	mg/kg	< 0.1
Acenaphthene	mg/kg	< 0.1
Fluorene	mg/kg	< 0.1
Phenanthrene	mg/kg	< 0.1
Anthracene	mg/kg	< 0.1
Fluoranthene	mg/kg	< 0.1
Pyrene	mg/kg	< 0.1
Benzo[a]anthracene	mg/kg	< 0.1
Chrysene	mg/kg	< 0.1
Benzo (b) fluoranthene	mg/kg	< 0.1
Benzo(k)fluoranthene	mg/kg	< 0.1
Benzo (a) pyrene	mg/kg	< 0.1
Indeno (1,2,3-cd) pyrene	mg/kg	< 0.1
Dibenzo(a,h)anthracene	mg/kg	< 0.1
Benzo[g,h,i]perylene	mg/kg	< 0.1
Total PAH(16)	mg/kg	< 0.4
BTEX		
Benzene	ug/kg	< 10.0
Toluene	ug/kg	< 10.0
Ethylbenzene	ug/kg	< 10.0
Xylenes	ug/kg	< 10.0
MTBE	ug/kg	< 10.0
TPH CWG		
>C5-C6 Aliphatic	mg/kg	< 0.01
>C6-C8 Aliphatic	mg/kg	< 0.01
>C8-C10 Aliphatic	mg/kg	< 1.0
>C10-C12 Aliphatic	mg/kg	< 1.0
>C12-C16 Aliphatic	mg/kg	< 1.0
>C16-C21 Aliphatic	mg/kg	< 1.0
>C21-C35 Aliphatic	mg/kg	< 1.0
>C35-C40 Aliphatic	mg/kg	< 1.0

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STR REF - Test Report Ref: STR 581131 Page 3 of 3

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LL15 1YN

Date: 15 March 2018
Test Report Ref: STR 581149

Order No: PO2168703

Page 1 of 1

Contract: Foryd Harbour, Rhyl

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Water Content of aggregates by – drying in a ventilated oven according to BS EN 1097-5: 2008

SAMPLE DETAILS:

Certificate of sampling received:	No
Laboratory Ref. No:	S71094
Client Ref. No:	Location 3 Sand / Soil
Date and Time of Sampling:	Unknown
Date of Receipt at Lab:	14/02/2018
Date of Start of Test:	28/02/2018
Sampling Location:	Location 3
Name of Source:	Foryd Harbour, Rhyl
Method of Sampling:	Unknown
Sampled By:	Client
Material Description:	Sand / Soil
Target Specification:	N/A

RESULTS:

Water Content (%) = 23.5

<u>Comments:</u> None	Report checked and approved by: <i>S Parry-Didcote</i> Sharon Parry-Didcote Aggregate Team Coordinator
---	---

Denbighshire County Council
County Offices
Wynnstay Road
Ruthin
LL15 1YN

Date: 15 March 2018
Test Report Ref: STR 581154

Order No: PO2168703

Page 1 of 1

Contract: Foryd Harbour, Rhyl

LABORATORY TEST REPORT

TEST REQUIREMENTS:

To determine the Permeability of a sample by the Constant Head Method in accordance with BS 1377: 1990: Part 5.

SAMPLE DETAILS:

Certificate of sampling received: No
Laboratory Ref. No: S71094
Client Ref. No: Location 3 Sand / Soil
Date and Time of Sampling: Unknown
Date of Receipt at Lab: 14/02/2018
Date of Start of Test: 09/03/2018
Sampling Location: Location 3
Name of Source: Foryd Harbour, Rhyl
Method of Sampling: Unknown
Sampled By: Client
Material Description: Sand / Soil
Target Specification: N/A

RESULTS:

Diameter of Permeameter Cell:	115 mm
Height of Permeameter Cell:	450mm
De aerated water used?	Yes / No
Proportion and size of material removed before preparing test sample:	1% >10mm
Method of placing and compacting:	Hand tamping / Placing under water
Dry Density:	1.545Mg/m ³
Coefficient of Permeability k at 20°C:	2.224x10 ⁻⁰⁵ m/sec

Comments:

None

Report checked and approved by:

S Parry-Didcote

Sharon Parry-Didcote
Aggregate Team Coordinator

Denbighshire County Council
County Offices
Wynnstay Road
Ruthin
LL15 1YN

Date: 15 March 2018
Test Report Ref: STR 581155

Order No: PO2168703

Page 1 of 1

Contract: Foryd Harbour, Rhyl

LABORATORY TEST REPORT

TEST REQUIREMENTS:

To determine the Dry Density and Moisture Content Relationship of soil
2.5kg Rammer Method in accordance with BS 1377: 4: 1990 Clause 3.3

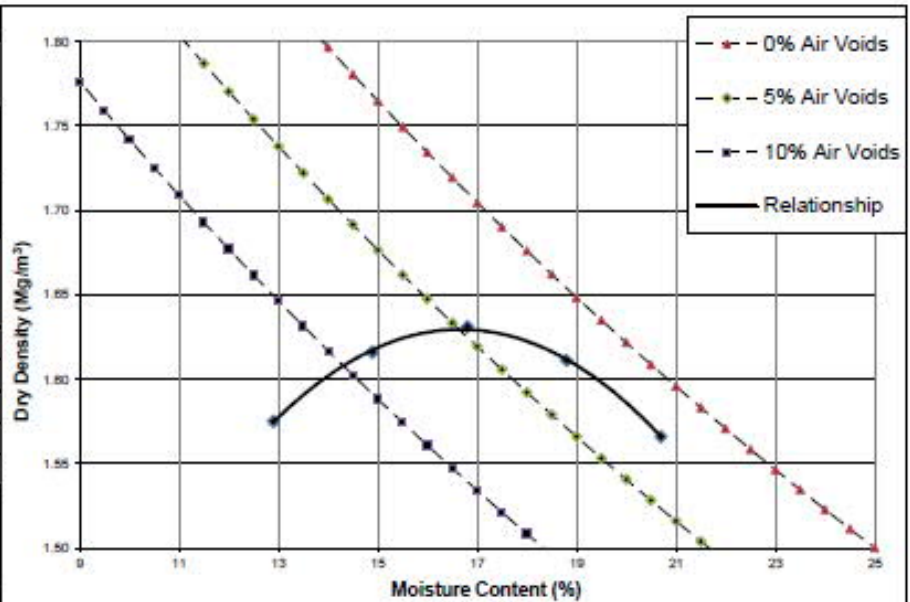
SAMPLE DETAILS:

Certificate of sampling received:	No	Name of Source:	Foryd Harbour, Rhyl
Laboratory Ref. No:	S71094	Method of Sampling:	Unknown
Client Ref.:	Location 3 Sand / Soil	Sampled By:	Client
Date and Time of Sampling:	Unknown	Unrepresentative lumps present?	No
Date of Receipt at Lab:	14/02/2018	Sample Preparation Procedure:	3.3.4.1
Date of Start of Test:	09/03/2018	Sample Preparation Method:	Single
Sampling Location:	Location 3		
Soil Description:	Sand / Soil		

RESULTS:

Particle Density: 2.4Mg/m³
(Assumed)

Retained on 37.5mm Sieve:	0 %
Retained on 20mm Sieve:	0 %
Moisture Content (%)	Dry Density Mg/m ³
12.9	1.58
14.9	1.62
16.8	1.63
18.8	1.61
20.7	1.57
Optimum Moisture Content (%)	Maximum Dry Density Mg/m ³
17	1.63



Comments:

None

Report checked and approved by:

S Parry-Didcote
Sharon Parry-Didcote
Aggregate Team Coordinator

Denbighshire County Council
County Offices
Wynnstay Road
Ruthin
LL15 1YN

Date: 15 March 2018
Test Report Ref: STR 581125

Order No: PO2168703

Page 1 of 3

Contract: Foryd Harbour , Rhyl

LABORATORY TEST REPORT

TEST REQUIREMENTS:

To determine the chemical analysis of a sample as per client request.

SAMPLE DETAILS:

Certificate of sampling received:	No
Laboratory Ref. No:	S71094
Client Ref. No:	Location 3 Water
Date and Time of Sampling:	Unknown
Date of Receipt at Lab:	14/02/2018
Date of Start of Test:	05/03/2018
Sampling Location:	Location 3
Name of Source:	Foryd Harbour, Rhyl
Method of Sampling:	Unknown
Sampled By:	Client
Material Description:	Water
Target Specification:	N/A

Results:

See Attached

Comments:

The work was carried out by our competent, sub contracted laboratory.

Report checked and approved by:

S Parry-Didcote

Sharon Parry-Didcote
Aggregate Team Coordinator

STR Ref: Test Report Ref: STR 581125Page 2 of 3

Total Metals		
Iron	ug/l	2270
Dissolved Metals		
Arsenic	ug/l	< 5
Cadmium	ug/l	< 1
Chromium	ug/l	< 5
Copper	ug/l	< 5
Mercury	ug/l	< 0.1
Nickel	ug/l	< 5
Lead	ug/l	< 1
Selenium	ug/l	< 5
Zinc	ug/l	< 5
Anions		
Chloride	mg/l	652
Inorganics		
Ammoniacal Nitrogen as N	mg/l	0.2
Miscellaneous		
pH	pH units	7.7
Phenols		
Total Phenols	ug/l	< 1
Polyaromatic hydrocarbons		
Naphthalene GCMS	ug/l	0.03
Acenaphthylene GCMS	ug/l	0.01
Acenaphthene GCMS	ug/l	0.03
Fluorene GCMS	ug/l	0.01
Phenanthrene GCMS	ug/l	0.05
Anthracene GCMS	ug/l	0.02
Fluoranthene GCMS	ug/l	0.05
Pyrene GCMS	ug/l	0.05
Benzo (a) anthracene GCMS	ug/l	0.03
Chrysene GCMS	ug/l	0.03
Benzo (b) fluoranthene GCMS	ug/l	0.04
Benzo (k) fluoranthene GCMS	ug/l	0.03
Benzo (a) pyrene GCMS	ug/l	0.04
Indeno (1,2,3-cd) pyrene GCMS	ug/l	0.02
Dibenzo(a,h)anthracene GCMS	ug/l	< 0.01
Benzo(ghi)perylene GCMS	ug/l	0.04
Total PAH(16) GCMS	ug/l	0.48
BTEX		
Benzene	ug/l	< 1.00
Toluene	ug/l	< 1.00
Ethylbenzene	ug/l	< 1.00
Xylenes	ug/l	< 1.00
MTBE	ug/l	< 1.00

STR REF - Test Report Ref: STR 581125 Page 3 of 3

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