Aberystwyth Marina: Marine Licence application for maintenance dredging

Water Framework Directive Assessment: Covering Note

This Water Framework Directive Assessment was produced in 2015 to support a marine licence application for water injection dredging in Aberystwyth Marina. A three-year licence was granted by Natural Resources Wales (NRW) on 6th March 2016 (Ref: DML1554).

The Marine Group is applying for a renewal of the above-mentioned marine licence, which expires on 7th March 2019.

According to the Environment Agency's Clearing the Waters for All guidance, which has been adopted by NRW, if the activity was carried out during 2009 to 2014 (when evidence was collected for the 2015 River Basin Management Plans) and a WFD Assessment has already been carried out, it is not necessary to repeat it unless:

- There is a change to how the activity is carried out, including method, size or scale, volume, depth, location or timings; or
- There has been a pollution incident since the activity was last carried out.

The method statement provided in Appendix B was prepared by the previous dredging contractor. As can be seen from the method statement submitted with the marine licence application, the principles of the water injection dredging methodology presented in the method statement are largely unchanged, and the assessment remains valid.

As there are no changes to the maintenance dredging activity, and there have been no pollution events since the activity was last carried out in May 2018, this 2015 WFD Assessment remains valid.

Sediment sampling analysis has been undertaken to support the marine licence application and the results have been submitted with the application.

THE MARINE GROUP

Anthony D Bates Partnership LLP
Dredging, Harbour & Coastal Consultants

Aberystwyth Marina

Water Framework Directive Assessment

October 2015

Project Nr
458

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Client :	The Marine Group
Project :	Aberystwyth Marina Maintenance Dredging
Title :	Aberystwyth Marina - Water Framework Directive Assessment

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Final Revision 1	**NAME**	**NAME**
DATE	**SIGNATURE**	**SIGNATURE**

Prepared by: **Reviewed by:**

Revision 2	**NAME**	**NAME**
DATE	**SIGNATURE**	**SIGNATURE**

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1. Introduction

1.1. Purpose of this report

Aberystwyth Marina, recently purchased by The Marine Group, from Ceredigion District Council, propose to continue with the historical method of maintenance dredging to maintain the required berthing depths within the marina. Currently, the vessels within the marina are beached at low tide (See Figure 1) due to progressive siltation since the previous dredging campaign. Although under the local Harbour Act Ceredigion District Council has powers to dredge it must comply will all other pertinent legislation to ensure de minimus impact on the sounding environment. To this end Natural Resources Wales (NRW) were consulted and indicated that a Water Framework Directive (WFD) assessment and a Habitat Regulations Assessment (HRA) would be required to be undertaken. This document focuses on the Water Quality aspects of the proposed dredging method and outlines whether this individual pre-existing maintenance dredging-related activity needs further assessment to establish if it complies with the Water Framework Directive. Ceredigion District Council will be the Appropriate Authority to review and approve all associated reports for the proposed maintenance dredging of the marina.

1.2. Legislative Background

The purpose of the WFD is to establish a framework for protecting inland surface waters, transitional waters, coastal waters and groundwaters. The EU Water Framework Directive was transposed into Welsh law as the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003. The requirements of the Directive need to be considered at all stages of the river and coastal planning and development process. The framework for delivering this Directive is through the River Basin Management Plans (RBMPs). Each RBMP has been characterised into smaller management units known as 'Water Bodies'.

A default Objective in all Water Bodies is to prevent deterioration in either the Ecological Status or, for Heavily Modified Water Bodies (HMWBs) or Artificial Water Bodies (AWBs), the Ecological Potential of the water body. Any activity which has the potential to have an impact on ecology (as defined by the biological, physico-chemical and hydromorphological Quality Elements (BQEs) listed in Annex V of the Directive) will need consideration in terms of whether it could cause deterioration in the Ecological Status or Potential of a water body.

Where there are sites designated under EU legislation (e.g. the Birds or Habitats Directives, Shellfish Waters Directive), the Directive aims for compliance with any relevant standards or objectives for these sites. Therefore, where a site which is water-dependent in some way is protected by designation under another EU Directive, and the Good Ecological Status (GES) or Good Ecological Potential (GEP) targets set under the Water Framework Directive would be insufficient to meet the objectives of the other Directive, the more stringent targets would apply.

Ecological Status is expressed in terms of five status classes – high, good, moderate, poor or bad. These classes are established on the basis of specific criteria and boundaries defined against biological, physico-chemical and hydromorphological elements (which are set out in Annex V of the WFD); these are shown in Table 1 below.

Type	Description
Biological assessment	Uses numeric measures of communities of plants and animals (e.g. fish, macrophytes).
Physico-chemical assessment	Looks at elements such as temperature and the level of nutrients, which support the biology.
Hydromorphological quality	Looks at water flow, sediment composition and movement, continuity (rivers) and the structure of physical habitat.

Table 1 Definition of Quality Elements

The overall ecological status of a 'Water Body' is determined by whichever of these assessments is the poorer. A Water Body might achieve 'Good Status' for chemical and physico-chemical assessments, but only achieve 'Moderate Status' for the biological assessment; in this case it would be classed overall as having 'Moderate Ecological Status'. To achieve the overall aim of good surface water status, the WFD requires that surface waters be of at least GES and Good Chemical Status (GCS).

The WFD recognises that physical alterations may have been undertaken to support the use of a Water Body for a particular purpose (e.g. water storage, coast or flood defence, navigation, etc). If this reason is still valid the Water Body may be designated as a HMWB, with the requirement to achieve GEP rather than GES.

1.3. Location

Aberystwyth Marina is a tidal drying harbour in West Wales with a spring tide tidal range of approximately 4.3m (Figure 1). The harbour was initially used for the exportation of lead, silver and copper ore and the import of timber, shop goods and other products from

Liverpool, Bristol and London. Shipbuilding and foundries were also present in the harbour. Commercial trade has now effectively ceased, however, the RNLI still maintain a base at this location. The 160 berth marina opened in 1995, with a target dredged level of -2.3mCD allowing berthed vessels to stay afloat at all states of tide.

Figure 1 Overview of layout of Aberystwyth Marina at low tide

The town of Aberystwyth is a popular seaside resort. To the west of the marina outside of the northern breakwater is a large west facing gravel beach. Further to the South beyond the southern breakwater a pebble beach is located. Both are used during the summer by locals and tourists.

Figure 2 Gravel and Pebble beaches surrounding Aberystwyth Marina

2. Harbour Act

The marina at Aberystwyth falls within the jurisdiction of the local harbour authority, managed by the local District Council of Ceredigion. The Harbour Authority, under its local act, has powers to permit it to dredge. For Harbour Authorities, dredging under the powers granted to them by Harbour Orders/Acts, exemption in Section 75 of the MCAA may apply. The local act states in Clause 24 the following:

"Subject to the provisions of this Act the Council may from time to time deepen, widen, dredge, scour, cleanse, alter and improve the bed and foreshore of the harbour…."

The full Harbour Act has been included in Appendix A for review.

Based on the above the District Council are the regulators of dredging within their harbour limits. However, sufficient and proper assessment of potential impacts must be undertaken and distributed for comment to appropriate consultees.

Natural Resources Wales (NRW) have been consulted to ascertain if they consider Water Injection Dredged to have both a dredging and disposal elements. After review NRW stated that they consider the dispersal of sediment by water injection dredging (and plough dredging) not to involve a "deposit" in terms of a licensable activity under the Marine and Coastal Access Act 2009.

3. Historical Dredging - Frequency, Timing and Extent

Maintenance dredging within the harbour has been undertaken in two ways in recent times. Firstly, the main River Rheidol flow channel is regularly maintained by land excavation plant (Figure 3) at times of low water. This activity is undertaken under a marine licence (DML1421) granted by NRW, with the material recovered being placed on the local gravel beach as nourishment material. The licence permits 2,000m³ of material to be dredged and relocated. The licensed area is highlighted approximately in red in Figure 4.

Figure 3 Dredging of the harbour in 2008

Further to the dredging of this area the marina was established in 1995 by the reduction of bed levels using land based methods The excavated material was used as fill for the building developments around the periphery of the new marina. Subsequent to this initial dredge maintenance dredging has been undertaken sporadically. Limited information is available on these activities but the most recent dredging was undertaken by the Harbour Authority in 2008. Water Injection Dredging was utilised to reinstitute the navigational levels at that time.

Figure 4 Dredging Areas within the Harbour limits

The timeline of the historic dredging activities, in the above area, is presented in Table 2.

Duration	Area	Method
8th - 12th March 2001	North End of Basin - Gravel	Land based machinery
9th - 24th Feb 2004	Main Basin – Fine Grained	Ploughing
19th Nov – 16th Dec 2007	Main Basin – Fine Grained	Water Injection Dredging
8th - 12th March 2008	North End of Basin - Gravel	Land based machinery
18th - 26th March 2011	North End of Basin - Gravel	Land based machinery
11th - 15th March 2013	North End of Basin - Gravel	Land based machinery

Table 2. Timeline and characteristics of Dredging Campaigns

Based on the above information gravel extraction by land based machinery, plough dredging and water injection dredging are all pre-existing activities having being undertaken prior to 2009.

4. Proposed Dredging

The proposed dredge area is identical to that undertaken in 2008/9, approximately outlined in blue in Figure 4. The average dredge target level within this area is -1.7mCD. To achieve this levels across the site a dredging tolerance of 0.3m would require to be implemented. This results in a maximum dredge level of -2.0mCD. Using this lower level the maximum dredge

volume is calculated to be approximately 32,000m³. Due to economic constraints and the presence of coarse grained material it is very unlikely that all of this volume will be dredged.

For clarity the dredge area coordinates in UK National Grid are:

258121.41, 281241.02
258148.20, 281205.14
258167.20, 281182.09
258171.65, 281174.40
258176.50, 281154.18
258172.86, 281136.80
258159.92, 281119.00
258134.85, 281095.15
258067.32, 281030.04
258051.96, 281050.26
258057.62, 281089.08
258063.28, 281122.64
258069.34, 281163.49
258074.88, 281201.72
258083.14, 281234.75

The proposed dredge method to be employed is Water Injection Dredging (WID). The WID plant consists of a small floating pontoon with a powerful water pump and injection arm attached. The pontoon is manoeuvred by its own propulsion system or attached tug. The injection arm is passed over the area to be dredged as the pontoon is manoeuvred, the height of the injection arm is also controlled during this. The system involves high volume but low pressure water being injected into the sediments on the seabed. The low pressure injection fluidises the sediments which will then flow as a dense fluid via natural seabed gradients towards lower bed levels. The density flow enters only the lower fraction of the water column. A detailed method statement from the contractor has been included in Appendix B.

Figure 5 Example of Van Oord's water injection plant

The duration of works is expected to take approximately 12-14days. Work will only occur during the period of 1 hour before high tide to 1 hour before low tide on both falling tides each day, hence limiting operations to approximately 12hrs per day with a 6 hour window of no dredging operations on rising tides. It is planned that the works will be undertaken in the winter months to ensure sufficient water depths are in place for the important spring/summer recreational period and aid coastal dispersion characteristics.

5. Sediment Quality Data

A number of samples were collected from various areas around the marina on the 27th September 2015. In total 6 samples were acquired from 3 locations. A sample at each location was taken from the surface and also from approximately 1.5m below the bed level. This was undertaken to allow an assessment of the vertical, as well as horizontal, distribution of sediment compositions though the proposed dredge area.

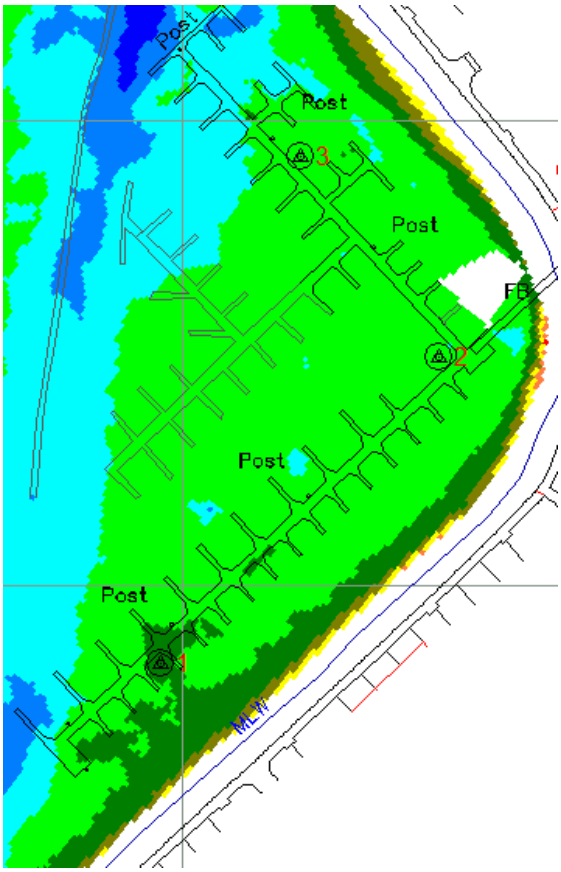


Figure 6 Sample locations in Aberystwyth Marina

The sediment was tested to determine its physical characteristics to inform the dredging method selection. The particle size distribution results area as follows:

The sediment was also tested for heavy metals, PAH's and TBT's and have been compaired against the CEFAS action levels. The results are surmised in the Table ???. The lab results are also included in Appendix C

It can be seen that….

6. Relevant River Basin Management Plan

The river basin management plan, pertinent to Aberystwyth Marina is West Wales, local water body is Ystwyth/Rheidol. Its current quality status is outlined in Table 2. The water body is classified as a Heavily Modified Water Body (HMWB) due to the presence of coastal protection structures. The failure to achieve good ecological potential by 2015 has been justified as it was "technically infeasible (M3f)" and "disproportionally expensive". GEP is now targeted for 2027 for this water body.

Water Body Name	Ystwyth/Rheidol
Water Body ID	GB511006315000
River Basin District	Western Wales
Typology	Partly mixed, meso
Hydromorphological Status	Heavily Modified
Current Ecological Quality	Moderate Potential
Current Chemical Quality	Does Not Require Assessment
2015 Predicted Ecological Quality	Moderate Potential
2015 Predicted Chemical Quality	Does Not Require Assessment
Overall Risk	At Risk
Protected Area	Yes
Number of Measures Listed	5
Hydro Morphological Quality:	
Overall Hydro Morphological Quality	Not High

Table 3 Current quality status (2009) of Ystwyth/Rheidol River Body

The extent of this water body is presented in Figure 7 below.

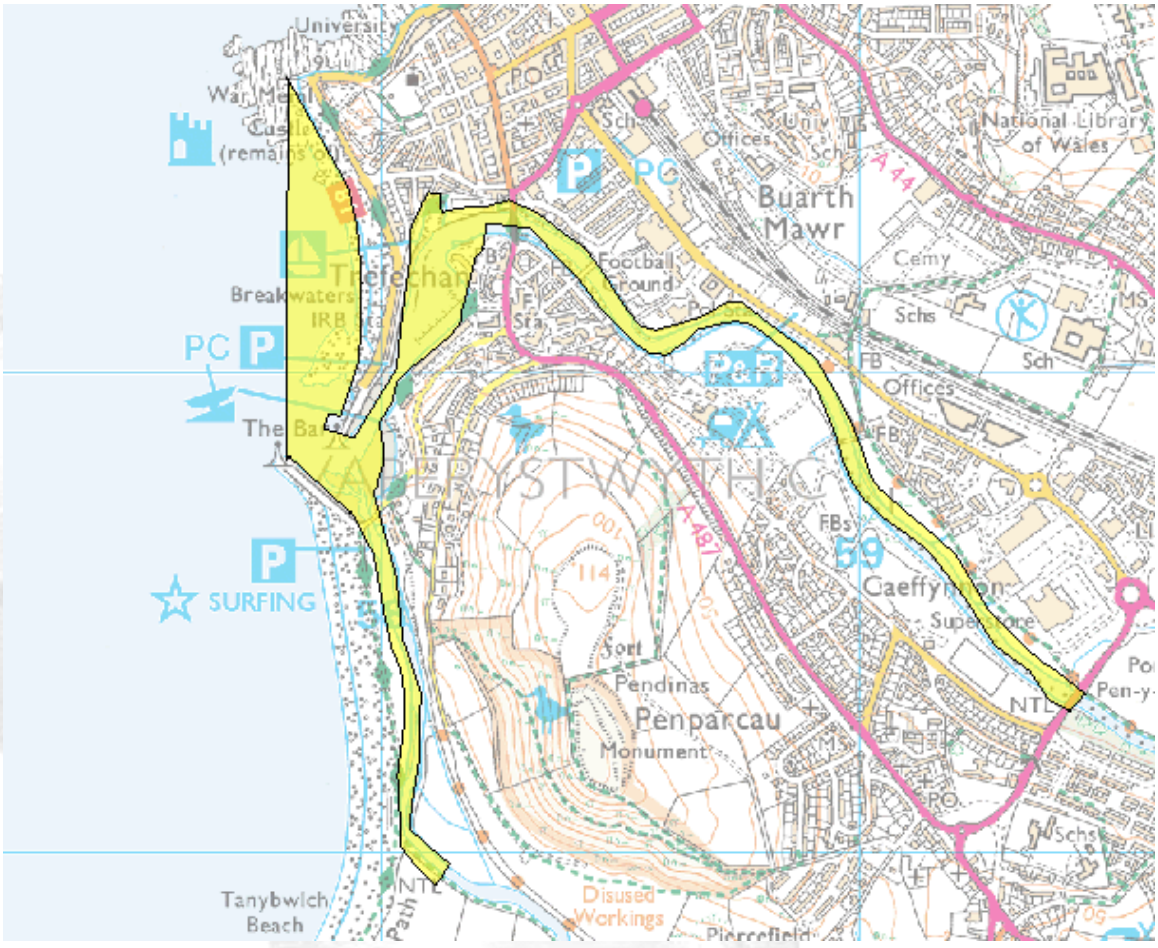


Figure 7 Extent of Ystwyth/Rheidol HMWB

7. Locally Designated Waters

The planned maintenance dredging area does not lie within any protected aquatic area, nor does it have any protected areas adjacent to the dredging site. There is one protected aquatic areas (SAC), *Lleyn Peninsula and the Sarnau Country*, located within 5km of the dredging site, as highlighted by the blue hatching in Figure 8.

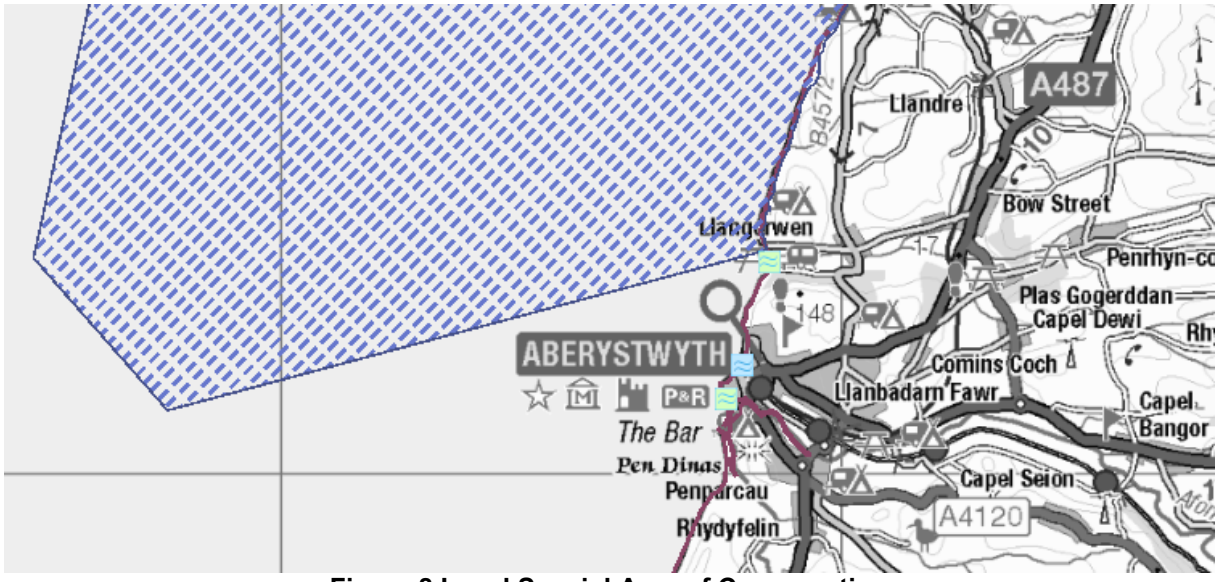


Figure 8 Local Special Area of Conservation

This SAC consists predominantly of large shallow inlets and bays and reefs. The direct distance between the dredging site and this SSSI is approximately 3km. However, for the sediment to be transported by local currents around the local coastal protection structures the distance is increased to a minimum of 4km. As the council is the Competent Authority a Test for Likely Significance (ToLS) has been undertaken as a Habitats Regulations Assessment. This document accompanies this report in the dredging application.

Further to the SAC above, two local bathing water areas are also designated. Their position is presented in Figure 8 by the blue and green symbols. Their details are:

Name	Aberystwyth South	Aberystwyth North
Reference	38800	38900
Bathing Water Type	Coastal	Coastal
Compliance Type	Imperative	Guideline
Sampling Point Grid Reference	SN5794281314	SN5823881898

Table 4 Details of local designated bathing waters

The nearest of these bathing waters is located on the northern beach displayed in Figure 8. This is approximately 1km by local current transport from the dredging site. The dynamics of a coastal area dictate what sediment is retained by the system. In this case the beach

consists of gravel material, with smaller particles such as sand and silt being washed away. The nourishment of the beach with material from the harbour area is successful due to the composition of the material being largely gravel in nature. The southern beach being made up of pebble material is further evidence of the high energy environment present. The high energy environment will ensure that the material relocated by the proposed dredging activity will be dispersed sufficiently and that any impact on bathing waters will be de minimus. To further mitigate any impact of the short term and intermittent elevated suspended solids levels the dredging will be carried out during the winter when the public use of the beaches is low and the expected marine energy levels will be high.

8. Potential Impact on Water Body

As discussed in Section 1 the WFD recognises that some water bodies have been physically altered, for example for navigation or flood defence, and allows for these water bodies to be designated as Heavily Modified Water Bodies (HMWB) or Artificial Water Bodies (AWB) and need to achieve good ecological potential rather than ecological status. Ecological potential means that the water body is managed to achieve the biology that can be achieved given its modified condition.

As detailed in Table 2 the relevant water body has a current status of moderate potential, with GEP aimed to be achieved by 2027. The dredging activity itself only takes place over certain periods of the day, as highlighted in Section 2.5, and currently at a frequency of one campaign every seven years. The local environment already contains a high suspended sediment load and the increases in suspended solids associated with the dredging activity will be temporary and are anticipated to be within the envelope of normal background levels at high tide.

The proposed form of dredging has been undertaken previously with no negative effects noted by the council or any third party. That particular campaign was carried out in conjunction with a significant monitoring program involving sediment samples and tracers. No significant impact of the dredging was detected by the study. There is no evidence that indicates that the minor maintenance dredging that is undertaken regularly has led to, or could lead to, a deterioration in the status of the water body or otherwise affect the future ability of the water body to meet GEP. As detailed in the dredging methodology above the sediment is re-fluidised and uses the local currents to continue its natural pathway, which would have been the case should the marina not been constructed. This dredging practice is widely regarded as a beneficial use of the material, known as sediment cell maintenance, as

it retains the naturally occurring sediments in the local environment rather than removing it to a distant environment, potentially impacting on offshore ecosystems in the vicinity of the disposal site.

Based on the above, the potential effects on the local water body from the proposed water injection dredging campaign are deemed to be negligible.

No ground water bodies are likely to be impacted by the proposed works.

9. Alternative Dredging & Disposal Methods

Due to the method of dredging proposed no material is excavated from the aquatic environment, therefore no disposal operation takes place. By using the WID dredging method the required depths can be maintained by regular small scale WID campaigns. Should other, more intrusive, dredging methods be employed it would make economic sense to dredge much higher volumes but probably less frequently.

The recovery of the material from the aquatic environment by other methods would also have very substantial cost implications. Substantially larger dredging plant would be required to excavate the sediment. Ancillary plant would also be required for transportation the dredged material to an offshore disposal site, of which there is none present locally. The cost of implementing such a process could increase the dredging costs by more than 300%. Alternatively, beach nourishment or land reclamation is not feasible due to the very fine nature of the sediment.

Alternative disposal to land has been considered, but the spoil would have to be dewatered or dried and transferred by truck via busy roads and a densely populated area. If spoil was not dewatered then trucks would be needlessly transferring seawater along with the spoil to a land based waste facility. The high potential for spills during transfer from vessel to truck and from truck spillages on roads will have consequential additional environmental impact. An alternative site for dewatering operations and recovery would also be required as the required space is not available onsite; such a site could not be identified.

10. Conclusions

The proposed pre-existing method of maintaining the marina navigational channels and berths is the most economic and environmentally sustainable option available.

The volumes being dredged and relocated within the dynamic environment are considered to be minor. The frequency and duration of operations are also minimal. The restricted dredging hours each day also ensures that limited material is relocated daily, promoting a trickle charge regime of the local downstream and coastal areas.

The proposed dredging process is an established pre-existing technique with no recorded impacts on the local environment, including local river basins, coastal waters or third parties. It is concluded that the proposed dredging will not cause a non-temporary deterioration in status at water body level or otherwise affect the ability of the water body to achieve either its WFD objectives or relevant water-related protected area objectives.

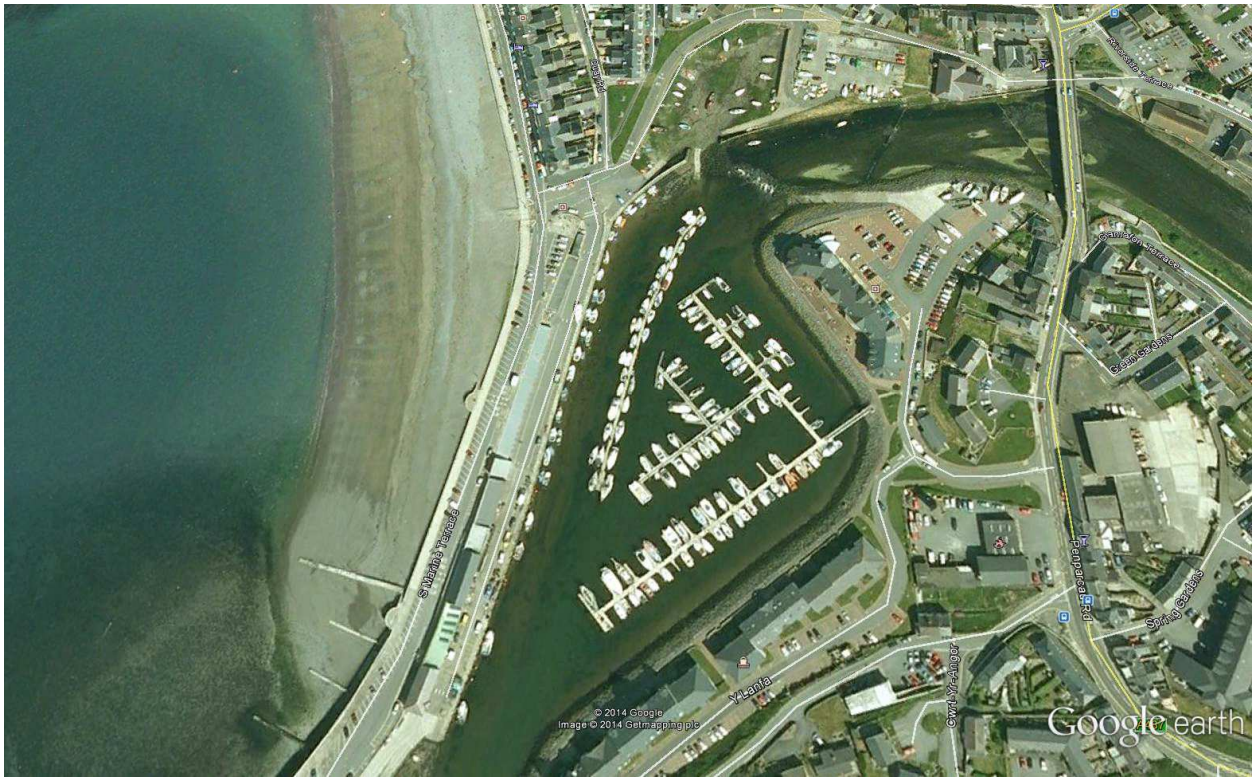
Appendix A – Local Harbour Act

Appendix B – Dredging Method Statement

Project:	**Aberystwyth Basin Maintenance dredging**	Page:	1 of 12
Project no	**20.xxxx**	Revision date:	09-Oct-2014
Client	**The Marine Group**	Reference:	GOO

Method Statement

Dredging at Aberystwyth Basin



Aberystwyth Basin

IMPORTANT

Any changes to working methods not identified within this method statement, will involve cessation of the works until a full risk assessment has been conducted on these changes and the method statement has been altered accordingly to reflect these changes. Advice from the QHSE Department should also be sought on these changes.

	Function	Initials	Date	Signature
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Verified by				
Approved by	Godfried van Oord	GOO	09-Oct-2014	
Authorized by				
Document owner	Staff Manager QHSE			

Revision record

Revision Number	Description	Date
1.0	First Issue	09-Oct-2014

Supporting documents

Document Number	Document Name

Table of Contents

1. Introduction

1.1 General Project Description

Aberystwyth Basin is situated at the West Coast of Wales.

Maintenance dredging of the marina basin and marina channel has been carried out in 2007 but significant siltation is ongoing and the latest survey shows a reduced clearance at LAT of approximately 1m. Dredging is required to a maximum depth of:

- Marina Basin: Subject to an updated survey but an estimated 2 meter layer of silt has to be removed

1.2 Scope of this Document

The purpose of this Method Statement is to give an adequate description of the dredging, disposal and survey methods to be followed and the precautions to be aware of in carrying out the works. This Method Statement will ensure that the works will be carried out in a safe, secure and efficient way. The Risk Assessment is part of this Method Statement and should be seen as a 'live' document which will be altered if there is any change in circumstances or knowledge

The sequence of operations described in this document is governed by weather and tidal conditions.

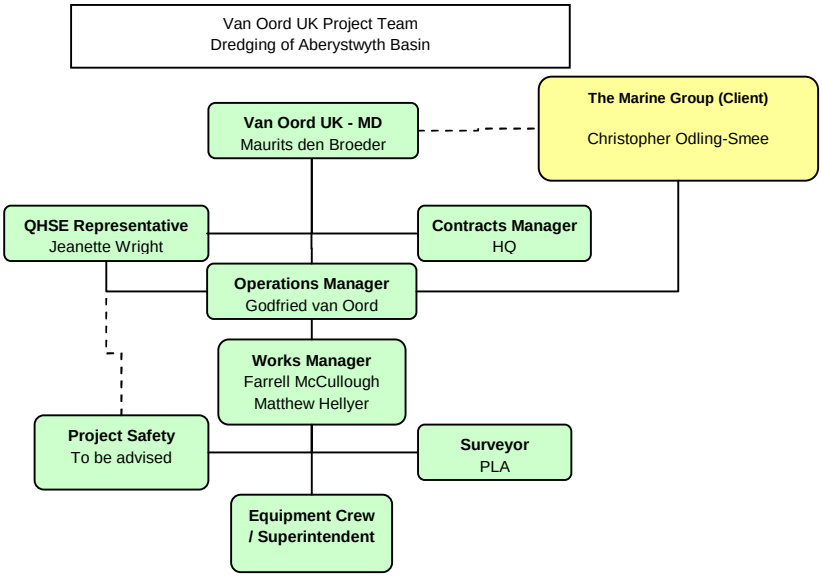
This Method Statement has developed and will be implemented with the health and safety and welfare of all personnel, the public, wild life and the environment being of utmost priority.

The contents of this Method Statement are to be verbally communicated to the workforce involved by the Project Manager the day prior to the task commencing, this ensures that the correct personnel, tools and equipment are in place and gives enough time for suggestions or additional control measures identified during the briefing to be included within the Method Statement, prior to the task commencing on each location.

The Method Statement will then be re-briefed in the form of a toolbox talk on the day of the activity, to ensure that the requirements are fully understood. Feedback from the workforce is encouraged

1.3 Responsibilities

The achievement of a satisfactory standard of quality is the responsibility of all those assigned to the project. The description of the responsibilities involved in the management of the site project team is provided in the table below.



The following site staff have the following responsibilities:

- Works Manager: Overall responsibility for ensuring safe working systems and control;
- Superintendent: Coordination of the works, liaise with Captain/crew;
- Surveyor: Responsible for all surveying work, contractual and requested.

2. Health, Safety & Environment

Van Oord will execute all works in line with Contract requirements, UK legislation, European, and International Guidelines and Standards. In view of the potential hazards for this type of work in these circumstances and in addition to the project related procedures, special attention is drawn to, but not limited to, the following:

2.1 Health and safety

In order to arrange, provide and maintain safe systems of work for all employees at all times:

- Areas of HSE responsibility will be clearly defined and relayed to the whole project team;
- Adequate and proper facilities, equipment and apparatus will be provided and its correct use will be ensured, Through training, all areas are to be kept clean and tidy and personnel will be responsible for ensuring their equipment is stored correctly at all times.
- Adequate training, instruction and information on Site specific Health, Safety and Environmental hazards and risks will be provided.

- A pro-active approach will be taken to Health, Safety and the Environment at all times, hazard spots and near miss reporting will encouraged throughout the duration of the project and any incidents will be investigated ensuring that procedures and / or RAMS are updated appropriately.

2.2 Personnel

All construction personnel involved in the work will observe the following basic working rules, amongst others:

- Relevant personnel protective equipment (PPE) will be issued and used prior to the commencement of the work;
- PPE shall be worn at all times on site with exception of the dedicated safe area(s) and welfare facilities;
- Proper training and induction in the various roles for the type of activity will be performed;
- Experienced and active supervision will be in place at all work times.

At least the following PPE should be worn to execute the works as described in this Method Statement:


Hi-Viz


Safety Shoes


Helmet


Life Jacket

The indicated PPE should be worn at all times, excluding when inside the ships accommodation area.

The Life Jacket Must be worn when working near open water where no sufficient handrail or edge protection is present or when accessing / egressing the vessel

2.3 Reporting of incidents and near misses

Incidents and near misses will be timely reported in compliance Van Oord corporate procedure.

2.4 Emergency response

Emergency Response will be in compliance with Van Oord corporate procedure and the project Emergency Response Plan which is on board the dredger.

Before the start of the Project an actual plan with actual names and numbers will be made and provided to all concerned.

2.5 Risk assessment

Risk assessments will be carried out in order to identify and control all hazards to the activities and to associate the risk and/or reduce it to acceptable levels. The risk assessment for this method statement can be found in appendix 1.

2.6 Environment

In order to minimize environmental impacts arisen from the work based on ecological knowledge and on regulatory background the following measures will be taken:

- All personnel will be appropriately trained about environmental issues prior to the start of the operation;

- All equipment will be in good condition to avoid spillage or discharge of oil, smoke and excessive noise;
- Refuelling will be carried out by competent and trained people away from any environmentally sensitive areas; and dredger to be moored up securely.
- An appropriate waste container will be placed to collect waste before the final disposal by authorised company and hazardous material storage areas will be identified, labelled, and properly marked and fitted with spill containment systems;
- Dredger will be checked for any fuel / oil leaks on a regular basis by the crew.
- Any spills we be reported immediately to the site agent/authorities
- In the event of a major spill due to damage to the dredger. Locate and isolate, inform harbour authorities, Project manager and environmental agency.

2.7 Pre-Check Procedure

Prior to commencing operations, all vessels, plant and machinery will hold relevant up-to-date certification, carry sufficient emergency oil spill kits, first aid kits and be more than adequate for their respective responsibilities.

Weather reports, both long and short range, will be available on a daily basis.

All relevant stakeholders will be informed of all operational movements

2.8 Training

All personnel will be competent, experienced and hold all relevant certifications, a copy of which will be held on the site files. VOUK will provide further training, as and when required. Safe working methods will be relayed to all personnel through RAMS Briefings and toolbox talks, this will also take place following any revisions and changes to the RAMS

3. Equipment

3.1 Equipment for maintenance dredge [WID]

WID dredger 'Odin'

Construction	2007
Dimensions Length overall	17.50m
Breadth	4.50m
Moulded depth	1.80m
Draught maximum	1.45m
Maximum dredging depth	12m
Width injection pipe	4.40m
Propulsion 2 x	89kW
Total power installed	410kW
Jet pump	220kW

4. Working Method

4.1 Working Method WID

Van Oord UK Ltd is the operator of the dredging system known as Water Injection Dredging. The Water Injection Dredging system is unique. The silt is re-liquefied by low-pressure injection of water. The layer thus formed is a liquid denser than water, which flows under the forces of nature present in the area, and for the works above, these would essentially be the friction force of the current flow together with the gravitational force of the bed slope. Over time the density layer will develops and merges back into the natural sediment transport system. It is unlikely that measurable deposits will return. Within the confines of the area, the layer formed will flow principally under the gravitational force of the bed slope only.

A short 6 minute movie about the WID process can be seen by following the link:

www.vimeo.com/69300630 [no login required]

PIANC report no 120-2013 setting out all relevant WID aspects is provided in Appendix 2

4.2 Scope of Works

To clear accumulated silts and fine sands from the dredge areas at Aberystwyth Basin as defined in the drawing with no: xxx [client to provideshown below]. Maintenance dredging of the marina + channel is to be done to a maximum depth of:

- Marina Basin: target dredge depth no more than [client to advise] m below CD

Estimated volume to be removed:

- Marina Basin: (17,000m2 x 2m deep = 34,000m3)

4.3 Sequence of Works

Mobilization:
Mobilisation date of the dredger(s) will be communicated well ahead of the actual start to all relevant stakeholders. A mobile crane will be set up at a quay to lift the dredger from the lowbed into the harbour. Separate lifting plans will be prepared and submitted prior to the lifting operations.

Dredging Operations
Once the equipment is ready to start operations, the tidal shift will commence 1 hr before high tide. The temporary flow channel will be maintained at 0.10m below target dredge depth from the furthest end of the dredge box towards the deeper area outside the dredge area. This channel will be maintained during the dredging of the dredge box. Then dredging will commence from both sides of the flow channel towards the end of the box. Bar depth will be logged and the areas dredged will be logged by DGPS. A tide gauge will be installed near the dredging areas.

Once the dredge depth is achieved then clients surveyor [or if required our surveyor] will be notified to plan the post survey. The objective is to maintain the dredge area to design parameters.

Demobilization:
Once the dredgeareas are dredged as per specifications the dredger(s) will be demobilized to other projects

Fuelling Operations:
Our crew is trained in safe fuel transfer procedures.

4.4 Daily programme

WID
The dredging programme will be to work on a 6 hour working window and 6 hours off for the crew.
Start of working window 1 hour before high water to 5 hours after.

Total duration of the works 9-11 days day and night tidal work.

4.5 Limitations
Big rocks or boulders and/or debris can't be removed by using the water injection dredger but will be marked on the survey if applicable.

5. Survey Data

The positioning of the dredger will be done by Differential Global Positioning System (DGPS)

In order to obtain continuous tidal data, a temporary (vessel owned) tide gauge will be installed at the site. The data transmitted by the gauge will constantly update the dredger's onboard navigation system so the reduced depth of the injection bar is always known.

Before the start of the works a pre-survey will be carried out and the xyz data installed on to the dredger's real time navigation system so the crew can see what has to be dredged.

Before carrying out the post survey it is recommended that you let a period of 4-5 days elapse to allow the material in the area to completely disperse.

Survey information on each dredge area will be stored with project manager.

Appendix 1 Risk Assessment

Appendix 2 PIANC report 120-2013

Appendix C – Sediment Quality Test Results

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Test Certificate

Client: Minton, Treharne & Davies Limited
Merton House, Croescadarn Close, Cardiff, CF23 8HF
Site: Sediment samples received 1/10/15
Date Tested: 05/10/15, 06/10/15, 09/10/15
Date Reported: 23 November, 2015
Date Received: 1 October, 2015
Sample Type: Solid

Certificate No: 15/4919/RG/S/C2
File No: 15/4919/RG/S
Client Ref: L/30340/15

Lab sample ref:	**C222947**	**C222948**	**C222949**	**C222950**	**C222951**
Client sample ref:	**R15-14457 38880**	**R15-14457 38881**	**R15-14457 38882**	**R15-14457 38883**	**R15-14457 38884**
Date sampled:	**27/09/15**	**27/09/15**	**27/09/15**	**27/09/15**	**27/09/15**
Sample matrix (see notes page):	**S**	**S**	**S**	**S**	**S**

Determinand	Method	Units	ISO17025	LOD					
Deviation Assessment									
Deviation(s)	C. Review	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Metals									
Arsenic	AN8b	mg/kg	Y	2	11	12	13	12	12
Cadmium	AN8a	mg/kg	Y	1	<1	<1	<1	<1	<1
Chromium (total)	AN8b	mg/kg	Y	2	24	25	27	25	26
Copper	AN8b	mg/kg	Y	2	19	21	20	20	23
Lead	AN8b	mg/kg	Y	2	71	94	75	93	72
Mercury	AN8a	mg/kg	Y	1	<1	<1	<1	<1	<1
Nickel	AN8b	mg/kg	Y	2	25	25	26	25	26
Selenium	AN8a	mg/kg	Y	1	<1	<1	<1	<1	<1
Zinc	AN8b	mg/kg	Y	2	180	199	171	189	177
Cadmium (lower level)	AN49	mg/kg	N	0.05	0.41	0.60	0.49	0.68	0.35
Mercury (lower level)	AN49	mg/kg	N	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Sample Prep(C)									
EMR	EMR	%	N	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
% Stones	Stones	%	N	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Moisture Content @ <30°C	AN1	% w/w	Y	0.1	47.6	46.8	52.3	48.1	48.4
Sample Description	MCERTS ver4.		N		7	7	7	7	7
PAH (USEPA16)									
Acenaphthene M	GCM501	mg/kg	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene M	GCM501a	mg/kg	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene M	GCM501	mg/kg	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benz(a)anthracene M	GCM501	mg/kg	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene M	GCM501	mg/kg	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b)fluoranthene M	GCM501	mg/kg	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)perylene M	GCM501	mg/kg	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(k)fluoranthene M	GCM501	mg/kg	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene M	GCM501	mg/kg	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenz(a,h)anthracene M	GCM501	mg/kg	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene M	GCM501	mg/kg	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene M	GCM501	mg/kg	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-cd)pyrene M	GCM501a	mg/kg	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Naphthalene (PAH) M	GCM501	mg/kg	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene M	GCM501	mg/kg	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene M	GCM501	mg/kg	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
PAH (USEPA16) Total M	GCM501	mg/kg	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Organotin									
Dibutyl Tin	subcontract*	mg/kg	N	0.02	<0.04	<0.04	<0.08	<0.04	<0.04
Tributyl Tin	subcontract*	mg/kg	N	0.02	<0.04	<0.04	<0.08	<0.04	<0.04
Triphenyl Tin	subcontract*	mg/kg	N	0.02	<0.05	<0.05	<0.08	<0.05	<0.05
Tetrabutyl Tin	subcontract*	mg/kg	N	0.02	<0.04	<0.04	<0.08	<0.04	<0.04
Monobutyl Tin	subcontract*	mg/kg	N	0.02	<0.15	<0.15	<0.15	<0.15	<0.15
Monophenyl Tin	subcontract*	mg/kg	N	0.02	<0.04	<0.04	<0.08	<0.04	<0.04
Diphenyl Tin	subcontract*	mg/kg	N	0.02	<0.04	<0.04	<0.08	<0.04	<0.04

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Date Tested: 05/10/15, 06/10/15, 09/10/15
Date Reported: 23 November, 2015
Date Received: 1 October, 2015
Sample Type: Solid

Certificate No: 15/4919/RG/S/C2
File No: 15/4919/RG/S
Client Ref: L/30340/15

Lab sample ref:	**C222952**
Client sample ref:	**R15-14457 38885**
Date sampled:	**27/09/15**
Sample matrix (see notes page):	**S**

Determinand	Method	Units	ISO17025	LOD	
Deviation Assessment					
Deviation(s)	C. Review	N/A	N/A	N/A	N/A
Metals					
Arsenic	AN8b	mg/kg	Y	2	12
Cadmium	AN8a	mg/kg	Y	1	<1
Chromium (total)	AN8b	mg/kg	Y	2	25
Copper	AN8b	mg/kg	Y	2	20
Lead	AN8b	mg/kg	Y	2	83
Mercury	AN8a	mg/kg	Y	1	<1
Nickel	AN8b	mg/kg	Y	2	25
Selenium	AN8a	mg/kg	Y	1	<1
Zinc	AN8b	mg/kg	Y	2	173
Cadmium (lower level)	AN49	mg/kg	N	0.05	0.38
Mercury (lower level)	AN49	mg/kg	N	0.05	<0.05
Sample Prep(C)					
EMR	EMR	%	N	0.1	<0.1
% Stones	Stones	%	N	0.1	<0.1
Moisture Content @ <30°C	AN1	% w/w	Y	0.1	44.6
Sample Description	MCERTS ver4.		N		7
PAH (USEPA16)					
Acenaphthene M	GCM501	mg/kg	Y	0.1	<0.1
Acenaphthylene M	GCM501a	mg/kg	Y	0.1	<0.1
Anthracene M	GCM501	mg/kg	Y	0.1	<0.1
Benz(a)anthracene M	GCM501	mg/kg	Y	0.1	<0.1
Benzo(a)pyrene M	GCM501	mg/kg	Y	0.1	<0.1
Benzo(b)fluoranthene M	GCM501	mg/kg	Y	0.1	<0.1
Benzo(ghi)perylene M	GCM501	mg/kg	Y	0.1	<0.1
Benzo(k)fluoranthene M	GCM501	mg/kg	Y	0.1	<0.1
Chrysene M	GCM501	mg/kg	Y	0.1	<0.1
Dibenz(a,h)anthracene M	GCM501	mg/kg	Y	0.1	<0.1
Fluoranthene M	GCM501	mg/kg	Y	0.1	<0.1
Fluorene M	GCM501	mg/kg	Y	0.1	<0.1
Indeno(1,2,3-cd)pyrene M	GCM501a	mg/kg	Y	0.1	<0.1
Naphthalene (PAH) M	GCM501	mg/kg	Y	0.1	<0.1
Phenanthrene M	GCM501	mg/kg	Y	0.1	<0.1
Pyrene M	GCM501	mg/kg	Y	0.1	<0.1
PAH (USEPA16) Total M	GCM501	mg/kg	Y	0.1	<0.1
Organotin					
Dibutyl Tin	subcontract*	mg/kg	N	0.02	<0.04
Tributyl Tin	subcontract*	mg/kg	N	0.02	<0.04
Triphenyl Tin	subcontract*	mg/kg	N	0.02	<0.05
Tetrabutyl Tin	subcontract*	mg/kg	N	0.02	<0.04
Monobutyl Tin	subcontract*	mg/kg	N	0.02	<0.15
Monophenyl Tin	subcontract*	mg/kg	N	0.02	<0.04
Diphenyl Tin	subcontract*	mg/kg	N	0.02	<0.04

Notes

1. All analyses performed on the sample dried at <30ºC, except analyses suffixed with 'M'.
2. Analyses suffixed 'M' were performed on the sample as received and corrected for '% moisture at <30ºC' where applicable.
3. All results are expressed as dry weight.
4. MCERTS accreditation applicable to Sample Matrix 'S' only.
5. Natural stones (pebbles, gravels etc.) which do not pass a 4mm sieve are excluded from dried analyses.
6. Tests marked * indicate subcontracted analyses.
7. The laboratory has tested the material/items supplied by the client as sampled in accordance with the client's own requirements.
8. ^Sample Description key: 1. - Sand, 2. Loam, 3. Clay, 4. Sand/loam mix, 5. Sand/clay mix, 6. Clay/loam mix, 7. Other.
   suffixed with: A - Stones, B - Construction rubble, C - Visible Hydrocarbons, D - Vegetation, E - Glass/metal, F - Strong odour, G - Other.
9. Leachate preparation is not included in our UKAS accreditation.
10. Dates of testing for all parameters are available upon request.
11. EMR denotes Extraneous material.
12. Sampling location details and sample information were supplied with the sample.
13. Bulk Analysis carried out in accordance with DIHM ASB/01 which is based on Health & Safety Executive procedure
    Appendix 2: Asbestos in Bulk Materials: Sampling and identification by polarised light microscopy(PLM) set out in HSG248.
14. Asbestos material identification is based on visual examination only. Comments are not covered by UKAS accreditation.
15. NAD denotes - 'No Asbestos Detected'.
16. *Deviating samples*: Deviating samples can be defined as those which are not (correctly) cared for. As a result, deviating samples may jeopardise the validity of the reported test result. Where a deviation has been found in relation to the sample(s) submitted for testing, the test result may be compromised. Reasons for deviating samples are denoted by means of a number 1, 2, 3, 4, 5A, 5B, 6 or 7 under the analyte 'Deviation(s)'. Explanation of this number coding as follows: 1. Sample not submitted in an appropriate container(organic testing), 2. Sample not submitted in an appropriate container(inorganic testing), 3. Sample not submitted in an appropriate container(all testing), 4. Sample lacks the date and time of sampling, 5A – Sample stability time exceeded prior to commencement of testing/receipt of sample, 5B – Sample stability time exceeded during testing, 6. Inappropriate storage/transit conditions, and 7. Other (please contact the laboratory for further information).
17. Issue 2 to include lower LOD's for Cd and Hg at client's request.

Signed for, and on behalf of Exova (UK) Ltd.

Prepared by:

F Barr
Administrator

Approved by:

J McEleny
Laboratory Manager

UKAS TESTING
0568