

**ASDA SITE, THE QUAYS, BARRY WATERFRONT
ASDA REQUEST FOR INFORMATION**

RFI No.012

Dated: 4th March 2013

Supply of the full QDS Ltd submission to the EA for contaminated groundwater treatment and a copy of the EA approval

During the meeting with Asda on 4th March 2013 it was drawn to their attention that the QDS Ltd had just secured approval to planning condition 40(OUT). This Condition is exactly the same as 15(FULL). A copy of the EA letter, on headed paper, will be forwarded to Asda asap.

A copy of the QDS submission to the EA is appended to this RFI in Annex A.

Updated 21st March 2013

A copy of the EA approval letter dated 25th February 2013 is in Annex B of this RFI

ANNEX A

**QDS Ltd submission to the EA
dated November 2012**



Remedial Action Plan

**West Pond
Barry Waterfront
Barry
South Wales**

for

Cuddy Group

Ref. 5040/5/3758/JH rev1

November 2012

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Delivering Land Regeneration

Registration No. 2831282

TABLE OF CONTENTS

1.	INTRODUCTION.....	1
1.1	Historic Site Information	1
1.2	Site Profile	1
1.3	Geology and Hydrogeology.....	2
2.	REMEDICATION DRIVERS	4
3.	PROPOSED REMEDIAL STRATEGY	6
3.1	Overview	6
3.2	Trial pitting (1 month, full-time supervision)	6
3.3	Total fluids pumping from 15 No. boreholes	7
3.4	Verification plan	7
3.6	Completion report	9

APPENDICES

APPENDIX A: FIGURES

- R8-3758 Site layout plan
- R1a-3758 Environmental monitoring locations
- R9-3758 Borehole construction design

APPENDIX B: BOREHOLE LOGS

- Trial pit and Borehole Logs

1. INTRODUCTION

QDS Environmental Ltd (QDS) was commissioned by Cuddy Group to undertake delineation and testing works in the north east part of West Pond, Barry Waterfront (the site), which has been identified as impacted with hydrocarbon contamination. Previous investigation works identified a requirement to carry out groundwater remediation to address the risk of contaminant migration to Dock No. 1 located to the north (east) of the site and to a lesser extent Bristol Harbour located to the south of the site.

1.1 Historic Site Information

The information used in designing the site investigation works of the site was contained in the following reports.

- Geo-Environmental Site Investigation Report – West Pond, Ove Arup and Partners Ltd, Ref: 08/7383, September 2008;
- Barry Waterfront Development West Pond – Controlled Water Risk Assessment, Earth Science Partnership, Ref: ESP4563s/1636, June 2010;
- Barry Waterfront Development West Pond – Supplementary Controlled Water Risk Assessment (Rev 1), Earth Science Partnership, Ref: ESP4563s/1636a, October 2010.
- Proposed Remediation Strategy, QDS, ref: 5007/4/3758/JH, September 2012.

1.2 Site Profile

The site (West Pond) is located to the west of Barry No. 1 Dock on Barry Waterfront, Barry. The site was historically reclaimed land from the sea with parts used as a municipal landfill site. The east of the site was developed as a tank farm in the late 1930s for storage of fuel (eg. heavy fuel oil) and other substances (eg. coal tars and cashew nut shell liquid). These tanks were operational until the 1980s when they were decommissioned. In the 1960s the area was used for storage and dismantling of railway wagons and engines. The site is presently open land with a sand and muddy surface overgrown with plants.

Previous investigations identified hydrocarbon contamination in the made ground and alluvium in the east area of the site. Groundwater in the east area also showed elevated concentrations of hydrocarbons. Free phase product had been observed in some wells in this area but no measurable thickness of product was recorded by QDS.

1.3 Geology and Hydrogeology

The ground conditions encountered at the site during the intrusive investigation works comprised up to 5.0 m of variable clayey to sandy to gravelly made ground. The made ground was underlain by Alluvium from approximately 13 m below ground level (bgl) which is underlain by Mudstone from approximately 20 m bgl. Borehole logs from ESP's investigation in August 2010 and trial pit logs from QDS' investigation in July 2012 are included as Appendix B.

Hydrogeological conditions across site are summarised (section 4.2) in the ESP October 2010 report. A hydraulic gradient was identified from (north) east to (south) west (toward the harbour) at around 0.005 m/s. Monitoring data indicates that the ground water is perched and no significant migration occurs from the made ground to Barry harbour (Sept 2008 report, section 11.2).

QDS found no evidence of tidal influence across the impacted area of the site.

1.3.1 Summary of conceptual model

Sources

- Generic contaminants from infilling of West Pond;
- Contaminants associated with historic uses – docklands, railway land, railway repairs;
- Hydrocarbons associated with oil storage tanks. Evidence of product has been identified during the Ove Arup report, September 2008 on the groundwater table at 4.4 m bgl.

Pathways & Receptors

- Vertical and lateral migration into bedrock (Secondary A and Secondary B aquifers) – abstraction approximately 500m from south boundary;
- Vertical and lateral migration into alluvium Secondary (undifferentiated) aquifer;
- Lateral migration to surface water - Dock;
- Lateral migration to surface water – Harbour / Bristol Channel.

The historical reports (and DQRAs within) conclude that the areas proposed for commercial end use maybe re-developed without the need for any remediation (Sept 2008 report, section 6.3.7).

The areas which require remediation are those in the more impacted (south) eastern areas of the site which are proposed for residential end use. These comprise: the old tank farm, the former pond area, the landfill area and the tank wash building area. These areas are also thought to be the location of the primary contamination Sources.

Section 6.4 of the Sept 2008 report presents data suggesting that the groundwater is not significantly impacted by the contamination present on site (section 6.4) as concentrations are similar on the northern boundary where groundwater enters as on the southern boundary where groundwater leaves the site. This and laboratory testing indicates that leachability from the made ground is low (although some vertical migration to from the made ground to groundwater within the alluvium has occurred in the most impacted areas). Both the 2010 ESP reports agree with these conclusions. However, groundwater monitoring data does indicate a link between the perched water in the made ground and the groundwater within the alluvium (June 2010 report; section 4.4 - which discusses likely contamination migration pathways).

2. REMEDATION DRIVERS

The data supports the conclusion that under current conditions there is no significant risk to the surrounding water bodies (Barry Harbour and the Severn Estuary and Dock No. 1). A summary of the reasons for this conclusion are outlined below:

- The groundwater risk assessment conducted in 2008 concluded that there was no risk to the Severn estuary (via Barry harbour). It concluded that there is a risk to dock No 1 but this was mainly based on the observation of 5 cm of free product in the vicinity of WPBH25. No free product was observed by ESP in their investigations of 2010 or by QDS during our current investigation;
- With the development of buildings and areas of hard standing this will decrease the infiltration of rainwater from the surface which will in turn decrease the transport of soil contamination to Barry harbour and dock No 1 via the made ground and alluvium (considered to be the main contamination migration pathway). With the intended addition of a capping layer and the raising of the ground level for flood prevention purposes this will further decrease the influence of infiltrating rainwater on the subsequent migration of contaminants. It is also noteworthy that the permeability of the alluvium is relatively low further restricting contaminant migration;
- “The masonry blocks of the dock wall will be of low permeability and hydraulic linkages between the dock water and the site will be limited to joints and possible cracks. The extent of the hydraulic link between dock and groundwater will be low, as typical dock water levels range from 3-6mAOD (extreme tides reach ~7mAOD) whilst monitoring of the perched and groundwater levels at the site identify a relatively consistent water level of around 5mAOD”. Extract from ESP June 2010 report (section 4.4.3);
- Monitoring data in 2010 showed that water levels within the dock were 1-1.5 m higher than on site preventing migration of contamination into the dock. Both ESP and QDS consider that the likelihood of the water level within the dock falling significantly is low;
- “The boreholes positioned between the identified plume and the dock (E4 and SQBH1) show no significant elevated levels – indicating leakage into the site of cleaner water from the dock, as opposed to contaminated waters trying to exit the site and discharge into the dock” Extract from ESP June 2010 report (section 6.1);

- There is evidence that natural attenuation (NA) is occurring with contamination concentrations falling sharply as the plume expands in a north and west direction into the site. Measured dissolved oxygen levels are also indicative that NA is occurring.

Despite this evidence it is considered that remediation is necessary to remove any source material (free phase LNAPL) and to reduce the contaminant load on the groundwater in this part of the site for the following reasons:

- Soil investigation data indicates hydrocarbon impacted soil is present across much of the area of the east corner of the site up to the extent of the investigation depth of 5.0 m. Groundwater hydrocarbon impact is present in three deep wells on site (BH25, BH E5 and BH E6) and to a lesser extent in BH E16 in the east corner of the site.
- Hydrocarbon concentrations in the groundwater are at levels indicative of LNAPL being present though no measurable thickness of Light Non-aqueous Phase Liquid (LNAPL) was identified in recent investigations.

3. PROPOSED REMEDIAL STRATEGY

Based on the findings and recommendations of the previous reports and the findings of QDS' investigation works, QDS proposes the following remedial strategy.

3.1 Overview

Though there is no identified risk to human health or controlled waters, a programme of ground improvement is considered necessary for confidence in the overall strategy. The remedial strategy is based on achieving betterment through source removal and contaminant mass reduction.

Works will identify areas impacted with free product in the 100-150 m area around boreholes BH25, E5 and E6 and then pumping any LNAPL (to remove the source) and contaminated water (to reduce contaminant mass) from these locations. The strategy is to recover contaminant mass from the groundwater to the maximum practical extent by installing an intensive pumped mass recovery system and operating it until the recovery rates have dropped to the point where further works are providing minimal benefit.

3.2 Trial pitting

QDS will excavate circa 50 trial pits/sumps to approximately 2 m below the water table across the impacted area (for proposed locations refer to Figure R8-3758). These locations would be dewatered using a diesel dewatering pump into a holding lagoon (volume circa 100 m³). QDS would then pump the waters from the holding lagoon through the Water Treatment Plant (WTP) prior to its discharge to sewer under license. The water treatment plant would consist of an Oil/Water/Silt Separator (OWSS); Sand Filter; and two 2 m³ Granular Activated Carbon (GAC) vessels all housed within a secured, bunded treatment compound equipped with duplicated high level emergency cut-out switches.

QDS envisage that these works would be completed on a month long rolling programme, whereby abstraction sumps are excavated and intensively dewatered prior to being backfilled, thus minimising the period of time excavations are open. It should be noted that groundwater is typically at rest across the site at between 3.5 – 4.0 mbgl and therefore trial pits would need to be installed to circa 5.5 – 6.0 mbgl. QDS envisage that approximately 5 m³ of groundwater and free product could be pumped out of each trial pit prior to backfill.

3.3 Total fluids pumping from 15 No. boreholes

Following the excavation and recovery works, QDS will install wells into the 15 most impacted locations. Each borehole would be installed to 6.0 m below ground level (bgl) and screened from 2 m bgl to the base of the well (see R9-3758 for Borehole construction design). This would be undertaken during the backfilling of the trial pits/sumps. The wells would be installed with an automated top loading pneumatic total fluids pumps. Total fluids pumps operate using compressed air which expels free phase LNAPL and / or groundwater from a chamber in the pump which fills by gravity. Pumps are manually adjusted within the wells such that the inlet to the chamber is at the correct height to collect any free phase LNAPL present. It is anticipated that the pumps will operate on a cycle with each pump discharging up to 150 litres per hour dependent on ground conditions.

Abstracted LNAPL and groundwater would be pumped to the water treatment system, comprising oil / water separation, particulate filtration and activated carbon filtration. Treated water would be discharged to sewer in accordance with a sewer discharge.

The pumped recovery system would operated for up to 5 months. The pumps would remove free product and contaminated waters from the wells and pass it through the water treatment system prior to discharge.

The system would be automated, with regular site visits by a QDS engineer during operational period to ensure the system is optimised and for the collection of data.

3.4 Verification plan

Whilst no risk to receptors has been identified, remediation is considered appropriate to reduce the contaminant mass within groundwater. The strategy has been designed to mitigate any residual risk of contaminant migration to the vulnerable water bodies which surround the site.

The targets for the works are:

- to remove any identified LNAPL to the maximum possible extent within the limitations of the geology. LNAPL removal works would be continued until asymptotic conditions were achieved where recovery rates were too low for further remediation works to be of significant benefit.

- to reduce the dissolved phase contaminant mass within the groundwater by pumped mass recovery. .

3.4.1 Environmental monitoring

Refer to Figure R1a-3758 for proposed monitoring locations.

Period	Noise (dB)	VOC's from site monitoring locations (ppm by PID)	Odour	Dust
Baseline/ background	✓	✓	✓	✓
1 month trial pitting	Daily	Daily	Daily	Daily
5 month total fluids	Monthly	Monthly	Monthly	Monthly
Trigger level	5dB above average baseline for a sustained 15 minute period	1 ppm (based on benzene) for a sustained 5 minute period	Any detectable rise over a sustained 15 minute period	Any detectable rise over a sustained 15 minute period. Not to exceed 200 mg/m3

Table 1: Proposed Monitoring Programme

3.4.2 Groundwater monitoring

- Pre works

The historical study carried out by ESP recommended that monitoring of the boreholes between the source area and dock No. 1 (E4 and SQBH1), the boreholes in the bedrock and the potential water receptors continue during and after the remedial works. QDS support this recommendation and will monitor both these locations for the presence of LNAPL prior to commencement of the works. After the completion of the trial pitting and borehole installation works, QDS shall also monitor the 15 remediation wells in the remediation area for LNAPL thickness before the second phase of works commences..

- During works

QDS shall monitor all 15 new boreholes and all existing boreholes in the remediation area for LNAPL thickness weekly throughout the operational period.

A monthly 'Oil Water Separator - in' sample will be taken and analysed for TPH to allow the amount of contaminant removed by the pumps during remediation works to be calculated. The volume of LNAPL present in the OWS will be measured monthly and transferred to a secure, bunded container.

A monthly 'GAC out' sample will also be taken to monitor the effluent leaving the water treatment system to ensure that it complies with the discharge-to-sewer consent.

- Post works

LNAPL thickness shall be measured in E4, SQBH1, all remediation wells and the other boreholes historically present in the remediation area post works on a monthly basis for 3 months following completion of the remedial works. In addition, on the last of the three monthly monitoring visits these wells shall also be sampled and analysed for Manganese, Sulphate, Nitrate, Iron (II) and pH. The target for the remediation work is to remove any identified LNAPL to the maximum possible extent and to remove a significant contaminant mass from the groundwater.

3.6 Completion report

A remediation completion report detailing the works undertaken, the results achieved and any recommendations for further work or monitoring will be prepared to enable the regulators to determine the success of remediation. Information to be included in the completion report will be:

- Trial pit/borehole logs records;
- Groundwater monitoring data;
- System operational data;
- Waste disposal records;
- Contaminated mass removal calculations;
- Environmental quality monitoring; and
- Records of any consents, authorisations or licenses obtained.

APPENDIX A
FIGURES



QDS Environmental
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 Tel: 01483 303070
 Fax: 01483 303080

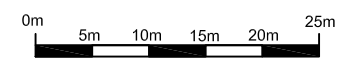
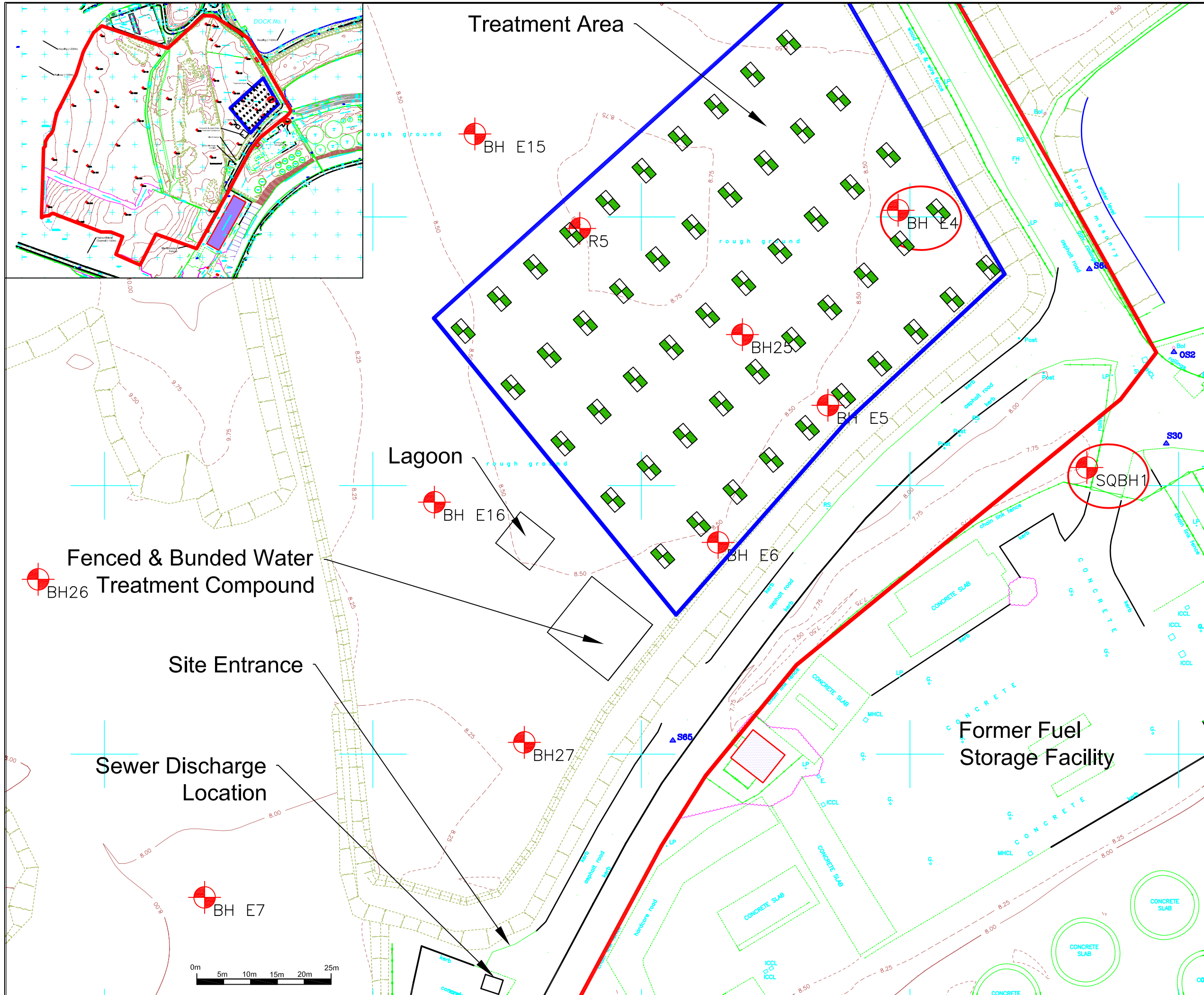
Delineation Works

Barry Waterfront

DRAWN	RN
CHECKED	JH
DATE	01/11/12
SCALE	See scale bar
DWG.No	R8-3758-01
FIG	0
REV	0

RELATED DRAWINGS	
NOTES	

- Site Boundary
- ARUP/SS 2008
- ESP 2010
- Borehole to be monitored during works
- Treatment Area
- Proposed Trial Pit Locations





QDS Environmental
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Site Layout Plan

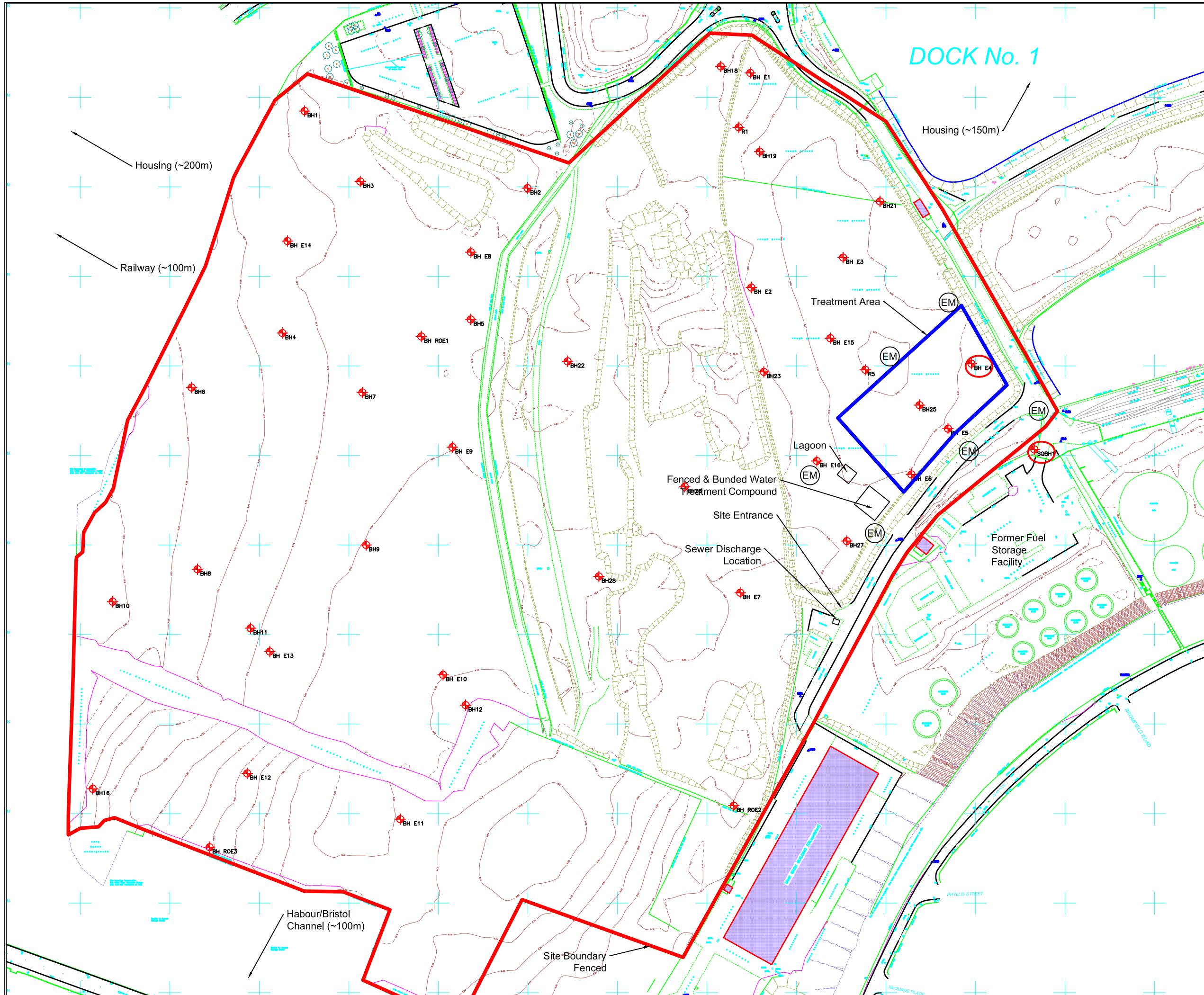
Barry Waterfront

DRAWN	RN
CHECKED	JH
DATE	23/07/12
SCALE	1:2000 @ A3
DWG.No	R1-3758-01
FIG	0
REV	A

RELATED DRAWINGS	
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NOTES	
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- Site Boundary
- ⊕ BHXX ARUP/SS 2008
- ⊕ BHEXX ESP 2010
- EM Environment Monitoring Point
- Borehole to be monitored during works
- Treatment Area





QDS Environmental
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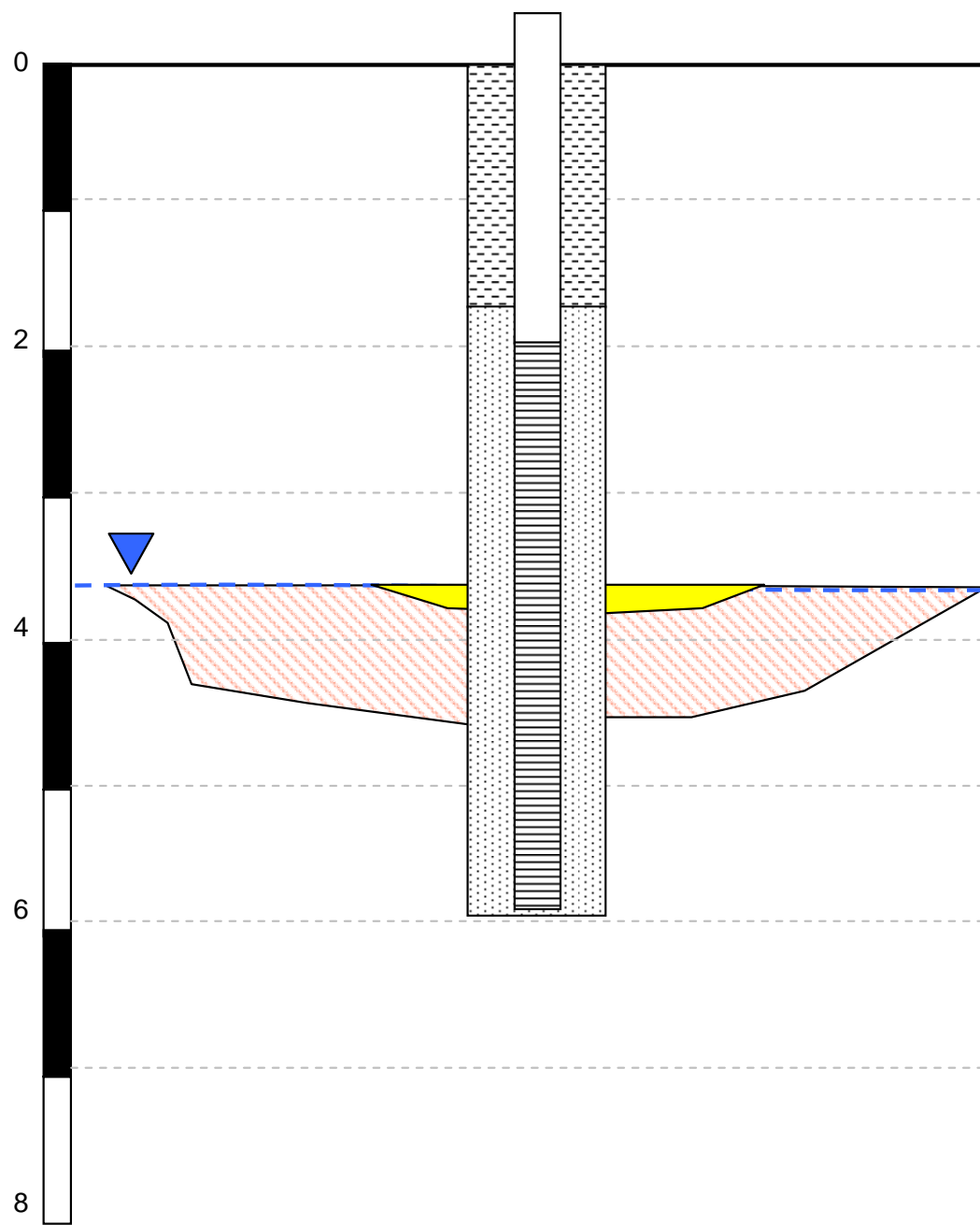
Borehole construction





Barry Waterfront

Date: 21/01/13

Ref: R9-3758

Depth below
Ground (m)



-  Bentonite pellets
-  Gravel pack
-  LNAPL
-  Dissolved phase hydrocarbons

APPENDIX B
TRIAL PIT AND BOREHOLE LOGS



Project Name: BWD Supplementary CWRA
Site Location: Barry Waterfront - West Pond
Client: Barry Waterfront Consortium
Project No: 4563S

Start date: 19/08/2010
 End date: 20/08/2010
 Backfill date: 20/08/2010

Driller: Apex
 Logged by: JOK
 Date logged: 20/08/2010

Drilling method:
 Cable Percussion

Equipment:
 Dando 150

Ground Level: 8.400 mOD
 Easting: 311353 m
 Northing: 167203 m

BH E4

Sample Details and SPT Data **Strata Details** **Water**

Depth	Type	SPT-N (penetration / sampler blows)	Water Depth	Casing Depth	Depth (Thickness)	Description	Legend	Strikes / Standing	Depth	Backfill / Installations
0.90 - 2.00	B				(4.00)	Dark brown sandy gravelly CLAY. Sand is fine with angular Mudstone fragments up to 3cm in diameter. Rare slag and brick fragments. (MADE GROUND).			1	
2.00 - 3.00	B							▽	2	
4.00 - 5.00	B				4.00 (1.30)	Dark brown to grey medium grained SAND. Some soft brown Clay with occasional subrounded Mudstone Fragments up to 1cm in diameter. (MADE GROUND).			3	
5.50 - 6.00	B				5.30				4	
6.00 - 7.00	B				(2.40)	Dark brown to grey slightly sandy slightly silty CLAY. Sand is fine with occasional sub-rounded Mudstone fragments up to 1cm in diameter. (MADE GROUND).			5	
7.00 - 8.00	B				7.70				6	
8.00 - 9.00	B				(2.10)	Dark brown grey slightly sandy slightly silty CLAY. (MADE GROUND).			7	
9.00 - 10.00	B				9.80				8	
10.00 - 11.00	B				(3.20)	Grey slightly sandy slightly silty CLAY. (ESTUARINE ALLUVIUM).			9	
11.00 - 12.00	B								10	
13.00 - 14.00	B				13.00	Grey to grey-green clayey sandy angular to sub-angular coarse Mudstone GRAVEL. (ESTUARINE ALLUVIUM).			11	
14.00 - 15.00	B								12	
16.00 - 17.00	B				(8.00)				13	
17.00 - 18.00	B								14	
18.00 - 19.00	B								15	
19.00 - 20.00	B								16	
20.00 - 21.00	B								17	
					21.00	<i>End of Borehole at 21.00 m</i>			18	
									19	
									20	
									21	
									22	
									23	

Progress & Standing Water Levels					Water Strikes							Chiselling			Hole and Casing Diameters			
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed minutes	Depth to Water	Depth Sealed	From Depth	To Depth	Minutes Taken	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
19/08/2010	1600	20.00	20.00	9.70	19/08/2010	-	3.40	-	20	3.40	-	1.00	1.80	120	21.00 m	200 mm		
20/08/2010	0730	20.00	20.00	8.20								20.40	21.00	135				

General Remarks:

1. Completed with installations



Project Name: BWD Supplementary CWRA
Site Location: Barry Waterfront - West Pond
Client: Barry Waterfront Consortium
Project No: 4563S
 Start date: 20/08/2010
 End date: 23/08/2010
 Backfill date: 23/08/2010
 Driller: Apex
 Logged by: JOK
 Date logged: 23/08/2010

Drilling method:
 Cable Percussion
Equipment:
 Dando 150
 Ground Level: 8.380 mOD
 Easting: 311331 m
 Northing: 167192 m

BH E5

Sample Details and SPT Data Strata Details Water

Depth	Type	SPT-N (penetration / sampler blows)	Water Depth	Casing Depth	Depth (Thickness)	Description	Legend	Strikes / Standing	Depth	Backfill / Installations
1.00 - 2.00	B				(2.60)	Dark brown to black sandy gravelly CLAY. Sand is fine with angular to sub-rounded Mudstone fragments up to 4cm in diameter with frequent slag and ash fragments. Rare Limestone cobbles. (MADE GROUND).			1	
2.00 - 3.00	B				2.60	Dark brown to grey clayey very sandy SILT. (MADE GROUND).		▽	2	
3.00 - 3.50	B								3	
3.50 - 4.50	B				(3.40)				4	
4.50 - 5.50	B				6.00	Dark brown to grey slightly sandy silty CLAY. (MADE GROUND).			5	
5.50 - 6.50	B				(1.00)				6	
6.50 - 7.50	B				7.00	Dark grey to brown clayey very silty fine to medium grained SAND. (MADE GROUND).			7	
7.50 - 8.50	B								8	
8.50 - 9.50	B				(3.30)				9	
					10.30	Dark grey to brown slightly sandy clayey SILT. Sand is fine with occasional angular Mudstone fragments up to 2cm in diameter. (ESTUARINE ALLUVIUM).			10	
					(1.70)				11	
					12.00	Dark grey slightly sandy clayey SILT. (ESTUARINE ALLUVIUM).			12	
									13	
					(3.00)				14	
					15.00	End of Borehole at 15.00 m				
									15	
									16	
									17	
									18	
									19	
									20	
									21	
									22	
									23	

Progress & Standing Water Levels					Water Strikes							Chiselling			Hole and Casing Diameters			
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed minutes	Depth to Water	Depth Sealed	From Depth	To Depth	Minutes Taken	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
//	0830	10.00	10.00	8.30	20/08/2010	-	3.40	-	20	-	-	0.40	0.80	75	15.00 m	200 mm		
	1600	10.00	10.00	9.70														
	0830	10.00	10.00	8.30														

General Remarks:

1. Completed with installations



Project Name: BWD Supplementary CWRA
Site Location: Barry Waterfront - West Pond
Client: Barry Waterfront Consortium
Project No: 4563S

Drilling method:
Cable Percussion

Equipment:
Dando 150

BH E6

Start date: 17/08/2010
End date: 18/08/2010
Backfill date: 18/08/2010

Driller: Apex
Logged by: JOK
Date logged: 18/08/2010

Ground Level: 8.360 mOD
Easting: 311330 m
Northing: 167160 m

Sample Details and SPT Data

Strata Details

Water

Depth	Type	SPT-N (penetration / sampler blows)	Water Depth	Casing Depth	Depth (Thickness)	Description	Legend	Strikes / Standing	Depth	Backfill / Installations	
1.00 - 2.00	B				(2.30)	Dark brown to black gravely very sandy CLAY. Sand is fine with abundant sub angular coal fragments up to 4cm in diameter and occasional brick and slag fragments. (MADE GROUND).			1		
2.00 - 2.50	B				2.30	Brown to grey slightly sandy silty CLAY. A slight hydrocarbon/creosote smell was noted. (MADE GROUND).			2		
2.50 - 3.50	B			(0.70) 3.00	3						
3.50 - 4.50	B				4						
4.50 - 5.50	B					Grey to dark brown slightly sandy silty CLAY. A moderate hydrocarbon/creosote smell was noted. (MADE GROUND).			5		
5.50 - 6.50	B			(5.00)	6						
6.50 - 7.50	B				7						
7.50 - 8.50	B				8						
8.50 - 9.50	B				(2.00)	Dark grey to brown clayey very silty medium SAND. Moderate smell of hydrocarbons/creosote was noted. (ESTUARINE ALLUVIUM).			9		
9.50 - 10.50	B				10.00	Dark grey clayey very sandy SILT. Sand is fine with occasional angular Mudstone fragments up to 10cm in diameter. A slight to moderate smell of hydrocarbons/creosote was noted. (ESTUARINE ALLUVIUM).			10		
10.50 - 11.50	B			(1.00) 11.00	11						
11.50 - 12.50	B				(3.00)	Dark grey clayey very sandy SILT. Sand is fine with occasional angular Mudstone fragments up to 10cm in diameter. No obvious smell of hydrocarbons/creosote was noted. (ESTUARINE ALLUVIUM).			12		
12.50 - 13.50	B				13						
13.50 - 14.50	B				14.00				14		
14.50 - 15.00	B				(2.00)	Brown to grey slightly sandy silty clayey coarse GRAVEL. Sand is fine with sub angular to subrounded cobbles. (ESTUARINE ALLUVIUM).			15		
15.00 - 16.00	B				16.00				16		
						<i>End of Borehole at 16.00 m</i>					
									17		
									18		
									19		
									20		
									21		
									22		
									23		

Progress & Standing Water Levels					Water Strikes							Chiselling			Hole and Casing Diameters			
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed minutes	Depth to Water	Depth Sealed	From Depth	To Depth	Minutes Taken	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
17/08/2010	1600	8.00	8.00	-	18/08/2010	-	9.10	-	20	8.60	-	1.40	1.80	60	16.00 m	200 mm		
18/08/2010	0800	9.10	9.10	8.60								15.70	16.00	60				

General Remarks:

1. Completed with installations



Project Name: BWD Supplementary CWRA
Site Location: Barry Waterfront - West Pond
Client: Barry Waterfront Consortium
Project No: 4563S

Drilling method:
Cable Percussion

Equipment:
Dando 150

BH E15

Start date: 23/08/2010
End date: 24/08/2010
Backfill date: 24/08/2010

Driller: Apex
Logged by: JOK
Date logged: 24/08/2010

Ground Level: 8.250 mOD
Easting: 311318 m
Northing: 167221 m

Sample Details and SPT Data

Strata Details

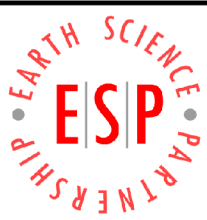
Water

Depth	Type	SPT-N (penetration / sampler blows)	Water Depth	Casing Depth	Depth (Thickness)	Description	Legend	Strikes / Standing	Depth	Backfill / Installations																												
0.50 - 1.00	B				(0.90)	Dark brown to black very sandy CLAY. Sand is medium grained with occasional fragments of coal and red brick up to 5cm in diameter. (MADE GROUND).			1																													
1.50 - 2.00	B			(1.40)																																		
2.50 - 3.00	B				2.30	Dark brown to black very sandy CLAY. Sand is medium grained with occasional fragments of coal and red brick up to 5cm in diameter. A slight creosote smell was recorded. (MADE GROUND).			2																													
3.50 - 4.00	B																																					
4.50 - 5.00	B			(5.00)																																		
5.50 - 6.00	B					Dark grey slightly sandy slightly gravelly silty CLAY. Sand is fine grained with angular to sub-angular slag and brick fragments up to 15cm in diameter. A slight creosote smell was noted. (MADE GROUND).			3																													
6.50 - 7.00	B																																					
7.50 - 8.00	B			7.30																																		
8.50 - 9.00	B																																					
9.50 - 10.00	B					Dark grey slightly sandy silty CLAY. Sand is fine grained with very occasional sub-angular gravels up to 1cm in diameter. (ESTUARINE ALLUVIUM).			4																													
10.50 - 11.00	B																																					
11.50 - 12.00	B			(7.70)																																		
12.50 - 13.00	B																																					
13.50 - 14.00	B																																					
14.50 - 15.00	B				15.00	End of Borehole at 15.00 m			5																													
													6																									
																	7																					
																					8																	
																									9													
																													10									
																																	11					
																																					12	
									14																													
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									16																													
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									20																													
									21																													
									22																													
									23																													

Progress & Standing Water Levels					Water Strikes							Chiselling			Hole and Casing Diameters			
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed minutes	Depth to Water	Depth Sealed	From Depth	To Depth	Minutes Taken	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
//	1630	6.00	6.00	5.00	23/08/2010	-	4.50	-	20	-	-	1.00	1.60	90	15.00 m	200 mm		
24/08/2010	0730	6.00	6.00	4.40														

General Remarks:

1. Completed with installations



Project Name: BWD Supplementary CWRA
Site Location: Barry Waterfront - West Pond
Client: Barry Waterfront Consortium
Project No: 4563S

Drilling method:
Cable Percussion

Equipment:
Dando 150

BH E16

Start date: 24/08/2010
End date: 25/08/2010
Backfill date: 25/08/2010

Driller: Apex
Logged by: JOK
Date logged: 25/08/2010

Ground Level: 8.310 mOD
Easting: 311278 m
Northing: 167175 m

Sample Details and SPT Data

Strata Details

Water

Depth	Type	SPT-N (penetration / sampler blows)	Water Depth	Casing Depth	Depth (Thickness)	Description	Legend	Strikes / Standing	Depth	Backfill / Installations
0.50 - 1.00	B				(1.10)	Grey sandy gravelly CLAY. Sand is fine grained with angular red to brown Mudstone cobbles up to 20cm in diameter and fragments of brick up to 2cm in diameter. (MADE GROUND).			1	
1.50 - 2.00	B				1.10				2	
2.50 - 3.00	B					Brown to grey clayey sub-angular coarse GRAVEL. (MADE GROUND).			3	
3.50 - 4.00	B				(4.90)				4	
4.50 - 5.00	B							▽	5	
5.50 - 6.00	B				6.00				6	
6.50 - 7.00	B				(1.30)	Dark grey slightly gravelly sandy CLAY. Gravel is medium with sub-angular Mudstone fragments up to 2cm in diameter. A slight smell of creosote was noted. (MADE GROUND).			7	
7.50 - 8.00	B				7.30				8	
8.50 - 9.00	B				(2.90)	Dark grey sandy gravelly CLAY. Occasional sub-angular Mudstone fragments up to 2cm in diameter. A moderate smell of creosote was noted. (ESTUARINE ALLUVIUM).			9	
9.50 - 10.00	B								10	
10.50 - 11.00	B				10.20	Dark grey slightly sandy silty CLAY. Sand is fine grained. A moderate to strong smell of creosote was noted. (ESTUARINE ALLUVIUM).			11	
11.50 - 12.00	B				(2.10)				12	
12.50 - 13.00	B				12.30	Dark grey slightly sandy silty CLAY. A strong smell of creosote was noted. (ESTUARINE ALLUVIUM).			13	
13.50 - 14.00	B				(2.70)				14	
14.50 - 15.00	B				15.00	End of Borehole at 15.00 m			15	
									16	
									17	
									18	
									19	
									20	
									21	
									22	
									23	

Progress & Standing Water Levels					Water Strikes							Chiselling			Hole and Casing Diameters			
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed minutes	Depth to Water	Depth Sealed	From Depth	To Depth	Minutes Taken	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
24/08/2010	1630	6.00	6.00	5.30	24/08/2010	-	4.50	-	20	-	-	6.20	6.60	60	15.00 m	200 mm		
25/08/2010	0730	6.00	6.00	5.80														

General Remarks:

- Completed with installations

TRIAL PIT TPQ 01

(Page 1 of 1)



PROJECT INFORMATION

Project Title : Barry Waterfront
 Project No. : 3758
 Date Completed : 04.07.2012
 Logged By : P. Leighton

Machine : Hyundai 14.5T
 Bucket type : 5' toothless
 Pit depth : 4.7 m

QDS Environmental Ltd
 Langton Priory, Portsmouth Road
 Guildford, Surrey, GU2 4YG

Tel: +44(0) 1483 303070

Fax: +44(0) 1483 303080

Depth in meters	Water Levels	Surf. Elev. 0	GRAPHIC	DESCRIPTION	Lab No.
0	0			Grass surface MADE GROUND Brown, occasionally black slightly sandy clay. Some brick fragments.	
1	-1			MADE GROUND Grey medium to coarse angular gravel. Geotextile membrane above and below horizon PID 0-1 m 110 ppm	
				MADE GROUND Black very sandy fine to coarse angular gravel. Abundant fine to coarse gravels of coal.	
				MADE GROUND Reddish brown slightly sandy soft clay with occasional coarse gravels. PID 1-2 m 110 ppm	
2	-2			MADE GROUND Grey/yellow-brown very soft mottled sandy clay. Slight coal tar odour. Patchy staining at 3.0 m PID 2-3 m 35 ppm	
3	-3			MADE GROUND Grey very soft sandy clay. Slight coal tar odour and patchy staining. PID 3-4 m 40ppm	
4	-4			MADE GROUND Grey coarse, angular gravels and occasional cobbles	
				Yellow-brown firm CLAY. Occasional yellow-brown coarse sandy lenses PID 4-5 m 20 ppm	
				End of Trial Pit at 4.7 m	

Water Ingress at 4.0 m

TRIAL PIT TPQ 02

(Page 1 of 1)



PROJECT INFORMATION

Project Title : Barry Waterfront
 Project No. : 3758
 Date Completed : 04.07.2012
 Logged By : P. Leighton

Machine : Hyundai 14.5T
 Bucket type : 5' toothless
 Pit depth : 5.0 m

QDS Environmental Ltd
 Langton Priory, Portsmouth Road
 Guildford, Surrey, GU2 4YG
 Tel: +44(0) 1483 303070
 Fax: +44(0) 1483 303080

Depth in meters	Water Levels	Surf. Elev. 0	GRAPHIC	DESCRIPTION	Lab No.
0	0		[Cross-hatched box]	Grass surface MADE GROUND Brown, occasionally black slightly sandy, firm clay. Rare gravels of brick.	
1	-1		[Cross-hatched box]	MADE GROUND Grey medium to coarse angular gravel. Geotextile membrane above and below horizon PID 0-1 m 2 ppm	
			[Cross-hatched box]	MADE GROUND Reddish brown coarse, subangular gravels. PID 1-2 m 105 ppm	
2	-2		[Cross-hatched box]	MADE GROUND Yellow-brown very soft sandy clay. PID 2-3 m 550 ppm	
3	-3		[Cross-hatched box]	MADE GROUND Grey very soft gravelly clay. Strong coal tar odour and heavy staining. PID 3-4 m 250 ppm	
4	-4		[Cross-hatched box]	MADE GROUND Grey slightly sandy soft clay	
			[Cross-hatched box]	MADE GROUND Yellow-brown clayey, coarse sand.	
			[Cross-hatched box]	MADE GROUND Firm, slightly sandy clay with occasional yellow-brown sand lenses. PID 4-5 m 150 ppm	
5	-5		[Cross-hatched box]	End of Trial Pit at 5.0 m	

Perched water ingress at 1.1 m
 Water Ingress at 4.3 m

07-20-2012. j:\QDS\Barry Waterfront\TPQ 02.BOR

TRIAL PIT TPQ 03

(Page 1 of 1)



PROJECT INFORMATION

Project Title : Barry Waterfront
 Project No. : 3758
 Date Completed : 04.07.2012
 Logged By : P. Leighton

Machine : Hyundai 14.5T
 Bucket type : 5' toothless
 Pit depth : 4.9 m

QDS Environmental Ltd
 Langton Priory, Portsmouth Road
 Guildford, Surrey, GU2 4YG

Tel: +44(0) 1483 303070

Fax: +44(0) 1483 303080

Depth in meters	Water Levels	Surf. Elev. 0	GRAPHIC	DESCRIPTION	Lab No.
0	0		[Cross-hatched box]	Grass surface MADE GROUND Brown, occasionally black slightly sandy, firm clay. Rare cobbles of brick.	
1	-1		[Cross-hatched box]	MADE GROUND Grey medium to coarse angular gravel. Geotextile membrane above and below horizon PID 0-1 m 25 ppm	
			[Cross-hatched box]	MADE GROUND Black, very sandy fine to coarse angular gravel. Occasional coal cobble. Large quantity of buried bricks from 1.05 - 2.5 m in NW corner of the TP.	
			[Cross-hatched box]	MADE GROUND Yellow-brown very sandy medium to coarse subangular gravel.	
2	-2		[Cross-hatched box]	MADE GROUND Red brown medium to coarse angular gravel. PID 1-3 m 15 ppm	
			[Cross-hatched box]	MADE GROUND Brown, very silty, gravelly soft clay. Occasional pale brown sand lenses and boulder clusters. Mild coal tar odour but no visible staining. PID 3-4 m 2 ppm	
3	-3		[Cross-hatched box]		
4	-4		[Cross-hatched box]		
5			[Cross-hatched box]	End of Trial Pit at 4.9 m	

Water Ingress at 3.7 m

TRIAL PIT TPQ 04

(Page 1 of 1)



PROJECT INFORMATION

Project Title : Barry Waterfront
 Project No. : 3758
 Date Completed : 05.07.2012
 Logged By : P. Leighton

Machine : Hyundai 14.5T
 Bucket type : 5' toothless
 Pit depth : 4.6 m

QDS Environmental Ltd
 Langton Priory, Portsmouth Road
 Guildford, Surrey, GU2 4YG

Tel: +44(0) 1483 303070

Fax: +44(0) 1483 303080

Depth in meters	Water Levels	Surf. Elev.	GRAPHIC	DESCRIPTION	Lab No.
0	0	0	[Cross-hatched box]	Grass surface MADE GROUND Brown, slightly sandy, firm clay. Rare fragments of brick.	
1	-1		[Cross-hatched box]	MADE GROUND Grey medium to coarse angular gravel. Geotextile membrane above and below horizon PID 0-1 m 2 ppm	
			[Cross-hatched box]	MADE GROUND Red-brown coarse, subangular gravels.	
			[Cross-hatched box]	MADE GROUND Yellow-brown clayey sands.	
2	-2		[Cross-hatched box]	MADE GROUND Grey coarse gravels with angular boulders and cobbles. Strong coal tar odour. PID 1-3 m 4 ppm	
3	-3		[Cross-hatched box]	UNDETERMINED (water ingress to rapid to log) PID 3-4 m 110 ppm	
4	-4				
				End of Trial Pit at 4.6 m	

Water Ingress at 3.2 m

TRIAL PIT TPQ 05

(Page 1 of 1)



PROJECT INFORMATION

Project Title : Barry Waterfront
 Project No. : 3758
 Date Completed : 06.07.2012
 Logged By : P. Leighton

Machine : Hyundai 14.5T
 Bucket type : 5' toothless
 Pit depth : 4.2 m

QDS Environmental Ltd
 Langton Priory, Portsmouth Road
 Guildford, Surrey, GU2 4YG

Tel: +44(0) 1483 303070

Fax: +44(0) 1483 303080

Depth in meters	Water Levels	Surf. Elev. 0	GRAPHIC	DESCRIPTION	Lab No.
0		0	[Cross-hatched box]	Grass surface MADE GROUND Brown, slightly sandy, gravelly, firm clay.	
1		-1	[Cross-hatched box]	MADE GROUND Grey medium to coarse angular gravel. MADE GROUND Black, very sandy fine to coarse angular gravel.	
			[Cross-hatched box]	MADE GROUND Red-brown coarse angular gravel. MADE GROUND Yellow-brown coarse angular gravel.	
2		-2	[Cross-hatched box]	MADE GROUND Brown clayey fine to coarse sand.	
3		-3	[Cross-hatched box]	MADE GROUND Grey slightly sandy soft clay with occasional cobbles. Heavy staining and strong coal tar odour.	
4		-4	[Cross-hatched box]	End of Trial Pit at 4.2 m	

Water Ingress at 3.5 m

TRIAL PIT TPQ 06

(Page 1 of 1)



PROJECT INFORMATION

Project Title : Barry Waterfront
 Project No. : 3758
 Date Completed : 05.07.2012
 Logged By : P. Leighton

Machine : Hyundai 14.5T
 Bucket type : 5' toothless
 Pit depth : 4.7 m

QDS Environmental Ltd
 Langton Priory, Portsmouth Road
 Guildford, Surrey, GU2 4YG

Tel: +44(0) 1483 303070

Fax: +44(0) 1483 303080

Depth in meters	Water Levels	Surf. Elev.	GRAPHIC	DESCRIPTION	Lab No.
0	0	0	[Cross-hatched box]	Grass surface MADE GROUND Brown, occasionally black slightly sandy, clay with cobbles. Buried sleeper at 0.4-0.5 m.	
1	-1		[Cross-hatched box]	MADE GROUND Grey medium to coarse angular gravel. Geotextile membrane above and below horizon PID 0-1 m 40 ppm	
			[Cross-hatched box]	MADE GROUND Black, very sandy fine to coarse angular gravel. Rare brick fragments. Buried scrap cable at 1.5 m PID 1-2 m 4,500 ppm	
2	-2		[Cross-hatched box]	MADE GROUND Grey sandy, firm clay. Rare angular cobbles. Abundant yellow-brown sand lenses. Light organic staining and moderate coal tar odour. PID 2-3 m 300 ppm, 3-4 m 1,500 ppm	
3	-3		[Cross-hatched box]		
4	-4		[Cross-hatched box]		
5			[Cross-hatched box]	End of Trial Pit at 4.7 m	

Water Ingress at 4.2 m

TRIAL PIT TPQ 07

(Page 1 of 1)



PROJECT INFORMATION

Project Title : Barry Waterfront
 Project No. : 3758
 Date Completed : 05.07.2012
 Logged By : P. Leighton

Machine : Hyundai 14.5T
 Bucket type : 5' toothless
 Pit depth : 4.5 m

QDS Environmental Ltd
 Langton Priory, Portsmouth Road
 Guildford, Surrey, GU2 4YG

Tel: +44(0) 1483 303070

Fax: +44(0) 1483 303080

Depth in meters	Water Levels	Surf. Elev.	GRAPHIC	DESCRIPTION	Lab No.
0	0	0		Grass surface MADE GROUND Brown, occasionally black slightly sandy, clay with occasional brick cobbles and gravels.	
1	-1			MADE GROUND Grey medium to coarse angular gravel. Geotextile membrane above and below horizon PID 0-1 m 3 ppm	
				MADE GROUND Black, very sandy, fine to coarse angular gravel.	
				MADE GROUND Light brown very sandy, fine to coarse subangular gravel. PID 1-2 m 250 ppm	
2	-2			MADE GROUND Black, very sandy coarse, sub-rounded gravel. Rare brick and concrete cobbles. PID 2-3 m 3,250 ppm	
3	-3			MADE GROUND Light brown, slightly sandy firm clay	
				MADE GROUND Grey slightly sandy firm clay. Light organic staining and mild coal tar odour. PID 3-4 m 400 ppm	
4	-4			End of Trial Pit at 4.5 m	
5					

Water Ingress at 3.1 and 3.9 m

TRIAL PIT TPQ 08

(Page 1 of 1)



PROJECT INFORMATION

Project Title : Barry Waterfront
 Project No. : 3758
 Date Completed : 05.07.2012
 Logged By : P. Leighton

Machine : Hyundai 14.5T
 Bucket type : 5' toothless
 Pit depth : 4.5 m

QDS Environmental Ltd
 Langton Priory, Portsmouth Road
 Guildford, Surrey, GU2 4YG

Tel: +44(0) 1483 303070

Fax: +44(0) 1483 303080

Depth in meters	Water Levels	Surf. Elev. 0	GRAPHIC	DESCRIPTION	Lab No.
0	0		[Cross-hatched box]	Grass surface MADE GROUND Brown, gravelly, firm clay with angular and subangular gravels and occasional brick cobbles. PID 0-1 m 7 ppm	
1	-1		[Cross-hatched box]	MADE GROUND Grey medium to coarse angular gravel. Geotextile membrane above and below horizon MADE GROUND Black, sandy, fine to coarse angular gravel. Abundant brick gravels PID 1-2 m 2,500 ppm	
2	-2		[Cross-hatched box]	MADE GROUND Light brown slightly sandy, firm clay PID 2-3 m 3 ppm	
3	-3		[Cross-hatched box]	MADE GROUND Grey-brown sandy, firm clay. Heavy staining and very strong coal tar odour. Visible sheen on wet material PID 3-4 m 30 ppm	
4	-4		[Cross-hatched box]	End of Trial Pit at 4.5 m	
5					

TRIAL PIT TPQ 09

(Page 1 of 1)



PROJECT INFORMATION

Project Title : Barry Waterfront
 Project No. : 3758
 Date Completed : 06.07.2012
 Logged By : P. Leighton

Machine : Hyundai 14.5T
 Bucket type : 5' toothless
 Pit depth : 4.9 m

QDS Environmental Ltd
 Langton Priory, Portsmouth Road
 Guildford, Surrey, GU2 4YG

Tel: +44(0) 1483 303070

Fax: +44(0) 1483 303080

Depth in meters	Water Levels	Surf. Elev. 0	GRAPHIC	DESCRIPTION	Lab No.
0	0			Grass surface MADE GROUND Brown, occasionally black slightly sandy clay. PID 0-1 m 3 ppm	
1	-1			MADE GROUND Grey medium to coarse angular gravel. Geotextile membrane above and below horizon MADE GROUND Black, very sandy, fine to coarse angular gravel. PID 1-2 m 7 ppm	
2	-2			MADE GROUND Brown slightly sandy, soft clay	
3	-3			MADE GROUND Grey-brown slightly sandy, mottled, firm clay. Heavy organic staining and strong coal tar odour. PID 2-4.9 m 300 ppm	
4	-4				
5				End of Trial Pit at 4.9 m	

TRIAL PIT TPQ 10

(Page 1 of 1)



PROJECT INFORMATION

Project Title : Barry Waterfront
 Project No. : 3758
 Date Completed : 06.07.2012
 Logged By : P. Leighton

Machine : Hyundai 14.5T
 Bucket type : 5' toothless
 Pit depth : 4.4 m

QDS Environmental Ltd
 Langton Priory, Portsmouth Road
 Guildford, Surrey, GU2 4YG

Tel: +44(0) 1483 303070

Fax: +44(0) 1483 303080

Depth in meters	Water Levels	Surf. Elev.	GRAPHIC	DESCRIPTION	Lab No.
0	0	0		Grass surface MADE GROUND Brown slightly sandy, firm clay. Occasional brick gravels. PID 0-1 m 5 ppm	
1	-1			MADE GROUND Grey medium to coarse angular gravel. Geotextile membrane above and below horizon MADE GROUND Black, very sandy, fine to coarse angular gravel. PID 1-2 m 90 ppm	
2	-2			MADE GROUND Red-brown coarse angular gravel and occasional cobbles. MADE GROUND Yellow-brown very sandy, coarse angular gravel with abundant cobbles and occasional boulders.	
3	-3			MADE GROUND Yellow-brown slightly gravelly cobbles. Abundant boulders. Mild coal tar odour. PID 2-4 m 80 ppm	
4	-4			End of Trial Pit at 4.4 m	
5					

Water ingress at 3.0 m

ANNEX B

**EA letter dated 25th February 2013
approving the QDS Ltd
groundwater treatment proposals**

creu lle gwell
creating a better place



Asiantaeth yr
Amgylchedd Cymru
Environment
Agency Wales

Mr. Jim Hayward
Q D S Environmental Ltd.
Langton Priory Portsmouth Road
Guildford
Surrey
GU2 4YG

Ein cyf/Our ref: SE/2012/115884/03-L01
Eich cyf/Your ref: 5040/5/3758/JH

Dyddiad/Date: 25 February 2013

Annwyl / Dear Mr. Hayward,

**QDS ENVIRONMENTAL LTD. REMEDIAL ACTION PLAN, WEST POND BARRY,
BARRY WATERFRONT, BARRY FOR CUDDY GROUP. REF. 504/5/3758/JH.
NOVEMBER 2012. LAND AT BARRY WATERFRONT, ADJACENT TO DOCK NO
1, BARRY**

Thank you for sending us the Remedial Action Plan (Ref. 5040/5/3758/JH rev1, dated November 2012) for the above development site, which we received on 6th February 2013.

We assume this is for the discharge of condition 40 of planning permission 2009/00946/OUT and in particular Part 4. We can confirm that the information is now sufficient to recommend discharge of this condition.

Yn ddiffuant / Yours sincerely,

Mr. Gwion Thorpe
Planning Liaison Officer / Swyddog Cynllunio

Deialu uniongyrchol/Direct dial 029 20 245046
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E-bost uniongyrchol/Direct e-mail gwion.thorpe@environment-agency.wales.gov.uk

