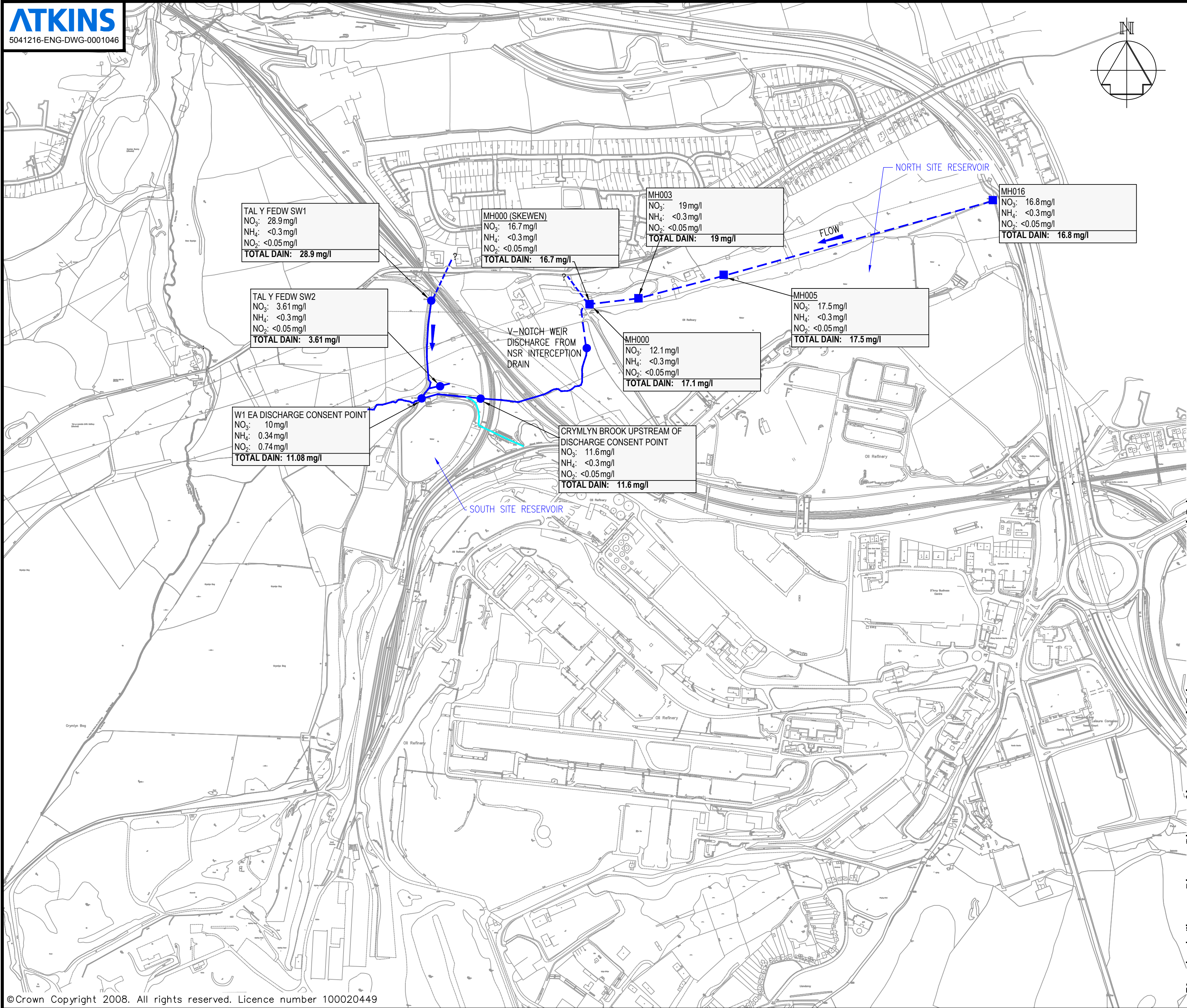
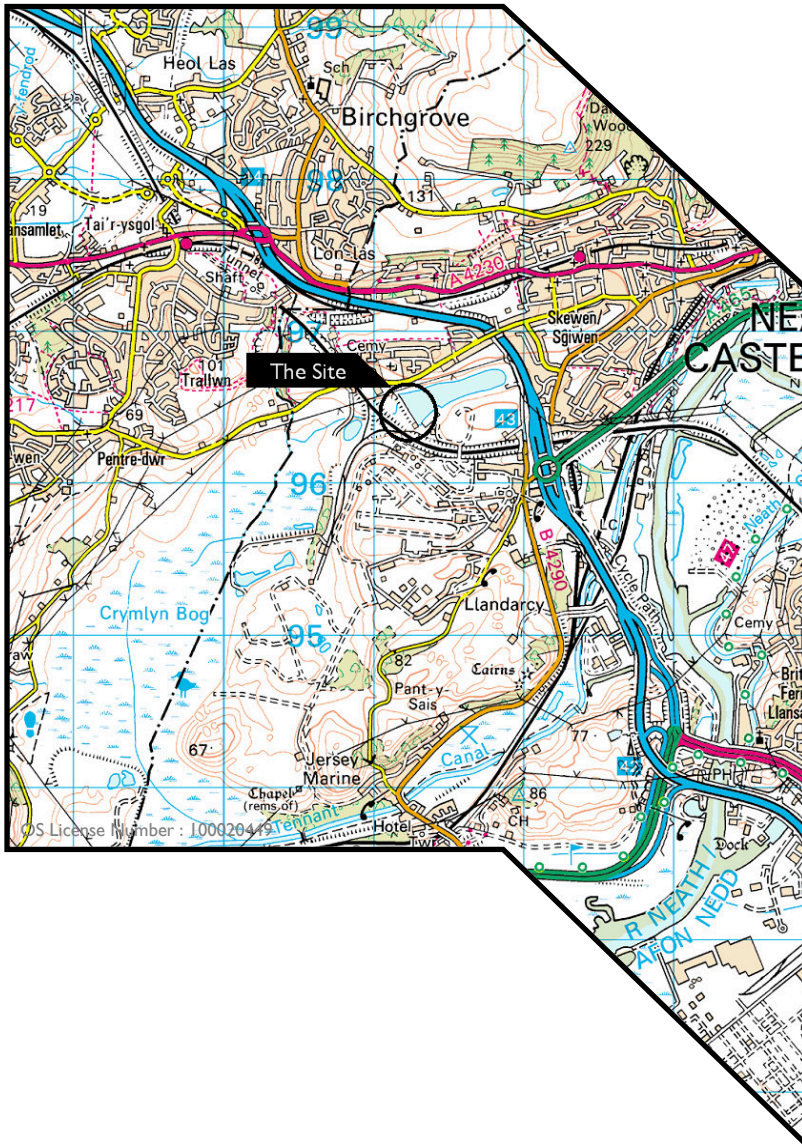




- KEY:
- APPROXIMATE LOCATION OF NSR INTERCEPTION DRAIN
 - SITE DERIVED WATER INPUT TO DISCHARGE CONSENT POINT
 - NON-SITE DERIVED WATER INPUT TO DISCHARGE CONSENT POINT
 - MANHOLE
 - SURFACE WATER MONITORING POINT

REVISIONS				Drawn By	Checked By	Date
PURPOSE OF ISSUE				Rev.	Authorised for issue	Date
Atkins Ltd Consulting Engineers The Axis, 10 Holiday Street Birmingham West Midlands B1 1TF Tel 0121 483 5000 Fax 0121 483 5252 THIS DRAWING IS NOT TO BE SCALED						
CLIENT ST.MODWEN						
PROJECT COED DARCY URBAN VILLAGE						
DRAWING TITLE NORTH SITE RESERVOIR INTERCEPTION DRAIN WATER QUALITY SURVEY						
SCALES 1:5000	DRAWN JH	CHECKED SB	CO-ORD CHECK	DATE 03/10/11	DATE 03/10/11	DATE 03/10/11
0 250m				SHEET A2	PLOT DATE 06/10/11	REV -
DRAWING NO 5041216-ENG-DWG-0001046						

Appendix E Previous Reports



**Ground Investigation
at**

**Coed Darcy Urban Village,
North Site Reservoir Dam**

Factual Report

for
St. Modwen Developments Limited

Engineer : Atkins Limited

Project Number : PC114596

June 2011

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Ground Investigation
at

**Coed Darcy Urban Village,
North Site Reservoir Dam**
for
St. Modwen Developments Limited

Factual Report

Engineer :
Atkins Limited

Project No:
PCI14596
June 2011

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1.0 INTRODUCTION

A geotechnical investigation was undertaken by Geotechnics Ltd at the site of a dam at the Coed Darcy Urban Village redevelopment. The investigation was carried out to the instructions of Atkins Limited (the Engineer) on behalf of the Client, St. Modwen Developments Limited. This report describes the work undertaken and presents the data obtained.

2.0 OBJECT AND SCOPE OF THE INVESTIGATION

The object of the investigation was to obtain information on the ground and groundwater conditions relating to the dam within the limitations posed by trial hole numbers, locations, depths, methods adopted and the scope of approved in situ and laboratory testing. The Brief for the project is included in Appendix 1. The investigation comprised a cable percussion borehole, hand excavated trial pits, in situ and laboratory testing and reporting. A geotechnical interpretation and evaluation of the data obtained was not commissioned.

3.0 PRESENTATION

A description of the site and a summary of the procedures followed during the investigation process are presented in Sections 4 to 6. The factual data so obtained are presented in Appendices 2 to 7 of this report.

In addition, data in electronic format in accordance with "The Electronic Transfer of Geotechnical Data from Ground Investigations" (Third Edition) published by the AGS (the AGS Format) are presented separately on disk together with a copy of the report in electronic PDF format.

Attention is drawn to the General Notes and Investigation Procedures presented in Appendix 8 to aid an understanding of the procedures followed and the context in which the report should be read.

4.0 THE SITE

4.1 Location

The site is located on the north western edge of Neath, approximately 1km north west of the M4 Junction 43. The approximate Ordnance Survey National Grid Reference for the site is SS 712 964 and an extract from the relevant 1:50,000 Scale O.S. Map (Sheet No. 170) is included as Appendix 2.

4.2 Description

The embankment dam is approximately 230m long with a maximum height of approximately 9m and a grassed downstream slope at a gradient of approximately 1:2.5 (vertical:horizontal). The crest of the dam is flat and approximately 2.5m in width. A concrete plinth supporting a CCTV mast, reduced the width to approximately 1.6m, at about 60m from the southern end of the dam.

Photographs of the site taken during the fieldwork are presented in Appendix 3.

5.0 PROCEDURE

5.1 Commissioning

The work was awarded following submission of a tender for work designed by the Client's advisers for ground investigation of the site in accordance with the Client's requirements (see Appendix A).

5.2 General

The procedures followed in this site investigation are based on BS 5930:1999 + A2:2010 - *Code of Practice for Site Investigations*. The soils and rocks encountered have been described in accordance with BS5930:1999 + A2:2010 and BS EN ISO 14688-1:2002 and BS EN ISO 14689-1:2003. The Borehole and Trial Pit Records are included in Appendices 4 and 5 and their approximate positions are shown on the Exploratory Hole Location Plan in Appendix 6.

The Exploratory Hole locations were selected by the Engineer. Levels and coordinates shown on the Exploratory Hole Records were determined using a Leica CS10 SmartRover Global Positioning System (GPS) and the depths quoted are in metres below ground level.

5.3 Borehole

A single 150mm diameter borehole (BHNSR01) was sunk by Cable Percussion Tool techniques to a depth of 15.50m. The work was carried out on the 9th and 10th May 2011. An inspection pit was excavated using hand tools to a depth of 1.20m below ground level to check for the presence of underground services.

Representative disturbed (D and B) and driven open-tube thick walled (U) samples of the soils encountered were obtained at regular intervals. Standard Penetration Tests (SPTs) were undertaken at the depths indicated on the borehole records in accordance with BS EN ISO 22476-3:2005 to obtain a measure of the engineering properties of the proved strata. No groundwater was encountered during the drilling operations. On completion the borehole was backfilled with grout.

5.4 Trial Pits

Six (6 No.) Trial Pits (numbered TP01 to TP06) were excavated by hand tools to depths of 1.20m below ground level. This work was supervised on site by a geotechnical engineer.

The profiles of strata or other features were recorded as excavation proceeded and measurements taken from ground level. Representative samples were taken for laboratory examination and analysis.

6.0 LABORATORY TESTING

6.1 Geotechnical

The laboratory testing schedule was specified by the Engineer in order to determine the properties of the dam construction. The tests, where appropriate, conform to BS 1377 - *Methods of Test for Soils for Civil Engineering Purposes (1990)* and were carried out in Geotechnics Limited's UKAS accredited Laboratory

(Testing No. 1365). Any descriptions, opinions and interpretations are outside the scope of UKAS accreditation.

The tests undertaken can be summarised as follows:-

BS 1377 (1990)

Test No.		Test Description
Part 2		
3.2	7 No.	Moisture Content Determination
4.3 & 5.3	10 No.	Liquid and Plastic Limit Determination
9.2 & 9.3	6 No.	Mechanical Analysis - Sieving
9.4	6 No.	Mechanical Analysis - Sedimentation
Part 7		
9	6 No.	Shear Strength Measurement - 100mm diameter (Multi-Stage) Quick Undrained Triaxial Compression Test.

The results of these tests are presented in Appendix 7.

Signed for and on behalf of Geotechnics Limited.

C Lange
BSc
Senior Engineer

T N Hardie
BSc,MSc,DIC,CEng,MICE.
Principal Engineer

APPENDIX I

The Brief

Schedule of Information
Coed Darcy Urban Village – Ground Investigation for North Site Reservoir Dam

Schedule of Information

Ground Investigation Contract for:	Coed Darcy Urban Village – Ground Investigation for North Site Reservoir Dam
Conditions of Contract	ICE Conditions of Contract, Ground Investigation Version, 2 nd Edition
Employer	St. Modwen Developments Limited (SMD)
Engineer	Atkins Limited
Specification	Thomas Telford 'Specification for Ground Investigation' (1993)
Time for Completion	4 weeks for fieldwork and provision of engineer's logs, lab test results and factual report
Method of Measurement	Re-measurable based on submitted Bill of Quantities
Supporting Documentation	The following documentation is provided to support this Schedule of Information: • Drawing 5041216-ENG-DWG-0862: Ground Investigation for North Site Reservoir Dam – Access Details and GI Requirements • Drawing 5041216-069: Composite Service Location Plan • Drawing 5041216-ENG-113: Composite Historic Services Plan • National Oil Refineries Ltd Drawing No. 21996 • Project Design Risk Assessment • Bill of Quantities (available electronically)
Schedule 1. Information	
1.1 Name of Contract and site address	Coed Darcy Urban Village – Ground Investigation for North Site Reservoir Dam Former Llandarcy Oil Refinery, Llandarcy, Swansea SA10 6HJ
1.2 Description of Site	The North Site Reservoir (NSR) Dam lies within the former Llandarcy Oil Refinery and is located off junction 43 of the M4, Llandarcy, Neath, South Wales. The approximate National Grid Co-ordinates for the dam are 271200 196400. The site is being redeveloped by SMD as the Coed Darcy Urban Village. The site is currently being remediated; the majority of existing buildings have been demolished at the time of writing and clearance works are ongoing across the site. A number of live services remain present within the site. The NSR Dam is an embankment dam with a maximum height of approximately 9m and a grassed downstream slope at a gradient of approximately 1v:2.5h. The crest of the dam is narrow (approx 2.5m) and access along the crest is obstructed by a concrete plinth, reducing the width to approx 1.6m. It is not considered to be safe to drive a 4WD vehicle along the dam crest and therefore it is envisaged that the borehole proposed on the crest will need to be drilled using either a lightweight modular cable percussion rig or a tracked 'Pioneer' type rig.

Schedule of Information
Coed Darcy Urban Village – Ground Investigation for North Site Reservoir Dam

	Photographs of the dam are attached to this specification; however, the Contractor is recommended to visit site prior to submission of his tender to satisfy himself of access issues and suitability of equipment proposed. Access to view the site may be arranged via Atkins' Site Engineer – Richard Western 07834 506255. Vehicular access to the dam is possible via a network of service roads through the main development site to the edge of the dam. The recommended access route is marked on the attached drawing (5041216-ENG-DWG-0862). A weak bridge over a railway cutting has a maximum weight limit of 3 tonnes and the contractor shall not use this route if the weight of his equipment exceeds the bridge weight limit. An alternative route to the dam site exists and access via any locked gates is to be arranged with the Principal Contractor (Hawk Limited) or Atkins' Supervising Engineer prior to commencement on site. Liaison with the Principal Contractor responsible for the main site area (Hawk Limited) will be required in order to ensure that no conflicts arise between the proposed ground investigation works and the ongoing site clearance works. A fence runs along the crest of the dam (see attached photographs). Access to the downstream face of the dam can be achieved via a locked gate at the north end; access is to be arranged with the Principal Contractor (Hawk Limited) or Atkins' Supervising Engineer, prior to commencement on site. The main Coed Darcy site is known to exhibit contamination in many areas. Both soil and groundwater contamination is present including extensive areas of free product. Contamination includes petroleum hydrocarbons, chlorinated solvents, asbestos (fragments of ACM and free fibres) and heavy metals. However, the NSR Dam is sited at the periphery of the site and is likely to have been constructed from reworked 'natural' materials. The dam site should therefore initially be considered a BDA 'yellow' site, however, this may need to be up-rated to 'red' if evidence of contamination is encountered during the works.
1.3 Background and purpose	The investigation is required to provide geotechnical information on the materials used to construct the dam to enable a Dam Break Analysis to be completed.
1.4 Scope of investigation	The investigation is to comprise 1 cable percussive borehole to 15m depth, 6 hand dug trial pits to 1.2m depth (including 1 trench nominally 3m long), as shown on the attached drawing (5041216-ENG-DWG-0862). Soil sampling is required to facilitate logging and laboratory testing. In order to prevent the creation of a groundwater pathway through the dam, the borehole shall be grouted from the base upwards on completion. Where required, temporary casing shall be provided in order to ensure that the borehole remains open after drilling to facilitate effective grouting. Further detail on the anticipated depths of investigation at each location is provided in Table 1. The depth and location of holes could vary based upon the findings during the investigation. The Client reserves the right to cancel or alter the locations, scheduled depths and sampling regime in any of the holes.

Schedule of Information
Coed Darcy Urban Village – Ground Investigation for North Site Reservoir Dam

1.5 Geology and ground conditions	The published 1:10,560 scale geological map SS79NW and site observation indicates the following geology underlying the site area: Dam Construction: Presumed earth fill (reworked 'natural' materials) Drift: Boulder Clay (Glacial Till). Locally thin peat recorded. Bedrock: Carboniferous, Upper Coal Measures Strata, Hughes Beds (Sandstone).
1.6 Schedule of drawing(s) and documents	• Drawing 5041216-ENG-DWG-0862: Ground Investigation for North Site Reservoir Dam – Access Details and GI Requirements • Drawing 5041216-069: Composite Service Location Plan • Drawing 5041216-ENG-113: Composite Historic Services Plan • National Oil Refineries Ltd Drawing No. 21996 • Project Design Risk Assessment
1.7 Particular Contract Restrictions	The hours of work on site will be between 07.30 and 18.00, Monday to Friday. Access to the proposed exploratory hole locations is via the main Coed Darcy site. All staff will be required to undertake a site induction with the Principal Contractor (Hawk Limited) prior to the start of any works on site. Exploratory holes shall not be terminated or backfilled without instruction from the Atkins' Supervising Engineer. The Contractor will be responsible for assessing access constraints at all locations and allowing for full access for all plant and equipment within his rates. A culvert (containing an outlet pipe) runs through the central part of the dam, perpendicular to the crest; see National Oil Refineries Ltd Drawing No. 21996, attached. The Contractor must ensure that the borehole avoids this culvert and therefore must visually locate this culvert at the downstream embankment toe prior to drilling the borehole, to ensure that the line of investigation is sufficiently far away from the line of the culvert. An approximate location for the access chamber to this culvert, which is at the downstream embankment toe, is shown on the attached drawing (5041216-ENG-DWG-0862), and photographs of this feature are attached to this specification. In addition, a historical plan is attached to the specification showing the culvert and run-off pipe at the North Site Reservoir.
1.8 Particular General Requirements	The Contractor should allow for a pre-start meeting with the Principal Contractor and Atkins' Supervising Engineer, required to take place at least one week prior to commencement of works on site, to familiarise himself with site constraints and working practices. Prior to works commencing, and in advance of the pre-start meeting, the Contractor is required to provide a detailed Method Statement and Health and Safety Plan. This is to be provided to Atkins, the Principal Contractor and the CDM Coordinator (CDM-C) and must be agreed in writing by the CDM-C prior to mobilisation to the site. Within reason, all works shall be carried out with least possible damage to the site and its environs. Any damage should be made good at no additional cost and Atkins' Supervising Engineer should be informed prior to the Contractor leaving site on completion of the works to enable any

Schedule of Information
Coed Darcy Urban Village – Ground Investigation for North Site Reservoir Dam

	checks to be completed. The Contractor shall ensure that there are sufficient appropriately qualified personnel to supervise the works on a full time basis. All drillers employed on the Contract shall hold a relevant certificate of competence from the BDA or equivalent. The Contractor's full time site engineer will be responsible for: ensuring health and safety requirements are enforced, setting out, instructing drillers, ensuring boreholes are drilled as per the specification, liaison with the Atkins' Supervising Engineer and logging of exploratory holes. Atkins will undertake part-time supervision of the investigation works. However, Atkins has a full-time presence on the Coed Darcy site and will be available to respond to queries and meet with the Contractor during the course of the contract. All holes shall be logged on site by the Contractor's engineer. Driller's logs shall be provided by the Contractor to the Engineer at the end of the shift or first thing the next morning. These should include reference to all samples obtained. The Contractor's engineer shall liaise with the Atkins' Supervising Engineer on a daily basis to inform on progress. Where anomalous or unexpected features/conditions are revealed, the Contractor shall inform the Atkins' Supervising Engineer immediately. Visual and olfactory evidence of contamination shall be notified immediately to the Supervising Engineer who will advise on measures to be taken or additional sampling requirements. The exploratory holes shall be set out at the positions shown on the drawings or as agreed with the Supervising Engineer on site. The as-dug locations of each exploratory hole shall be established by the Contractor. Co-ordinates shall be given relative to National Grid and levels shall relate to Ordnance Datum. The Supervising Engineer will provide the contractor with details of survey control stations in the vicinity of the site. Prior to digging the inspection pit, turf and topsoil shall be placed to one side for reinstatement upon completion of the borehole. The borehole location shall be reinstated on completion and excess spoil shall be bagged and removed from the site. The Contractor should allow for all temporary storage for its plant, equipment and samples. Welfare facilities belonging to the Principal Contractor (Hawk Limited), including toilets and showers, will be made available to the Contractor within the main Coed Darcy site.
	<u>Live Services</u> Although the site is largely considered as redundant, some live services remain; see attached drawings (5041216-069 and 5041216-ENG-113). The accuracy of these plans cannot, however, be guaranteed. The Contractor is responsible for the avoidance of all underground and overhead services and is liable for any damage to services. The Contractor shall satisfy himself of the adequacy of any service plans supplied. The Contractor shall use a Cable Avoidance Tool to check for the absence of underground services. Hand dug inspection pits shall be advanced at each hole location to check for the presence of buried services. <u>Health and Safety</u> The work shall be undertaken under the CDM Regulations 2007. The appointed CDM-C for the Coed Darcy site is RFS Consulting. Risk Assessments and Method Statements shall be prepared for their approval

Schedule of Information
Coed Darcy Urban Village – Ground Investigation for North Site Reservoir Dam

	prior to works commencing. A Project Design Risk Assessment Form has been completed and is attached to this Schedule of Information. The site has been deemed a BDA 'yellow site'. Appropriate PPE shall be worn at all times and revised measures taken as appropriate if gross contamination is encountered. The nearest hospital with an A&E Department is; Neath Port Talbot Hospital Baglan Way, Port Talbot, SA12 7BX (Located approximately 3 miles from Jn 43 of the M4). Telephone 01692 862000. The site was subjected to bombing during the WWII. A Desk Stop Threat Assessment by Bactec International can be made available on request. Due to the continued use of all of the proposed works areas throughout WWII, it is considered likely that any strikes within these areas would have been well documented. The greatest risk of encountering Unexploded Ordnance is considered to relate to the peripheral areas of the site and the areas of soft ground across the site. However, care should be taken in all excavations across the site.
1.9 Particular borehole requirements	The Contractor shall excavate by hand an inspection pit in the proposed location of the borehole in advance of drilling, to check for services and to confirm the borehole location is satisfactory. Atkins' Supervising Engineer will at this stage agree the location for the borehole with the Contractor. The Contractor's rates shall allow for the use of temporary casing or other measures to ensure that the hole remains open until the required depth is reached or they are instructed to terminate the hole by the Supervising Engineer. The Atkins' Supervising Engineer shall be contacted on completion of the borehole to confirm that the hole does not require continuation. Obstructions, Hard Stratum and Bedrock will be confirmed through chiselling for a minimum of 0.5hr and informing the Atkins' Supervising Engineer, who will advise on whether the hole is to be terminated. Water shall not be added to assist the advance of the borehole except in the case of dry granular soils or where approved by the Supervising Engineer. Where the borehole penetrates below the water table and disturbance of the soils is likely, a positive hydraulic head shall be maintained in the borehole by adding water from a bowser. Observations of groundwater must be made during advancement of all boreholes. On encountering groundwater drilling will be suspended for 20 minutes and observations made on water behaviour at five minute intervals. A special note should be made of water appearance including the presence of free product and any ocherous discharges. Groundwater measurements should be taken at the beginning and end of each shift including casing depth. The borehole shall be backfilled with a cement/bentonite grout installed and tremied from the base of the borehole.
1.10 Particular trial pit and trench requirements	Photographs shall be taken of the hand dug trial pits and trenches, including both the pit and the spoil materials encountered. Trial trench TP NSR01 shall nominally be 3m long and is proposed to be dug from the embankment dam centre line downstream across the dam

Schedule of Information
Coed Darcy Urban Village – Ground Investigation for North Site Reservoir Dam

	crest. The aim of the trench is to record the position and geometry of any clay core that may be present. (The contractor may consider the aid of a mini excavator if it is practical and safe to dig the trench with such equipment). Pits shall be backfilled in thin layers using hand tools to compact the material back into the pits.
1.11 Particular sampling requirements	Bulk disturbed samples shall not weigh less than 25kg. The frequency of sampling will be determined by ground conditions. As a minimum, the following sampling strategy should be maintained in the cable percussion borehole: • Cohesive soils – U100's alternating with SPTs at 1m intervals. • Granular soils – SPTs at 1m intervals or as instructed by the Engineer. • Small disturbed samples should be taken at each change in soil type and at 1m intervals, mid-way between U100's in cohesive soil and SPT's in granular soil. • Bulk disturbed samples to be taken at each change in soil type and at 2m intervals. Within hand dug trial pits small disturbed samples should be taken at each change in soil type and at 0.5m intervals, with bulk disturbed samples taken at each change in soil type and at 1m intervals.
1.12 Particular in situ testing requirements	In boreholes, SPTs as described in Section 1.10. In trial pits hand shear vane tests (set of 3) shall be taken in cohesive strata at each change in soil type and at 1m intervals.
1.13 Particular instrumentation and monitoring requirements	None required.
1.14 Particular daily report requirements	Driller's logs shall be provided by the Contractor to the Supervising Engineer at the end of the shift or first thing the next morning. These should include reference to all samples obtained.
1.15 Particular laboratory testing requirements	Laboratory testing is expected to include, but may not be limited to, the following: • Natural Moisture Content • Atterberg Limits • Particle Size Analysis • Unconsolidated Undrained Triaxial
1.16 Particular reporting requirements	Engineers logs shall be supplied to the Atkins' Supervising Engineer within 24 hours following completion of the exploratory hole. Engineers logs are to be provided for all holes, including the borehole inspection pit. A factual report is required. AGS digital data is required to be submitted with the final report. The final report, including photographs, is also required to be submitted as an Adobe Acrobat *.PDF file (compressed to minimum size). Additionally, the exploratory hole location plan shall be provided digitally in AutoCAD *.DWG format. A base survey plan will be provided by the Supervising Engineer.

Schedule of Information
Coed Darcy Urban Village – Ground Investigation for North Site Reservoir Dam

Schedule 2. Exploratory Holes	
2.1 Summary of Exploratory Holes	A summary of target depths is detailed on the attached Table 1. Exploratory hole references relate to the locations proposed on the attached drawing (5041216-ENG-DWG-0862).

Schedule of Information
Coed Darcy Urban Village – Ground Investigation for North Site Reservoir Dam

Table 1: Schedule of proposed exploratory holes

Hole Ref	Type* ¹	Anticipated Depth (m BGL)	Sampling	Installation
BH NSR01	CP	15	Yes (incl SPT/U100)	No
TP NSR01	HTT	1.2	Yes	No
TP NSR02-06	HTP	1.2	Yes	No

*¹

RO	Rotary (Open) Borehole
CP	Cable Percussive Borehole
RC	Rotary Coring
HTT	Hand dug trial trench
HTP	Hand dug trial pit

Schedule of Information
Coed Darcy Urban Village – Ground Investigation for North Site Reservoir Dam

Photographs of dam site



Schedule of Information
Coed Darcy Urban Village – Ground Investigation for North Site Reservoir Dam

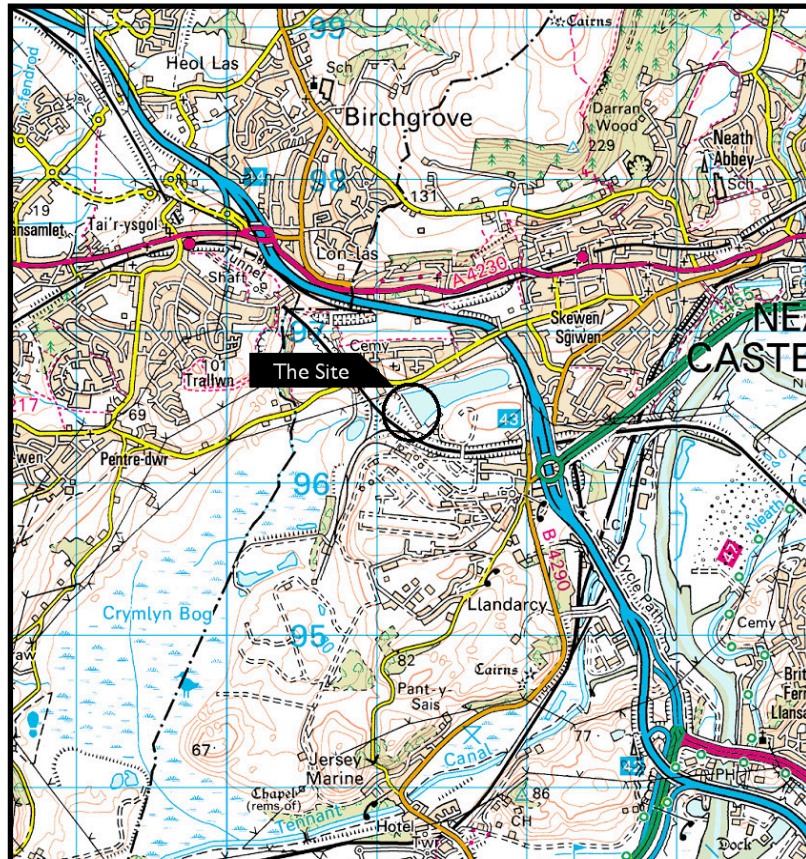
Photographs of access chamber to culvert



APPENDIX 2

Site Location Plan

SITE LOCATION PLAN



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Ground Investigation
at
Coed Darcy Urban Village,
North Site Reservoir Dam
for
St. Modwen Developments Limited



APPENDIX 3

Site Photographs