# ARCHITECT CO PARTNERSHIP

# TECHNICAL PAPER IN SUPPORT OF THE ENVIRONMENTAL ASSESSMENT

# WASTE RECYCLING FACILITY NEATH PORT TALBOT

# TECHNICAL PAPER No 5

# GROUND CONDITIONS AND CONTAMINATION

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# 1 NON-TECHNICAL SUMMARY

This is the non-technical summary for Technical Paper No 5 Ground Conditions and Contamination in support of the Environmental Assessment for the proposed recycling facility at Crymlyn Burrows in the County Borough of Neath Port Talbot.

Site investigations, in the form of trial pits and boreholes, have been carried out to enable samples of the existing soils which underlie the site, to be sent for laboratory testing and analysis. The results of the tests show that there are elevated levels of contaminants within the soils and is likely to be as a result of previous activities at the site, by adjacent users and historical backfill materials.

The effects on groundwater quality resulting from the proposed development are considered to be minimal and may be considered as insignificant. Measures have been designed and will be implemented in order to avoid or reduce disturbance of soils during construction work. It is considered that these mitigation measures should ensure that changes in groundwater quality do not occur.

Prior to construction, discussions will take place with environmental health officers of the Local Authority and Environment Agency. These discussions will allow for agreement with regards to acceptable levels of contamination which may be allowed to remain on the site and any measures which may be required to remove contamination from the site.

Consultation with the Local Authority and Environment Agency will also be undertaken to agree a process of ongoing water quality monitoring, prior to, during and after the construction phase of the project.

# 2 INTRODUCTION AND TERMS OF REFERENCE

GIBB Environmental (GIBB) was commissioned on 18 September 1998 by Architects Co-Partnership (ACP) to provide technical support for an Environmental Assessment for a proposed reclamation facility at Crymlyn Burrows in the County Borough of Neath Port Talbot. The Environmental Assessment project is being led by ACP.

The Environmental Statement will be presented in three parts:

Part 1 - Project Description and Existing Environmental Conditions
Part 2 – Plan and Policies
Part 3 - Assessment of Environmental Impact

ACP is responsible for Part 1 and Part 2 of the Environmental Statement. ACP and GIBB are responsible for Part 3 of the Environmental Statement. The following Technical Reports are provided by GIBB in support of the Environmental Statement to be submitted with the Planning Application.

Technical Paper No. 1 – Ecological Impact Assessment
Technical Paper No. 2 - Noise and Vibration
Technical Paper No. 3 - Traffic and Highways
Technical Paper No. 4 – Water Resources
Technical Paper No. 5 – Ground Conditions and Contamination
Technical Paper No. 6 – Air Quality

This report is the Technical Paper No.5 Ground Conditions and Contamination.

The terms of reference for Technical Paper No.5 are to identify the existing ground conditions and contaminants and assess whether the proposed development will have any adverse effect on the ground conditions. This will include consultation with the local organisations, site investigations, a review of previous uses of the land and results from the laboratory testing, and consideration of the requirement for mitigation works.

The location of the proposed site is shown on Figure 1, and the location of the site investigations are shown in Figure 2. A description of the waste recycling process is given in Chapter 4 of this report.

# 3 SCOPING AND CONSULTATION EXERCISE

A scoping and consultation exercise was undertaken for the preparation of the technical paper in support of the environmental assessment process. The objective of the scoping and consultation exercise was to:

(a) identify environmental baseline data available for the site;

(b) gain an understanding of the proposed project in terms of the potential for environmental effects;

(c) identify the key environmental issues to be addressed in the environmental statement; and

(d) determine the extent and scope of any baseline surveys required.

The information sought for this exercise was obtained from various sources as set out below:

**1. EnviroCheck Survey**

An EnviroCheck report was obtained from the Landmark Information Group Ltd (LIGL), a database company that specialises in the provision of environmental information. This report provides historical ordnance survey maps, a site sensitivity map and data tables pertaining to the site, which identify and tabulate information such as landfill sites, British Geological Survey boreholes, Regionally Important Geological Sites (RIGS), Sites of Special Scientific Interest (SSSI), nature reserves, water/groundwater abstraction points, discharge consents, etc.

The full EnviroCheck report is included in Appendix B

**2. Historical Records Review**

The history of the land was researched to identify the previous land uses of the site and the surrounding environment. The object was to identify potentially contaminative historical land uses on or adjacent to the site. The search included a review of available historical maps, and other identified site specific information.

# 4 PROJECT DESCRIPTION

The process carried out within the waste recycling facility comprises of waste separation, composting, refining and packaging and power generation. All operations are carried out within an enclosed building in order to contain the dust, odour and noise. The building will be insulated and all openings will be designed to minimise any impact on adjacent buildings.

Incoming refuse vehicles deposit the waste on the floor of the reception building, where buckets loaders stack and transfer the waste material onto conveyors feeding the process plant. Any large unwanted items are removed prior to treatment. The reception area will utilise rapid response doors to minimise dust and odour emissions.

Waste from the reception area is placed in a large hopper, where the plastic refuse sacks are split open, the contents screened and conveyed to the picking station. The picking stations remove the recyclable materials, placing them in separate containers for exportation from the plant. The remaining waste materials are further screened into materials which are combustible and waste material suitable for composting.

The material suitable for combusting is further screened before being densified into pellet form. The densified pellets are then stored prior to being fed into the combustor, which generates electricity to be used by the plant and exported to the National Grid.

The material suitable for composting is fed into the composting reactors, which convert the waste material into compost. The process involves the material being continuously turned to ensure the correct aeration and moisture levels are maintained, for approximately 63 days. The refined material is then bagged and stored ready for exportation.

# 5 REVIEW OF EXISTING INFORMATION

## 5.1 Site History

### 5.1.1 Sources of information

The historical information reviewed below has been compiled from Ordnance Survey maps as follows:

| | | |
|---|---|---|
| 1880 | 1:2,500 | Appendix C |
| 1884 | 1:10,560 | Appendix B |
| 1899 | 1:2,500 | Appendix B |
| 1900 | 1:10,560 | Appendix B |
| 1917 | 1:2,500 | Appendix B & Appendix C |
| 1921 | 1:10,560 | Appendix B |
| 1938 | 1:10,560 | Appendix B |
| 1941 | 1:2,500 | Appendix B & Appendix C |
| 1964 | 1:10,560 | Appendix B |
| 1971 | 1:2,500 | Appendix C |
| 1979 | 1:10,000 | Appendix B |
| 1989 | 1:10,000 | Appendix B |

The maps in Appendix C were obtained from the archives of Swansea City Records Office. Appendix B maps were provided by LIGL in the EnviroCheck Report

### 5.1.2 Introduction

During the last two hundred years or so and up until the second world war, Swansea was one of the country's largest and busiest ports. Along the navigable length of the River Tawe, heavy industrial factories were constructed to produce steel, tin, zinc, copper, arsenic etc. as all the materials required for the production of these products were available. Ores were imported from other parts of Britain or abroad and coal imported from the South Wales coal fields which extended from the Swansea valley eastwards. Over a period of time the docks were expanded to cope with the larger ships bringing in the raw materials and exporting coal and other finished products to all parts of the world. The port was further enhanced by the increased use of rail freight, which continued expanding up until the establishment of the M4 motorway.

The site is in and area which reflects Swansea's more recent industrial past as the docks developed.

### 5.1.3 1880

The earliest maps available of the area date from 1880 (Ordnance Survey 1st Edition) and indicate that the site was undeveloped and in its natural state as sand burrows (Crymlyn Burrows). At this time the site was bounded to the north by a dual track rail line which remains today. Beyond this and slightly to the north west, a chemical production factory existed from pre 1880, owned by J.D. Pritchard & Company. Adjacent to the north of the factory was the Port Tennant Canal which remains today but in a disused state.

### 5.1.4 1880 - 1884

Between these years the area remains substantially unchanged. The site is shown as undeveloped rough pastures with no further developments in the surrounding area except markings to the north of the site, east of the Pritchard chemical factory (noted on the map as Burrows Works - Chemical), which may indicate a new boundary and the appearance of a pit.

It is possible that this shows the construction of the terraced houses known as Pritchard's Cottages.

### 5.1.5 1884 – 1899/1900

The site still remains undeveloped at this time. The Pritchard chemical works were still in use and the company had constructed a terrace of six houses to the east of the factory (Pritchards Cottages). A number of pits have appeared to the north and the east of the chemical factory, possibly generated by the construction works in the local area.

Carriage repair sheds were also constructed to the west of the site, one immediately adjacent to the site entrance as shown on the 1899 map. This structure remains and is currently used by Gower Chemicals Ltd.

### 5.1.6 1899 - 1917

By 1917 the area saw massive and rapid development on the Crymlym Burrows, possibly on a par with the nearby docks expansion. The site was now used as rail sidings, possibly as holding areas for ore and coal either for the local industry or export.

Pritchard's chemical works has been re-named Crymlyn Chemical Works.

Immediately to the south of the site a large tinplate works had opened. Marked on the maps as Kings Dock Tinplate Works and owned by Baldwins Ltd, the company also constructed a number of houses further south. These houses exist today, the street being known as Baldwin's Crescent. Surrounding the Tinplate works, to the south and east, the land shows distinct marks indicating that the area has been backfilled to accommodate rail sidings. This construction appears to be by end-tipping, probably using ash from the railways or slag waste from the tin plate works.

### 5.1.7 1917 - 1921

There are no substantial changes to the site and the surrounding area. Construction of a railway line had begun to the north of the site and the original railway lines. The original lines remain and are noted as serving the Vale of Neath. Within the site, two rail lines were extended to the east and are indicated as the Rhondda – Swansea line. Both of these lines would have carried coal mainly for export from the extensive South Wales coal fields.

The sand pit to the north of the chemical works has expanded, possibly due to on-going construction works in the local area.

### 5.1.8 1921 - 1938

Several structures had been constructed on the land adjacent to the site. The Baldwin's tinplate works is indicated to have expanded considerably and another large tinplate works had been constructed to the south. To the east, another large tinplate works had been constructed, this being owned by the Elba Tinplate Company Ltd, who also constructed housing to the south of the factory (Elba Crescent).

Pritchard's Cottages remain and are indicated as being inhabited, Crymlyn Chemical Works still appears to be operational.

### 5.1.9 1938 - 1941

The site itself remains largely unchanged at this time. During this period an extension of the rail sidings occurred. Rail tracks were constructed closer to the site to the north. A spur off the northern rail line had also been constructed, leading to further sidings at Jersey Marine, approximately 1 mile to the east.

### 5.1.10 1941 - 1964

Buildings and railway lines around the site remain unchanged during this time. Pritchard's Cottages remain marked on the map but appear derelict. The chemical factory has now been demolished, with most of this land to the north of the rail line having been reverted to sand burrows/woodland/bog. The area previously indicated as a pit has now been reclaimed and is featured on the plan as a contoured area.

### 5.1.11 1964 - 1971

By 1971, the rail sidings had been fully removed from the site with only the Vale of Neath line remaining. Rail sidings serving the Baldwin's tinplate works remain, however it is not known when the works ceased production.

By this time the A483 (Jersey Marine/Fabian Way) road had been constructed linking Swansea with the M4 motorway at Baglan, Port Talbot. During the mid 1960s the Ford motor company constructed their factory adjacent to the A483. It is possible that the Elba tinplate works building was transferred to Ford.

### 5.1.12 1971 - 1979

On the 1979 map, the site area is noted as the Freightliner Terminal. Baldwin's tinplate factory has been demolished and replaced by another works unit to the south of the site. An additional building has been constructed to the east, just south of the original tinplate works. An oil storage area has also expanded along the coastline, to the south of the site.

### 5.1.13 1979 - 1989

The site and surrounding areas remain substantially unchanged up to 1989, with the dismantling of the Vale of Neath railway being the only alteration to the area.

### 5.1.14 1989 - Present Day

The Freightliner terminal, still identified in the 1989 map is thought to have closed within the last 5 years. From this time it is thought the site has remained derelict. Ford Motor Co. still occupy the former tinplate works to the south. The Gower Chemicals works occupies the former railway sheds and warehouse to the east.

## 5.2 Previous Ground Investigations

Two previous ground investigations are known to have been carried out recently. These were by Golder Associates (1989) and Eastwood Materials Laboratory [EML] (1996). Both of these reports are included as Appendix E in this report.

No contamination testing was undertaken as part of the Golders report but the fourteen trial pits and five cable percussion boreholes revealed made ground to a maximum thickness of 3.5m (generally 1 to 1.5 metres thick).

The EML report revealed the ground to have been impacted, principally with diesel fuel and lubricating oil. Total PAH was recorded at levels up to 170 mg/kg. Made ground was measured at thicknesses of between 0.6 and 2.4 metres.

## 5.3 Pollution Incidents

Several Pollution incidents are recorded in the EnviroCheck report, although one concerning an adjacent site user, Gower Chemicals, is not included. The incident, which is not recorded in the EnviroCheck report, involved a leak of Arcton 11®, a chemical synonymous with trichlorofluoromethane. This report is important as elevated levels of trichlorofluoromethane were found in the groundwater of BHE3, adjacent to the Gower Chemicals site.

# 6 EXISTING ENVIRONMENT

The existing environment is described below, based upon observations made at the site and the results of intrusive investigations.

## 6.1 Description of Site Conditions and Surrounding Area

The site is generally flat and is currently derelict. A large proportion of the centre of the site is covered in a concrete hardstanding. This relatively good quality concrete is doweled and sealed between joints.

To the north the Rhondda – Swansea railway line is currently in use and is known to carry coal. Further north a SSSI area of marsh (Crymlyn Bog) exists. Immediately to the east of the site is derelict land where rail sidings once stood.

The southern part of the site is bounded by a railway line used by Ford Motor Co. for their engineering works. This operation, manufacturing motor components, is housed in the old tin works.

Two major operations are housed immediately to the west of the site. Gower chemicals manufacturing various types of refrigerants and a metal works, machining pipes and other materials for Margham steelworks.

## 6.2 Fieldwork

The ground investigation fieldwork that has been carried out by Exploration Associates has included:

- Eleven environmental trial pits with disturbed sampling.
- Three shallow cable tool percussion environmental boreholes with in-situ testing, gas monitoring and disturbed sampling.
- Four cable tool percussion geotechnical boreholes with in-situ testing and disturbed and undisturbed sampling. A standpipe piezometer installation has been included one of the boreholes for ground water observations.

These were located as shown in Appendix A - Figure 2.

Samples of soil and groundwater were taken for chemical analysis and for future inspection. In situ testing in the form of Standard Penetration Tests (SPTs) was carried out to assist with the preliminary geotechnical appraisal of the site.

Soil samples for each trial pit and borehole were selected for chemical analysis, based on site observations.

PVC Type II permanent groundwater monitoring wells were installed into all three environmental boreholes drilled. The locations were chosen in order to assess the soil and groundwater quality on-site, to allow the direction of groundwater to be evaluated, and to assess the potential migration of contaminants on and off the site. The wells were purged after installation to ensure that the sample was taken from representative formation water. One groundwater sample was submitted for chemical analysis from each well location. The samples were delivered to the laboratories of Hyder Testing services for chemical analysis.

The samples were transported under chain-of-custody and UKAS accredited analytical methodologies were generally used.

Further ground investigations are proposed to be carried out by Exploration Associates, which will include two geotechnical boreholes utilising the ODEX drilling method. The purpose of these boreholes is to determine the depth of the dense gravel underlying this site

## 6.3 Geology and Ground Engineering

The following information is based on preliminary borehole logs, trial pit logs and the driller's daily sheets. Laboratory test results for geotechnical samples are unavailable.

The ground conditions that have been revealed by the excavations carried out to date reveal Made Ground overlying Recent Deposits and Alluvium.

### 6.3.1 Made Ground

Made Ground was encountered in all the trial pits and boreholes, comprising of a reinforced concrete slab, hardcore, dense to very dense gravels and occasional cobbles of ash, coal and slag. The thickness of the Made Ground varies between 0.5 and 1.6m.

### 6.3.2 Recent Deposits

The Recent Deposits was encountered in all the boreholes and trial pits underlying the Made Ground. These deposits comprise of loose to medium dense sand with occasional gravels, bands of peat and occasional bands of soft clay/silt. The thickness of the Recent Deposits varies between 3.7 and 6.5m. The thickness of the peat layer varies between 0.1 and 0.9m.

### 6.3.3 Alluvial Deposits

The Alluvial Deposits were encountered in all the geotechnical boreholes. However the full depth of these deposits was not determined during this phase of investigation, due to the very dense nature of the underlying gravels.

The alluvial deposits generally comprise very soft to soft sandy silty clay, very loose to medium dense sandy clayey silt, bands of peat, dense to very dense gravels and silty sand. Both clay and silt horizons were found to contain varying amounts of peat and plant remains. Boreholes G1, G3 and G4 were terminated into very dense gravels and cobbles. The thickness of the Alluvial Deposits penetrated varies between 13 and 19m.

## 6.4 Engineering Conditions

It is anticipated that the proposed development will have column loads varying between 600 and 1200 kN, and a ground floor loading of 50 kN/sqm. Assuming the columns are supported on 2m square foundations then the resulting loads on the founding medium will be 150 and 300 kPa.

The ground conditions, which include very soft alluvial deposits, are not adequate to provide sufficient bearing capacities. Structures founded on these deposits with peat layers will be subjected to considerable settlements and differential settlements.

The structures within this development are used to house and process domestic refuse, which contains leachates, and therefore need to be designed with very low differential settlements. In view of this requirement the existing ground conditions are not considered suitable. Therefore the structures should be supported on foundations incorporating piles taken into the very dense gravels.

## 6.5 Contaminated Land

### 6.5.1 Objectives

The objective of the assessment was to evaluate potentially contaminated shallow soils and groundwater within a targeted area of the site (Figure 2, Appendix A) for the presence of contaminants and to assess whether historical and current activities have adversely impacted the environmental condition of the site.

### 6.5.2 Contamination Criteria

In order to interpret the analytical results, it is common practice to compare them with the various guidelines published in the UK and Europe: the UK Interdepartmental Committee on the Redevelopment of Contaminated Land's (ICRCL) guidelines published as Guidance Note 59/83 (second edition 1987) and the guidelines published by the Dutch authorities as the Dutch Test Table. These guidelines are used to provide an indication of the levels of contamination present at the site, assess the potential risks to health posed by the levels for various end-uses and aid in the identification of potential environmental liabilities associated with a site.

The ICRCL values provide the most appropriate guidance in the UK and are primarily intended as a guide for site redevelopment. They were published in 1983 and revised in 1987 and use the concept of `trigger concentrations' of contaminants in soil which are related to the intended end use of the site, these trigger concentrations differ depending upon the sensitivity of the end-use to contamination. There are two trigger concentrations given known as the threshold level and the action level. In general, if after a thorough investigation, soil samples from a site show values below threshold trigger concentrations it is reasonable to regard the site as uncontaminated. If, however, some results exceed the action level, some remedial action may be required if the chosen form of development is to proceed. It is recommended that sites with sample concentrations that fall between the threshold and action trigger levels be assessed on a site specific basis, where considerations such as level of risk and cost of remediation are taken into account in determining whether remedial action is necessary.

However, the ICRCL guidelines do not contain trigger concentrations for all contaminants in soil and in particular they do not contain action levels for metals. Furthermore they do not contain trigger concentrations for any contaminants in groundwater. They were developed in the late 1970s/early 1980s using humans as the most sensitive receptor to contamination, and are now considered to be somewhat dated by many practitioners. The Department of the Environment has initiated a research programme into contaminated land in order increase the list of substances for which guidance is given, to revise the current ICRCL limit values, and to review their relation to ecological effects which in some cases can be a more sensitive receptor than humans. It is likely that this programme will result in a revised set of ICRCL guidelines in which a number of the threshold values are changed.

In the meantime, it is common practice to refer to the more comprehensive guidance levels used by the Dutch authorities and given in the Dutch Test Table. However, these levels are generally more stringent than the ICRCL values because they are not `end-use' specific and therefore the levels reflect the values at which the most sensitive receptors (ie. groundwater or children) are considered at risk. In addition they have been developed for the Netherlands specific ground conditions where groundwater is highly vulnerable to pollution from

contamination. Nevertheless, the Dutch values are commonly used as a framework for indicating and evaluating potential contamination risks for those contaminants not specified by the ICRCL guidelines in soil and for contaminants in groundwater.

The Dutch guidelines are based on a framework comprising a `target' level and an `intervention' level. This replaces previous Dutch limits which have comprised an A, B and C classification for uncontaminated, need for further investigation and need for environmental remediation respectively.

**The `Target' level** is a reference value above which there is demonstrable pollution and below which there is no demonstrable pollution.

**The `Intervention' Level** is the threshold value above which the pollutant should generally be treated, if sufficient volume of contamination exists.

The results of the chemical analysis are discussed in the following section.

### 6.5.3 Results of Chemical Analysis

#### a) Soils (Appendix F)

***Polyaromatic Hydrocarbons (PAH)***

All of the soil samples tested for PAHs were below the ICRCL Threshold level for Landscaped areas and hard cover. One sample however, TP2 @ 0.6 - 0.7m was greater than the Dutch Intervention Level of 40 mg/kg at 61.91mg/kg.

***Total Petroleum Hydrocarbons (TPH)***

This analysis was undertaken to indicate the presence of petroleum hydrocarbons in the subsurface. This method allows the identification of the total concentration of petroleum hydrocarbons in the Carbon 7 to Carbon 32 (C7-C32) range.

Soil samples BHE2 and BHE3 were found to contain concentrations of petroleum hydrocarbons (53.6 mg/kg, and 61.1 mg/kg, respectively) which exceed the Dutch Target level concentration of 50 mg/kg. However, the concentrations did not exceed the Dutch Intervention level concentration of 5000 mg/kg. TPH concentrations tended to reduce with soil depth.

Soil taken from trial pits contained only trace amounts of petroleum hydrocarbons and were below the Dutch target level.

***Volatile Organic Compounds (VOCs)***

All soil samples submitted for analysis were found to be below the Dutch Intervention levels for all VOCs for which intervention levels are available, although traces of certain VOCs were found in a number of samples, taking the concentrations of these particular VOCs above the Dutch Target value.

Soil samples BHE1, BHE2 and BHE3 contained traces of Dichloromethane at 7.1 mg/kg, 11.3 mg/kg and 4.98 mg/kg respectively. The higher concentrations were found to occur in samples collected from deeper levels in the borehole. Soil samples taken from the environmental boreholes and all of the trial pits contained traces of 1,1,1 trichloroethane and toluene at concentrations ranging from 0.0025 mg/kg to 32.8 mg/kg and 0.002 mg/kg to 23.1 mg/kg respectively. The highest concentration of 1,1,1, trichloroethane was found at BHE2, between 2.5 - 3.5 meters depth and toluene at TP1, at a depth of 1.9 - 2.3 meters.

Trichloroethene was present in all trial pit samples at concentrations of 0.0011 mg/kg to 0.168 mg/kg, with the largest concentration occurring at TP6 between depths of 1.2 - 1.4 meters. In comparison to the data from other boreholes, there is no connection of elevated

concentrations with depth.

Traces of trichloromethane and M/P xylene were also found in some trial pit samples at concentrations of between 0.002mg/kg to 0.088 mg/kg and 0.002 mg/kg to 0.035 mg/kg respectively. The highest of these concentrations are found in TP1 soil samples, which in addition to the compounds above, also contains tetrachloromethane and O-xylene at concentration of 0.0107 mg/kg and 0.0118 mg/kg respectively.

Soil sampled from TP9 at a depth of 2.6-2.7 meters also contain a number of derivatives of butyl/propylbenzene which are not found in any other soil sample. The concentrations of these compounds are also very high in comparison to the concentrations of other VOCs. For example sec-butylbenzene is found at elevated concentrations of 0.528 mg/kg

***Metals***

Samples taken from the top layers of the soil profile, from 0.1 to 1.2 meters show elevated concentrations of the metals that have been analysed. The highest concentrations found in the soil samples are detailed below.

Arsenic was detected at concentrations of 49mg/kg, 52mg/kg, 55mg/kg, 91mg/kg and 196mg/kg in the soil samples from BHE3, TP2(0.6 to 0.7m depth), TP4(0.4 to 0.6m depth), TP8(0.3 to 0.4m depth) and TP10(0.6 to 0.7m depth) respectively, exceeding the ICRCL Threshold level concentration of 40 mg/kg, especially in the latter two boreholes where the concentrations are particularly high.

Boron was detected at concentrations 4.3 mg/kg and 6.6 mg/kg in the soil samples from TP1 and TP9 respectively, exceeding the ICRCL Threshold level concentration of 3 mg/kg. It should be noted that the high concentration of boron in TP9 was found at a depth of between 2.6 and 2.7 meters.

Copper was detected at concentrations of 386mg/kg, 441mg/kg, 171mg/kg, 191mg/kg, 310mg/kg in the soil samples from BHE3, TP2, TP5, TP8, TP10, respectively, all of which exceed the ICRCL Threshold level concentration of 130 mg/kg.

Nickel was detected at concentrations of 80mg/kg, 74mg/kg and 76mg/kg in the soil samples from BHE3, TP8 and TP10, respectively, all of which exceed the ICRCL Threshold level concentration of 70 mg/kg.

Zinc was detected at concentrations of 5440mg/kg, 3550mg/kg, 330mg/kg and 407mg/kg in the soil samples from TP2, TP5, TP6 and TP8, respectively, all of which exceed the ICRCL Threshold level concentration of 300 mg/kg.

**b) Groundwater (Appendix F)**

***Total Petroleum Hydrocarbons (TPH)***

Petroleum Hydrocarbons were not detected in any of the groundwater samples taken from the environmental boreholes, therefore concentrations of TPHs in groundwater were within the Dutch target value of 50 µg/l.

***Volatile Organic Compounds (VOCs)***

Water samples collected from all boreholes were found to contain only traces of VOCs at concentrations that do not exceed the Dutch Intervention values. However, the VOCs that were detected during analysis are classed as being above the Dutch Target levels. These particular VOCs are detailed below.

BHE1 was found to contain trichlorofluoromethane at a high concentration of 62.0µg/l, although there is no target level defined for this compound in the Dutch recommendations. Similarly 1,1,1 trichloroethane and tetrachloroethene are found at concentrations of 3.2 µg/l

and 1.2 µg/l respectively, with no target level defined. 1,1 dichloroethane is also found in the groundwater of BHE1 at 1.7 µg/l which is below the Dutch Intervention level of 400 µg/l

BHE2 contains a number of VOCs which include 1,3,5/1,2,4 trimethlybenzene, N-butylbenzene, benzene, M/P xylene, O-xylene and p-isopropyltoluene at concentrations of 33.9 µg/l, 17.6 µg/l, 6.6 µg/l, 1.1 µg/l, 7.7 µg/l, 2.5 µg/l and 6.4 µg/l . The only compounds which have been designated an intervention level are benzene (at 30 µg/l) and Xylene (at 70 µg/l) and so these compounds are below the Intervention Levels.

In groundwater sampled from BHE3 the only VOC to be present is trichloromethane existing at a concentration of 3.4µg/l which does not exceed the Dutch Intervention level of 400 µg/l.

***Metals***

Arsenic is present in BHE2 and BHE3 samples at concentrations of 51µg/l and 28 µg/l which are above the Dutch target value of 10 µg/l but are just below the Intervention value of 60 µg/l. The groundwater sample taken from BHE1 shows a concentration of 9 µg/l which is just below the target value.

Chromium is only detected in BHE3. The water sample from this borehole shows an elevated concentration of this metal of 70µg/l which exceeds the intervention value of 30 µg/l.

Copper is detected in all three boreholes (BHE 1, 2, and 3) at concentrations between 20µg/l and 40µg/l which are below the intervention value of 75µg/l, but above the target value of 15µg/l.

Lead is present in BHE2 and BHE3 to concentrations of 60µg/l and 180µg/l respectively. The Dutch Intervention level for arsenic in water is 60 µg/l, and therefore exceeds the intervention level in groundwater from BHE3 and is equal to the intervention level in BHE2

Mercury is present in BHE2 and BHE3 at concentrations of 0.14µg/l and 0.04µg/l respectively. The concentration of mercury in BHE3 is just below the target value of 0.05 µg/l, whereas BHE2 exhibits concentrations greater than the target level but below the Intervention level of 0.3 µg/l.

Nickel is present in boreholes BHE1, BHE2 and BHE3 at concentrations of 30µg/l, 60µg/l and 100µg/l respectively. The concentration of Nickel in BHE3 is above the Intervention level of 75 µg/l and BHE1 and 2 are above the target value of 15 µg/l.

Concentrations of zinc in all three groundwater samples are below the intervention value of 800 µg/l at concentrations of 80 µg/l, 260µg/l and 610 µg/l respectively, but exceed the target value of 65 µg/l

Boron was present in BHE1, BHE2, and BHE3 at concentrations of 130µg/l, 190µg/l and 180µg/l. However, no assessment levels of boron in groundwater has been defined in the Dutch criteria.

Neither Selenium, chromium or cadmium were detected in any of the borehole groundwater samples.

### 5.2.3 Quality Assurance/Quality Control (QA/QC) (Table Appendix F)

The duplicate groundwater sample, taken from BHE2 but labelled E4, showed good correlation to the primary sample, with regard to all analysed parameters. Elevated concentrations were not detected in the laboratory blank sample which indicates that cross contamination via the sampling equipment or storage and transport of samples is unlikely to have occurred.

## 6.6 Gas

Gas monitoring was carried out at the site during drilling and on 16 October 1998, as detailed in Appendix H. The results of gas monitoring have been interpreted with respect to the guidance given in Waste Management Paper No.27 1991: Landfill Gas, and The Building Regulations Approval Document 1991 Part C2 "Dangerous and Offensive Substances". These documents give a trigger value of 1% by volume for methane and 1.5% by volume for carbon dioxide in buildings.

If methane or carbon dioxide levels in the soil atmosphere beneath the site are found to exceed these trigger values, then a risk assessment and possibly remedial / preventive action is appropriate.

### 6.6.1 Methane

Methane was recorded at elevated concentrations of 82% and 24% by volume in BHE1 and BHE3, respectively, on 16 October 1998.

### 6.6.2 Carbon Dioxide

Carbon dioxide was recorded at elevated concentrations of 2.6% and 1.7% by volume in BHE1 and BHE3, respectively, on 16 October 1998.

# 7 CONSTRUCTION EFFECTS AND MITIGATION MEASURES

## 7.1 Construction Effects

The main construction works will take approximately 18 months to complete, and will require the use of heavy machinery. It is assumed there will sub-structure will be supported on piled foundations which will necessitate the removal of sections of the existing concrete apron.

Piling may provide a potential route for contamination to the deeper aquifer in the dense gravels at approximately 20 metres depth. Dewatering activities from excavations may also spread contamination and pollute controlled waters.

The effect of elevated methane and carbon dioxide must also be taken into account in both the design and in any construction operations which may include confined spaces. Methane is a potential explosive gas whilst carbon dioxide is an asphyxiate.

## 7.2 Mitigation Measures

The risks to workers, the general public and the environment from construction works on a site where elevated levels of contamination have been found will need to be assessed. Risk assessments must be undertaken both by the contractor for the works and by those involved in the planning and design of the works.

The Site Contractor would be required to undertake measures to prevent the spread of contamination. Typical construction activities such as excavation, trenching, and general site groundworks which disturb the ground, should be minimised both in design and execution, and be carefully managed to limit disturbance and infiltration of the surface water. Where the ash fill material is excavated it will need to be tested prior to either disposal or re-use. Further consideration should be given to this when site layout is finalised and working methods and construction phasing have been identified.

During the planning and design work, discussions will need to take place with officers of the Local Authority with respect to acceptable levels of contamination. Ongoing consultation with the Local Authority will be undertaken to ensure acceptable work procedures at the site and where contaminated materials are to be transported off-site.

The construction will be designed in such a way as to prevent the ingress of gas from beneath the floor slab, or into the buildings. The existing slab will be vented to prevent the build up of gases.

# 8 OPERATIONAL EFFECTS AND MITIGATION MEASURES

## 8.1 Operational Effects

Operations at the site will be planned so as not to create further contamination. All fuel and chemical storage will be within reinforced concrete bunded areas, all ground floor slabs are to be designed and constructed to minimise cracking and the number of floor joints – reducing the possible leachate migration. All surface water is to be stored and recycled through the composting process, negating the need for soakaways.

## 8.2 Mitigation Measures

Measures will be incorporated into the project during operation to prevent further contamination of the soil and groundwater. No intrusive work shall be undertaken unless a defined strategy, agreed with the Local Authority has been formulated.

The facility will be designed and operated in such a way that leachates generated during the storage and treatment of the waste will be collected and recycled into the composting process.

# 9 DEMOLITION/DECOMMISSIONING EFFECTS AND MITIGATION MEASURES

It is understood that this facility will be in continuous operation for a minimum period of 12 years, after which the combustor will have to be replaced due to wear and tear. Replacement work could take up to 3 to 4 months, after which the combustor will be in continuous operation for a further 12 years.

Demolition should, when required, be undertaken in a safe and clean manner, preventing the spread of dust and potentially harmful materials.

# 10 MONITORING REQUIREMENTS

## 10.1 Construction Monitoring Requirements

It is recommended that gas and ground water monitoring is undertaken prior to construction to provide a reasonable set of baseline data with which to compare future readings.

Ground water monitoring should be undertaken at location(s) to be agreed with the Local Authority, during critical phases when there may be a possibility of impacting the groundwater. This will allow any further impact on the quality of the groundwater to be identified, if it occurs. It will provide a database of information to show that the mitigation measures undertaken during the construction works have been successful. If possible the existing monitoring wells (BHE1 to BHE3 in Figure 2, Appendix B) should be utilised for this purpose.

Due to the high concentrations of gas measured, monitoring, which will include flow measurements, should be carried out to enable the risks posed by the subsurface gases to be more clearly understood and incorporated into the design prior to construction.

## 10.2 Operational Monitoring Requirements

Monitoring may be required by the Local Authority during the operational life of the plant. Ongoing monitoring of gas concentrations is recommended for both the exteriors and interiors of the building for a period following completion of the construction works.

# 11 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of this investigation, there is evidence that both the made ground and the groundwater beneath the site have been impacted. At this stage, it is not known if the site is currently causing contamination of the groundwater. Due to the proximity of other possibly contaminating facilities in the area it is considered likely that the findings of this assessment reflect the true groundwater quality in the area.

It is recommended that gas and water monitoring is undertaken prior to, and during construction, to provide a reasonable set of baseline data with which to compare future readings. There should then be an ongoing monitoring regime to firmly establish and fully understand the conditions at the site.

This monitoring should consist of water contamination sampling and testing, gas monitoring and gas flow measurement.

It is not considered necessary to undertake any remedial work at the site as the contaminated materials are considered to be isolated by the existing concrete slab, which is to be retained. The development of the site will increase the area of hardstanding on the site, which will further isolate any contaminated materials and limit further infiltration of contaminates into the groundwater.

It is recommended that any excavation of materials is undertaken after assessment of the risk to site operatives and the potential for leachate generation. All works are to be undertaken in a manner which will limit or prohibit these risks.

# APPENDIX A

# FIGURES

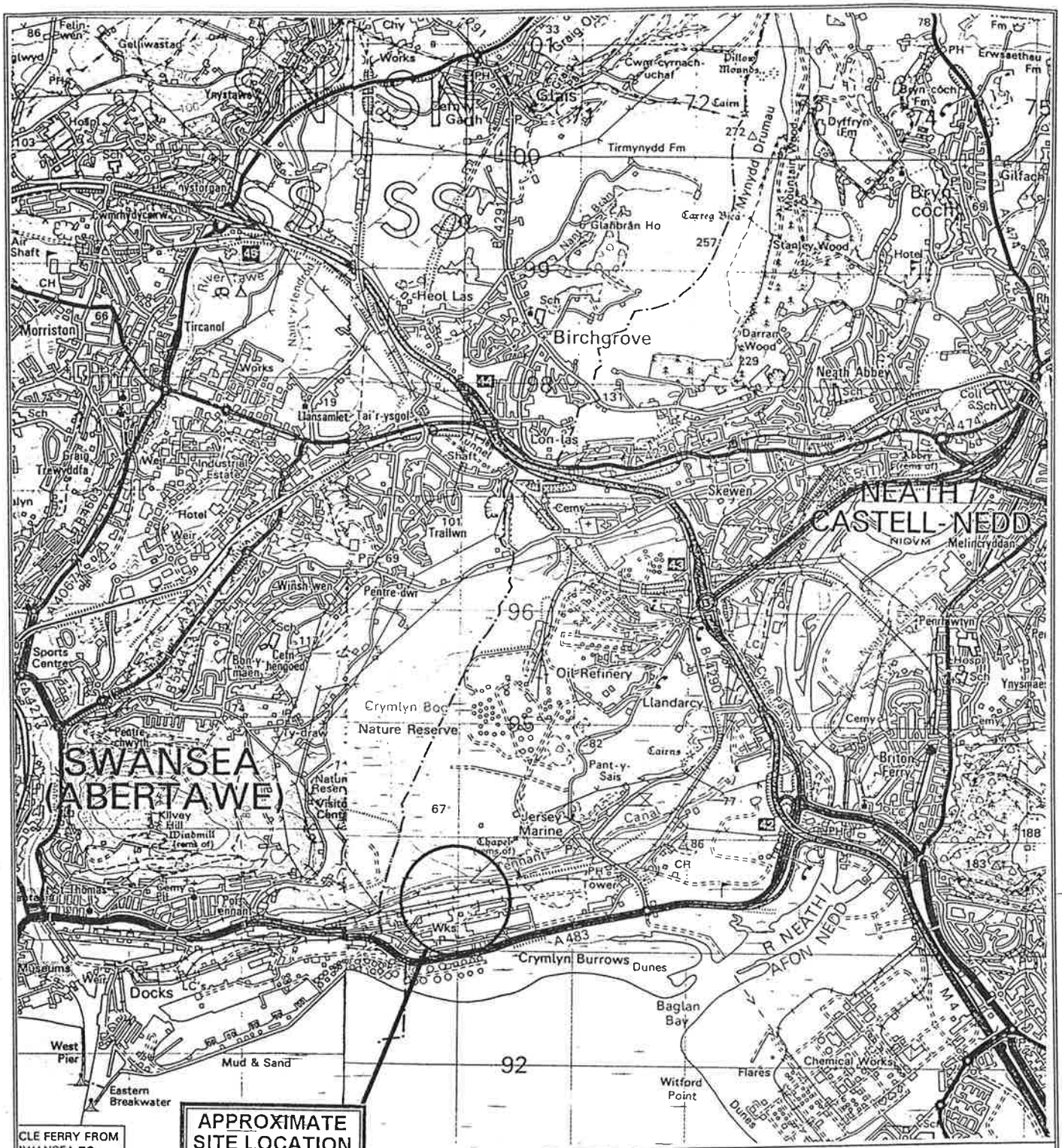



FIGURE 1

WASTE FACILITY, NEATH, PORT TALBOT - ARCHITECT CO PARTNERSHIP

SITE LOCATION PLAN

| | |
|---|---|
| Job Number: P5174 | Approved by: |
| Date: October 1998 | Scale: Not to Scale |

GIBB Environmental Engineering

LAWGIBB Group Member

GIBB House, 427 London Road,
Reading, RG6 1BL

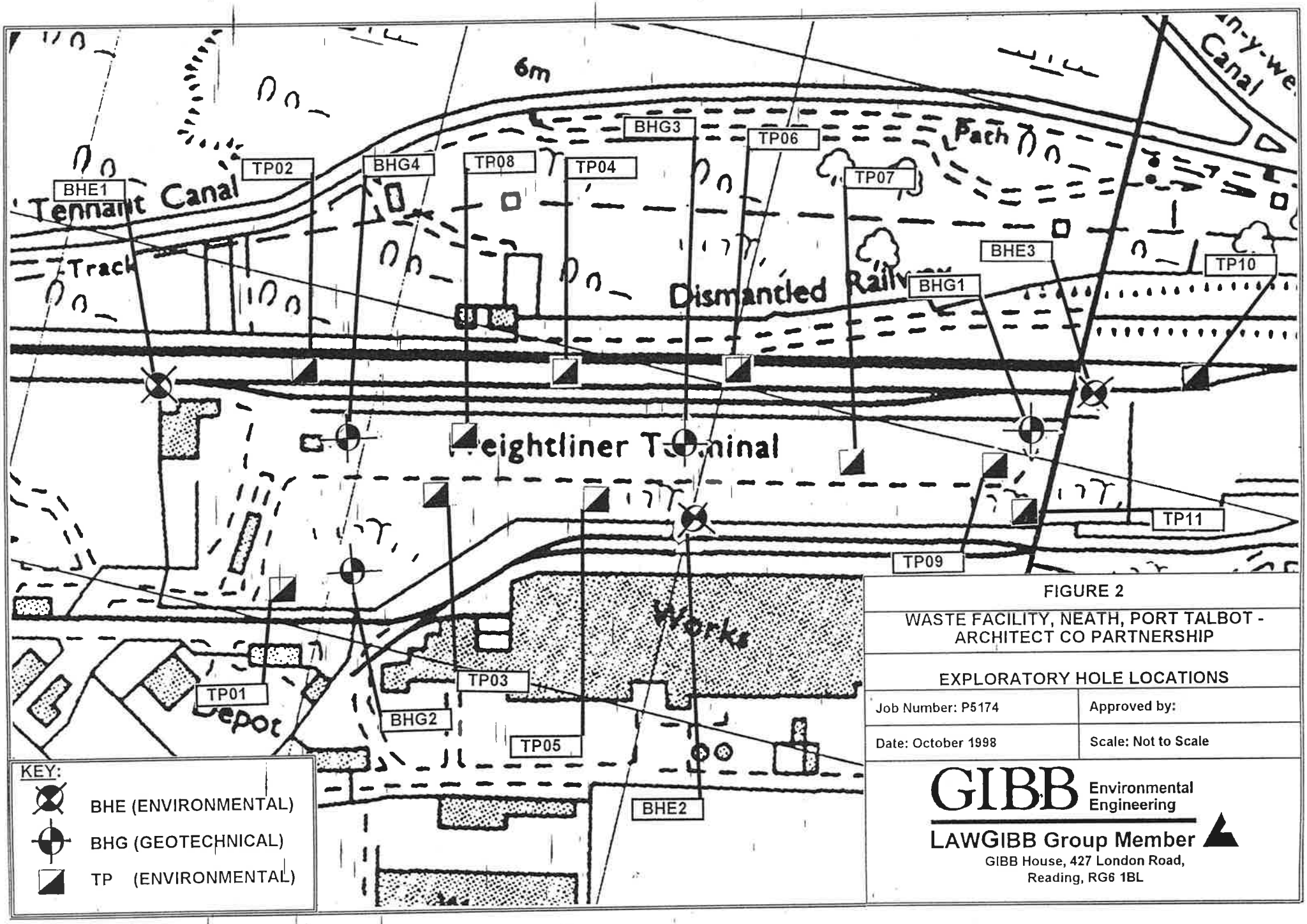



FIGURE 2

WASTE FACILITY, NEATH, PORT TALBOT - ARCHITECT CO PARTNERSHIP

EXPLORATORY HOLE LOCATIONS

| | |
|---|---|
| Job Number: P5174 | Approved by: |
| Date: October 1998 | Scale: Not to Scale |

GIBB Environmental Engineering

LAWGIBB Group Member

GIBB House, 427 London Road,
Reading, RG6 1BL

# APPENDIX B

# ENVIROCHECK REPORT

## EnviroCheck Report on:

Freightliner Terminal Site
SWANSEA

## National Grid Reference :

269800, 193300

## Prepared For :

Gibb Ltd
Development House
Rood End Road
Oldbury
Warley
B69 4HW

## Your Reference :

Neil Parry, NVP/J410/P5174/355/

Summary

Environmental Setting

Industrial Setting

Useful Contacts

BGS Borehole Order Form

## Introduction

The Environment Act 1995 has made site sensitivity a key issue, as the legislation pays as much attention to the pathways by which contamination could spread, and to the vulnerable targets of contamination, as it does to the potential sources of contamination. For this reason, Landmark's Site Sensitivity Data Sheet places great emphasis on statutory data provided by the Environment Agency and the Scottish Environment Protection Agency; it also incorporates data from English Nature (and the Scottish and Welsh equivalents), the Environment Agency (and the Scottish equivalent) and Local Authorities; and highlights hydrogeological features required by environmental and geotechnical consultants. It does not include any information concerning past uses of land. The data sheet is produced by querying the legend database to 1km from a single point provided by the client.

Landmark has geocoded and plotted the data to 1m accuracy where possible. Where this isn't the case, data is geocoded to +/- 100m accuracy. In the attached datasheet the National Grid References (NGRs) are rounded to the nearest 100m in accordance with Landmark's agreements with a number of Data Suppliers.

| Data Type | 50m | 250m | 500m | 1000m |
|---|---|---|---|---|
| **Water** | | | | |
| Water Abstractions | | | | |
| Discharge Consents | | | ✓ 1 | ✓ 1 |
| Red List Discharge Consents | | | | |
| Prosecutions relating to Controlled Waters | | | | |
| Pollution Incidents to Controlled Waters | | | ✓ 3 | ✓ 2 |
| Nearest Surface Water Feature | | | ✓ | |
| **Waste** | | | | |
| Landfill Sites | | | | ✓ 1 |
| BGS Recorded Landfill Sites | | | | |
| Waste Treatment or Disposal Sites | | | | |
| Waste Transfer Sites | | | ✓ 1 | |
| IPC Registered Waste Sites | | | | |
| **Statutory / Authorisation** | | | | |
| Integrated Pollution Controls | | | | |
| Air Pollution Controls | | | | |
| Registered Radioactive Substances | | | | |
| Prosecutions relating to Authorised Processes | | | | |
| Enforcement and Prohibition Notices | | | | |
| Planning Hazardous Substance Consents | | | | |
| Planning Hazardous Substance Enforcements | | | | |
| **Other** | | | | |
| Planning Applications (of possible contaminative uses) | | | | ✓ 1 |
| BGS Recorded Mineral Sites | | | | |
| BGS Boreholes | | ✓ 1 | ✓ 1 | ✓ 10 |
| Sites of Special Scientific Interest | | | ✓ 1 | ✓ 2 |
| Potentially Contaminative Industrial Use | | | | ✓ 2 |

Water Abstractions identified, whose centres are more than 1000 metres (but less than 2000 metres) from the centre of the site: 1

| Map ID | | Details | Estimated Distance from Site | Source | NGR |
|---|---|---|---|---|---|
| | ***Water Abstraction*** | | | | |
| - | Operator | B.P Oil Refinery Ltd | 1300 | EA | 269900 |
| | Licence No | 22/59/5/0007 | | | 194600 |
| | Location | Location Description Not Available | | | |
| | Abstraction | General Industrial | | | |
| | Source | River | | | |
| | Daily Rate | 0 cubic metres | | | |
| | Yearly Rate | 205 cubic metres | | | |
| | Details | Freemans Bund | | | |
| | ***Most Sensitive Groundwater Resource*** | | | | |
| - | | Minor Aquifer with possible Drift Deposits | - | EA/SEPA | - |
| | ***Discharge Consent*** | | | | |
| 1 | Operator | Dwr Cymru Cyfyngedig | 710 | EA | 269900 |
| | Property Type | Sewerage Network - Sewers | | | 192600 |
| | Location | Em O'Flow B Crymlyn Bur , Crymlyn Burrows S Scheme | | | |
| | Catchment Area | N/A | | | |
| | Discharge Reference | BE0010502 | | | |
| | Issued | 8th October 1969 | | | |
| | Discharge Type | Sewage Effluent Discharge-Crude Effluent | | | |
| | Discharge Environment | Coastal | | | |
| | Received Water | Sea Outfall | | | |
| | ***Discharge Consent*** | | | | |
| 2 | Operator | Dwr Cymru Cyfyngedig | 500 | EA | 269500 |
| | Property Type | Sewerage Network - Sewers | | | 192900 |
| | Location | Emergency O'Flow A , Crymlyn Burrows Sewerage S | | | |
| | Catchment Area | N/A | | | |
| | Discharge Reference | BE0010501 | | | |
| | Issued | 8th October 1969 | | | |
| | Discharge Type | Sewage Effluent Discharge-Crude Effluent | | | |
| | Discharge Environment | Coastal | | | |
| | Received Water | Sea Outfall | | | |
| | ***Site of Special Scientific Interest*** | | | | |
| 8 | Details | Site of Special Scientific Interest | 820 | - | 270500 |
| | | | | | 193700 |
| | ***Site of Special Scientific Interest*** | | | | |
| 9 | Details | Site of Special Scientific Interest | 270 | - | 269700 |
| | | | | | 193600 |
| | ***Site of Special Scientific Interest*** | | | | |
| 10 | Details | Site of Special Scientific Interest | 580 | - | 270300 |
| | | | | | 193000 |
| | ***BGS Borehole*** | | | | |
| 12 | BGS Reference | SS69SE 2 | 120 | BGS | 269800 |
| | Drilled Length | 42.67 metres | | | 193200 |
| | Bore Name | CRYMLYN BURROWS (NEATH U.D.C.) BOREHOLE | | | |
| | ***BGS Borehole*** | | | | |
| 13 | BGS Reference | SS69SE 17 | 510 | BGS | 269400 |
| | Drilled Length | 21 metres | | | 193000 |
| | Bore Name | KINGS DOCK JUNC. E. SIDE APPROACH RD, SWANSEA. 2 | | | |
| | ***BGS Borehole*** | | | | |
| 14 | BGS Reference | SS69SE 23 | 980 | BGS | 268900 |
| | Drilled Length | 0 metres | | | 193700 |
| | Bore Name | TIR JOHN POWER STATION. BH.2 | | | |
| | ***BGS Borehole*** | | | | |
| 15 | BGS Reference | SS69SE 28 | 910 | BGS | 269000 |
| | Drilled Length | 0 metres | | | 193700 |
| | Bore Name | TIR JOHN POWER STATION. BH.7 | | | |
| | ***BGS Borehole*** | | | | |
| 16 | BGS Reference | SS69SE 16 | 490 | BGS | 269400 |
| | Drilled Length | 22.22 metres | | | 193000 |
| | Bore Name | KINGS DOCK JUNC. E. SIDE APPROACH RD, SWANSEA. 1 | | | |

| Map ID | | Details | Estimated Distance from Site | Source | NGR |
|---|---|---|---|---|---|
| | ***BGS Borehole*** | | | | |
| 17 | BGS Reference | SS69SE 22 | 990 | BGS | 268900 |
| | Drilled Length | 0 metres | | | 193600 |
| | Bore Name | TIR JOHN POWER STATION. BH.1 | | | |
| | ***BGS Borehole*** | | | | |
| 18 | BGS Reference | SS69SE 24 | 1000 | BGS | 269000 |
| | Drilled Length | 0 metres | | | 193900 |
| | Bore Name | TIR JOHN POWER STATION. BH.3 | | | |
| | ***BGS Borehole*** | | | | |
| 19 | BGS Reference | SS69SE 29 | 950 | BGS | 269000 |
| | Drilled Length | 0 metres | | | 193800 |
| | Bore Name | TIR JOHN POWER STATION. BH.8 | | | |
| | ***BGS Borehole*** | | | | |
| 20 | BGS Reference | SS69SE 139 | 1000 | BGS | 268900 |
| | Drilled Length | 0 metres | | | 192900 |
| | Bore Name | SWANSEA BAY BW1 SCHEME BH 165 | | | |
| | ***BGS Borehole*** | | | | |
| 21 | BGS Reference | SS69SE 140 | 910 | BGS | 269000 |
| | Drilled Length | 0 metres | | | 192900 |
| | Bore Name | SWANSEA BAY BW1 SCHEME BH 175 | | | |
| | ***BGS Borehole*** | | | | |
| 22 | BGS Reference | SS69SE 141 | 840 | BGS | 269100 |
| | Drilled Length | 0 metres | | | 192900 |
| | Bore Name | SWANSEA BAY BW1 SCHEME BH 185 | | | |
| | ***BGS Borehole*** | | | | |
| 23 | BGS Reference | SS69SE 142 | 750 | BGS | 269100 |
| | Drilled Length | 0 metres | | | 192900 |
| | Bore Name | SWANSEA BAY BW1 SCHEME BH 195 | | | |
| | ***Landfill Site*** | | | | |
| 24 | Licence Holder | Swansea D c_City Of | 860 | EA | 269000 |
| | Licence Reference | L1/21 A & B | | | 193600 |
| | Site | Tir John Tip, Crymlyn Bog, Swansea, W Glam | | | |
| | Operator | The Guildhall, Swansea, W Glam SA1 4PE | | | |
| | Authority | Environment Agency - Welsh Region South West Area | | | |
| | Site Category | Landfill Site | | | |
| | Licence Status | Site is operational as far as is known | | | |
| | Waste types on Site: | | | | |
| | Authorised waste | Household Waste | | | |
| | | Max.Waste From Fees/Charges | | | |
| | Prohibited waste | Toxic/Poisonous Wastes | | | |

| Map ID | Details | | Estimated Distance from Site | Source | NGR |
|---|---|---|---|---|---|
| | ***Pollution Incident to Controlled Waters*** | | | | |
| 3 | Name | Unknown Operator | 500 | EA | 270200 |
| | Property Type | Road (Lost Load) | | | 193000 |
| | Location | Jet Garage , Fabian Way , Swansea | | | |
| | Authority | Environment Agency Welsh Region | | | |
| | Pollutant | Miscellaneous - Fire water / Foam | | | |
| | Note | Mechanical Failure | | | |
| | Incident Date | 26th June 1995 | | | |
| | Incident Reference | 24572 | | | |
| | Catchment Area | N/A | | | |
| | Received Water | N/A | | | |
| | Cause | Spillage | | | |
| | Severity | Category 3 - Minor Incident | | | |
| | ***Pollution Incident to Controlled Waters*** | | | | |
| 4 | Name | Unknown Operator | 580 | EA | 270300 |
| | Property Type | Unknown | | | 193000 |
| | Location | Fabian Way , Swansea Opp, Fords Factory | | | |
| | Authority | Environment Agency Welsh Region | | | |
| | Pollutant | Crude Sewage | | | |
| | Note | Not Given | | | |
| | Incident Date | 17th February 1995 | | | |
| | Incident Reference | 22687 | | | |
| | Catchment Area | N/A | | | |
| | Received Water | N/A | | | |
| | Cause | Unknown | | | |
| | Severity | Category 3 - Minor Incident | | | |
| | ***Pollution Incident to Controlled Waters*** | | | | |
| 5 | Name | Unknown Operator | 290 | EA | 270000 |
| | Property Type | Unknown | | | 193500 |
| | Location | Location Description Not Available | | | |
| | Authority | Environment Agency Welsh Region | | | |
| | Pollutant | Light Oil | | | |
| | Note | Not Given | | | |
| | Incident Date | 9th February 1995 | | | |
| | Incident Reference | 23086 | | | |
| | Catchment Area | N/A | | | |
| | Received Water | N/A | | | |
| | Cause | Unknown | | | |
| | Severity | Category 3 - Minor Incident | | | |
| | ***Pollution Incident to Controlled Waters*** | | | | |
| 6 | Name | Unknown Operator | 940 | EA | 269000 |
| | Property Type | Unknown | | | 192800 |
| | Location | Tank Farm | | | |
| | Authority | Environment Agency Welsh Region | | | |
| | Pollutant | Unknown | | | |
| | Note | Not Given | | | |
| | Incident Date | 25th June 1996 | | | |
| | Incident Reference | 28924 | | | |
| | Catchment Area | N/A | | | |
| | Received Water | N/A | | | |
| | Cause | Unknown | | | |
| | Severity | Category 3 - Minor Incident | | | |
| | ***Pollution Incident to Controlled Waters*** | | | | |
| 7 | Name | Unknown Operator | 320 | EA | 269500 |
| | Property Type | N/A | | | 193200 |
| | Location | Opposite Blazers Caravans, Ewloe, Crymlyn Burrows, Swansea | | | |
| | Authority | Environment Agency Welsh Region | | | |
| | Pollutant | Crude Sewage | | | |
| | Note | Mechanical/Electrical Plant Failure | | | |
| | Incident Date | 10th October 1996 | | | |
| | Incident Reference | 30444 | | | |
| | Catchment Area | N/A | | | |
| | Received Water | N/A | | | |
| | Cause | Burst | | | |
| | Severity | Category 1 - Major Incident | | | |

| Map ID | Details | | Estimated Distance from Site | Source | NGR |
|---|---|---|---|---|---|
| | ***Waste Transfer Site*** | | | | |
| 11 | Licence Holder | Gower Chemicals Ltd | 450 | EA | 269400 |
| | Licence Reference | NBWD 6 | | | 193100 |
| | Site | Crymlyn Burrows, Swansea, W Glam SA1 8PT | | | |
| | Operator | | | | |
| | Authority | Environment Agency - Welsh Region South West Area | | | |
| | Site Category | Transfer | | | |
| | Licence Status | Site is operational as far as is known | | | |
| | Waste types on Site: | | | | |
| | Authorised waste | Ferric Chloride Max.Stor | | | |
| | Prohibited waste | Elemental Sodium/Potassium | | | |
| | | Metal In Fine Powder Form | | | |
| | | Percussive/Explosive/Similar Waste | | | |
| | | Special Wastes N.O.S. | | | |
| | | Sub'S Control. Radioactive Subs Act'60 | | | |
| | | Waste Cont. Flam.Solvent (Exc.Petrol) | | | |
| | | Waste N.O.S. | | | |
| | ***Planning Application (of possible contaminative use)*** | | | | |
| 25 | Name | Filling Station Redevelopment | 580 | LPR | 270300 |
| | Location | Llandarcy Filling Station, Jersey Marine, Swansea, West Glamorgan SA1 8QB | | | 193000 |
| | Authority | Neath Port Talbot County Borough Council | | | |
| | Description | Petrol Filling Stations | | | |
| | Application Ref. | 95/0146/03 Dated 24th March 1995 | | | |
| | Status | Detailed Plans Approved | | | |
| | Site Area | n/a | | | |
| | ***Potentially Contaminative Industrial Use*** | | | | |
| 26 | Name | Llandarcy Filling Station Jet | 590 | Catalist Petroleum Station Database | 270300 |
| | Location | Fabian Way, Swansea, West Glamorgan SA1 8QB | | | 193000 |
| | Classification | Fuel: retail sale of automotive fuel | | | |
| | ***Potentially Contaminative Industrial Use*** | | | | |
| 27 | Name | Jeremy's Oil Distributors Ltd | 510 | Thomsons Trade Directory | 270300 |
| | Location | Elba Crescent, Crymlyn Burrows, Swansea, West Glamorgan SA1 8QQ | | | 193100 |
| | Classification | Wholesale non-agricultural intermediate products, inc. waste/scrap | | | |

## British Geological Survey Information Services Group

Keyworth
Nottingham
Nottinghamshire
NG12 5GG

Telephone 0115 936 3100
Fax 0115 936 3200

## Environment Agency - Welsh Region South West Area

Llys Afron
Hawthorn Rise
Haverfordwest
Dyfed
SA61 2BQ

Telephone 01437 760081
Fax 01437 760881

## Environment Agency Welsh Region

Rivers House
St Mellons Business Park
St Mellons
Cardiff
Mid Glamorgan
CF3 0LT

Telephone 01222 770088
Fax 01222 798555

## Institute of Hydrology

Maclean Building
Crowmarsh Gifford
WALLINGFORD
Oxfordshire
OX10 8BB

Telephone 01491 838800
Fax 01491 692424

## Neath Port Talbot County Borough Council

Civic Centre
Port Talbot
SA13 1PJ

Telephone 01639 763333
Fax 01693 763444

## Ordnance Survey

Romsey Road
SOUTHAMPTON
Hampshire
SO16 4GU

Telephone 01703 792000
Fax 01703 792404

**Report Reference:** 12525-1

**Site Address:** Freightliner Terminal Site, SWANSEA,

**Company Name:**

**Grid Reference:** 269800 193300

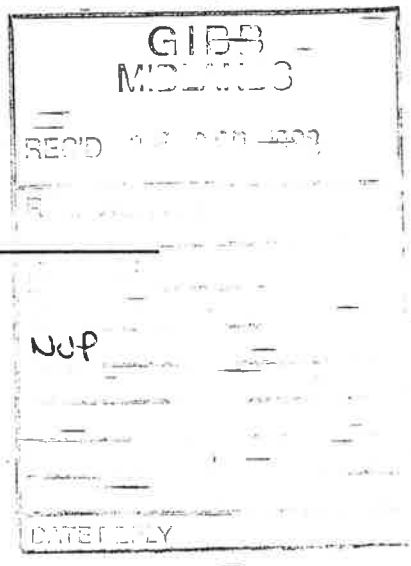
*EA (Water) Prosecutions*

The following company(s) have been prosecuted as shown below, however, from the information supplied , Landmark is unable to provide a National Grid Reference for the record(s).

| | |
|---|---|
| **Name** | A J G I and Rosemary Matth |
| **Address** | Pennard Stream, SWANSEA, SA1 |
| **Authority** | Environment Agency, Welsh Region |
| **Details** | EA Data. Other C. |
| **Hearing Date** | 29-Mar-90 |
| **Verdict** | Guilty |
| **Fine** | £450.00 |
| **Costs** | £260.00 |

| | |
|---|---|
| **Name** | Alberto Culver Co (UK) Limited |
| **Address** | River Tawe, SWANSEA, SA1 |
| **Authority** | Environment Agency, Welsh Region |
| **Details** | EA Data. Industrial. |
| **Hearing Date** | 16-Dec-94 |
| **Verdict** | Guilty |
| **Fine** | £3,000.00 |
| **Costs** | £391.98 |

| | |
|---|---|
| **Name** | Alcoa Manufacturing (G.B.) Limited |
| **Address** | Trib of Gors Fawr Brook, SWANSEA, SA1 |
| **Authority** | Environment Agency, Welsh Region |
| **Details** | EA Data. Oil. |
| **Hearing Date** | 01-Jul-94 |
| **Verdict** | Guilty |
| **Fine** | £2,000.00 |
| **Costs** | £1,803.35 |



| | |
|---|---|
| **Name** | BP Oil Llandarcy Refinery |
| **Address** | Queens Dock, SWANSEA, SA1 |
| **Authority** | Environment Agency, Welsh Region |
| **Details** | EA Data. Industrial oil. |
| **Hearing Date** | 30-Jun-93 |
| **Verdict** | Guilty |
| **Fine** | £2,000.00 |
| **Costs** | £600.00 |

| | |
|---|---|
| **Name** | British Electrical Repairs Limited |
| **Address** | River Tawe, SWANSEA, SA1 |
| **Authority** | Environment Agency, Welsh Region |
| **Details** | EA Data. Industrial. |
| **Hearing Date** | 16-Dec-94 |
| **Verdict** | Guilty |
| **Fine** | £3,000.00 |
| **Costs** | £345.50 |

| | |
|---|---|
| **Name** | Dwr Cymru Cyf |
| **Address** | Unnamed tributary of Parkmill Stream, SWANSEA, SA1 |
| **Authority** | Environment Agency, Welsh Region |
| **Details** | EA Data. Sewage. |
| **Hearing Date** | 06-Sep-91 |
| **Verdict** | Guilty |
| **Fine** | £600.00 |
| **Costs** | £540.00 |

| | |
|---|---|
| **Name** | Ethnic Cuisine Limited |
| **Address** | Nant-y-Ffin, Viking Way, Winch Wen Indusstrial Estate, Winch Wen, SWANSEA, West Glamorgan, SA1 7DA |
| **Authority** | Environment Agency, Welsh Region |
| **Details** | Environment Times Vol.4 Issue 3, For polluting the Nant-y-Ffin and the Nant Fenfrod Lake with vegetable oil after a sippliage from the company's effluent treatment plant. |
| **Hearing Date** | 05-Feb-98 |
| **Verdict** | Guilty |
| **Fine** | £7,500.00 |
| **Costs** | £500.00 |

| | |
|---|---|
| **Name** | Swansea City Council |
| **Address** | Glan-Y-Wern Canal and Crymlyn Bog SSSI, SWANSEA, SA1 |
| **Authority** | Environment Agency, Welsh Region |
| **Details** | EA Data. Other. |
| **Hearing Date** | 31-Oct-90 |
| **Verdict** | Guilty |
| **Fine** | £2,000.00 |
| **Costs** | £750.00 |

| | |
|---|---|
| **Name** | W E Dowds |
| **Address** | Trib of Gors Fawr Brook, SWANSEA, SA1 |
| **Authority** | Environment Agency, Welsh Region |
| **Details** | EA Data. Oil. |
| **Hearing Date** | 01-Jul-94 |
| **Verdict** | Guilty |
| **Fine** | £2,000.00 |
| **Costs** | £1,803.35 |

| | |
|---|---|
| **Name** | Welsh Water |
| **Address** | Ystalyfera, SWANSEA, SA |
| **Authority** | Environment Agency, Welsh Region |
| **Details** | ENDS Report; 282; p.56. Guilty of 8 charges of supplying water unfit for human consumption to addresses in Swansea Area. Some 18,000 people affected in Ystalyfera area. Customers complained of burning sensation in throat, diarrhoea, stomach cramps. |
| **Hearing Date** | 15-Jul-98 |
| **Verdict** | Guilty |
| **Fine** | £24,000.00 |
| **Costs** | £7,960.00 |

***Current Trade Directory Search***

The following company(s) have been identified as possible contaminative premises as shown below, however, from the information supplied , Landmark is unable to provide a National Grid Reference for the record(s).

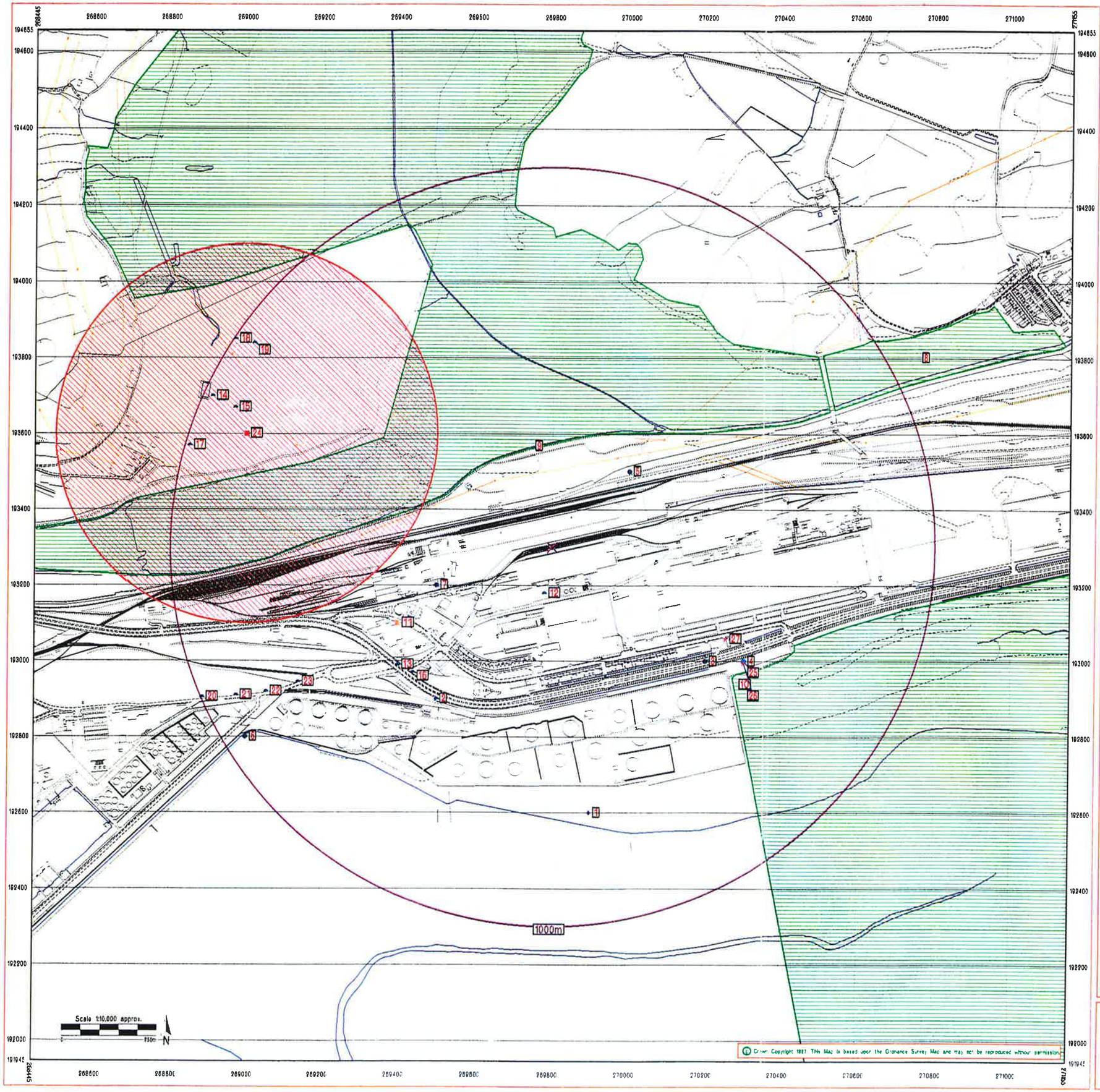
| | |
|---|---|
| **Name** | Princess Service Station |
| **Address** | York Street, SWANSEA, West Glamorgan, SA1 3LZ |
| **Classification** | Fuel: retail sale of automotive fuel |
| **Data Source** | Petroleum Station Database |
| **Source Date** | 30-Sep-97 |

| | |
|---|---|
| **Name** | Shooters Of Swansea |
| **Address** | Regional Sports Centre, Upper Banc, SA1 7DS |
| **Classification** | Weapons & ammunition [manufacture and storage] |
| **Data Source** | Trade Directory |
| **Source Date** | 26-May-95 |

| | |
|---|---|
| **Name** | SOUTH WALES SAND & GRAVEL |
| **Address** | Prince of Wales Dock, Langdon Road, Swansea, West Glamorgan, SA1 8RQ |
| **Classification** | Quarrying of sand & clay, operation of sand & gravel pits |
| **Data Source** | Trade Directory |
| **Source Date** | 01-Mar-97 |

| | |
|---|---|
| **Name** | THE FORGE |
| **Address** | Alexandra Road, Swansea, West Glamorgan, SA1 5EE |
| **Classification** | Metals: precious & non-ferrous metal manufacture |
| **Data Source** | Trade Directory |
| **Source Date** | 01-Mar-97 |

| | |
|---|---|
| **Name** | Ward Bros Mining Ltd |
| **Address** | Nanthir Colliery, SA1 1PC |
| **Classification** | Mining of coal & lignite |
| **Data Source** | Trade Directory |
| **Source Date** | 26-May-95 |




# EnviroCheck

*Environmental Site Sensitivity Data*

## CLIENT DETAILS

Order No. ES12525-1

Customer Ref: Neil Parry, NVP/J410/P5174/355/
Gibb Ltd
Development House Rood End Road
Oldbury
Warley B69 4HW

## SITE DETAILS

Grid Reference 269800 193300

Freightliner Terminal Site

SWANSEA

## KEY TO THE LEGEND DATABASE

### SITE SETTING

- Specified Site
- Buffer
- Reference Number
- Several of Type at Location
- Pylon or Mast

### ENVIRONMENTAL SETTING

- Landfill
- BGS Recorded Landfill Site
- BGS Recorded Mineral Site
- BGS Borehole
- River Network and Water Feature
- Water Abstraction
- Discharge Consent
- Site of Special Scientific Interest

### INDUSTRIAL SETTING

- Integrated Pollution Control
- Air Pollution Control
- Red List Discharge Consent
- Enforcement or Prohibition Notice
- Prosecution Relating to Authorised Process
- Registered Radioactive Substance
- Planning Application (of Possible Contaminative Use)
- Waste Treatment or Disposal Site
- Waste Transfer Site
- Integrated Pollution Control Registered Waste Site
- Planning Hazardous Substance Consent
- Planning Hazardous Substance Enforcement
- Potentially Contaminative Use
- Prosecution Relating to Controlled Waters
- Pollution Incident Relating to Controlled Waters



British Geological Survey
Value Added Reseller

Ordnance Survey
Value Added Reseller

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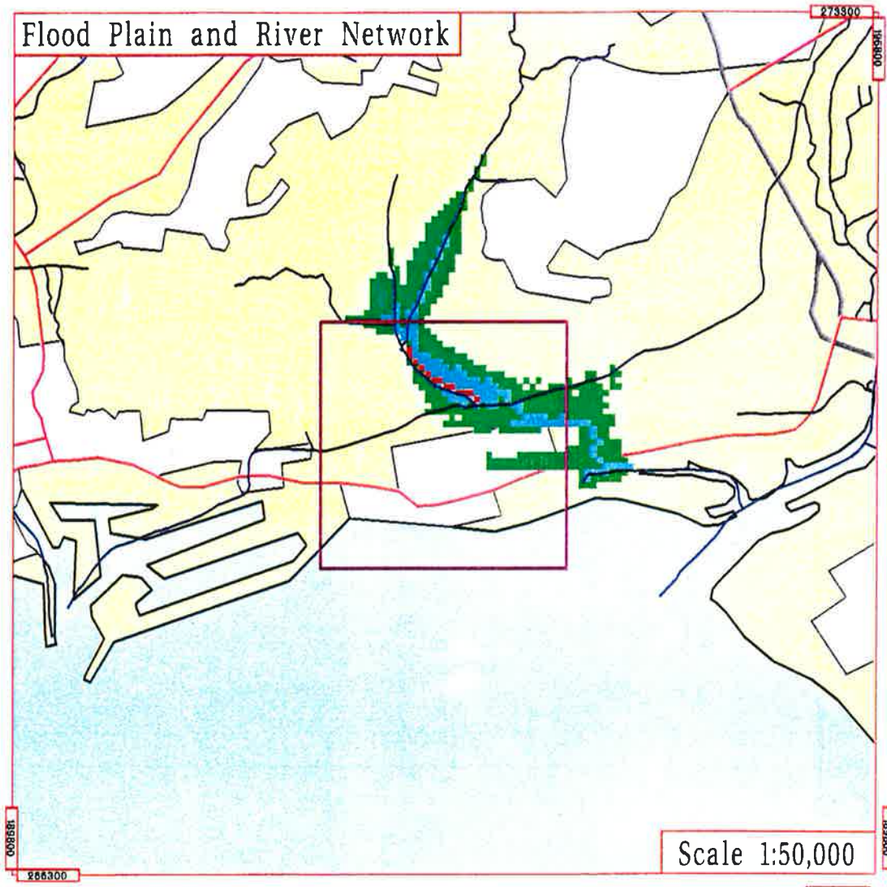
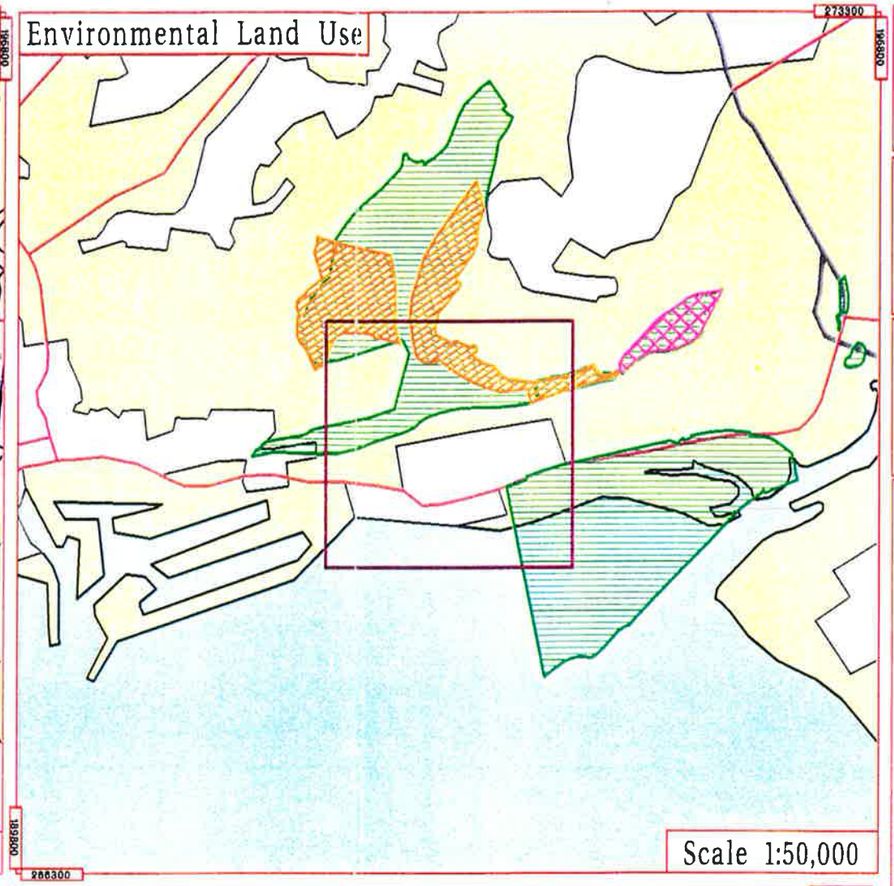
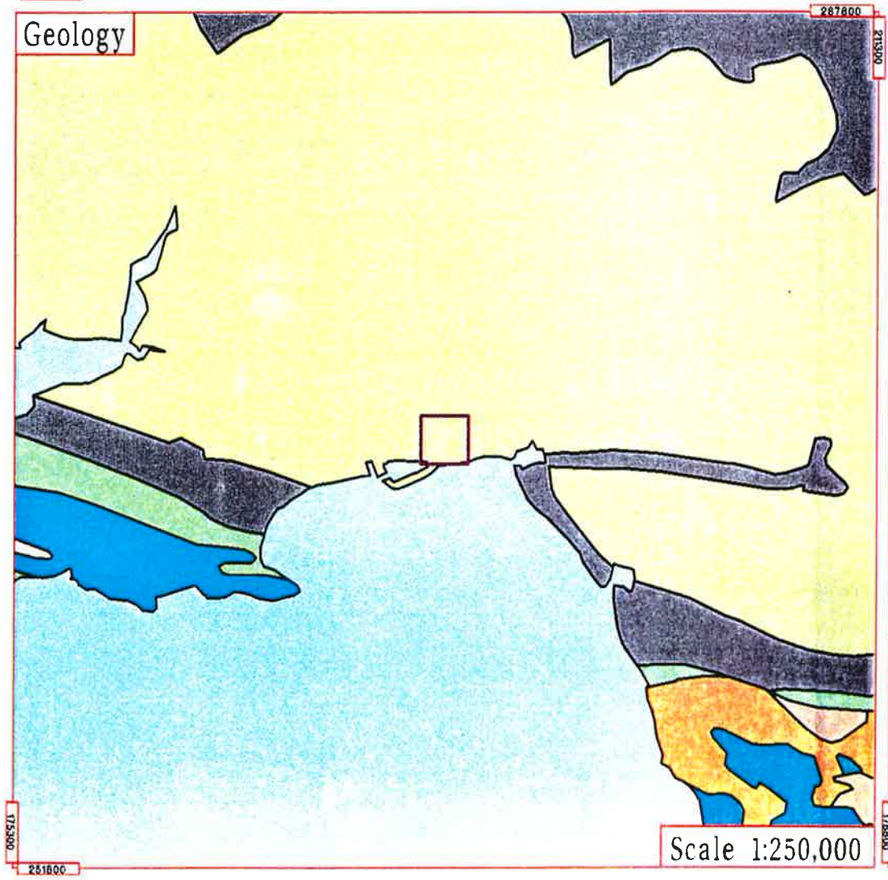
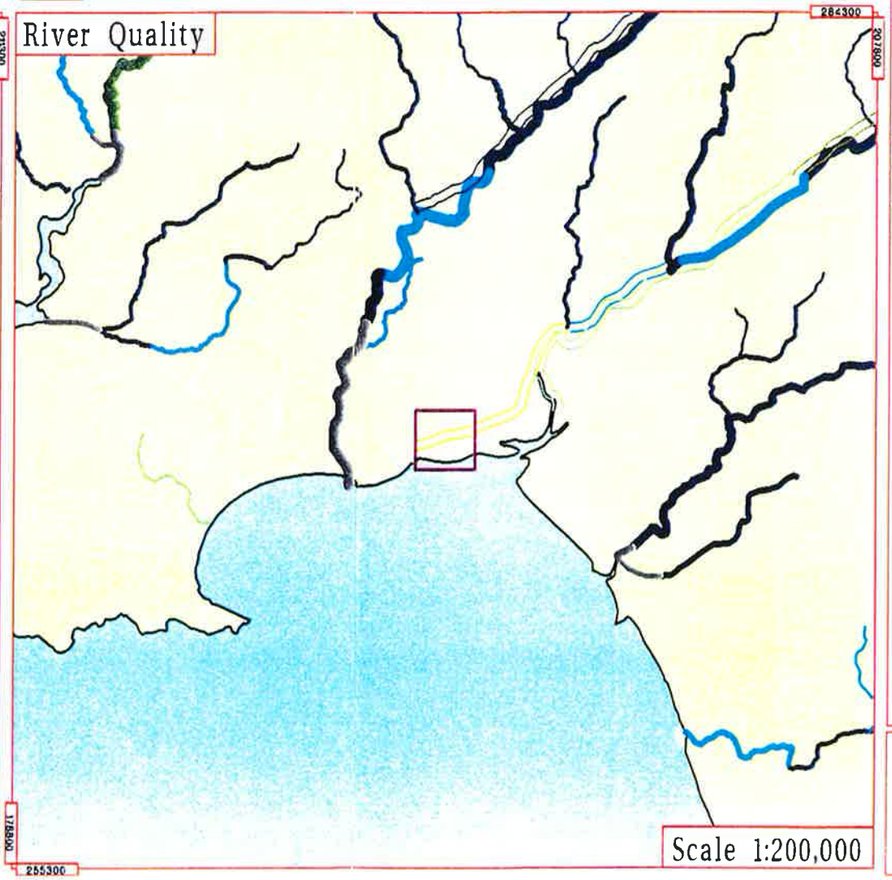



# EnviroCheck

*Environmental Site Sensitivity Data*

## CLIENT DETAILS

Order No. ES12525-1

Customer Ref: Neil Parry, NVP/J410/P5174/355/
Gibb Ltd
Development House Rood End Road
Oldbury
Warley B69 4HW

## SITE DETAILS

Grid Reference 269800 193300

Freightliner Terminal Site

SWANSEA

### General Legend

Urban Areas | Motorways | 'A' Roads | Extent of search

### Guide to the Flood Plain and River Network Map

0 - 1 m estimated 100 yr flood depth | 1 - 2 m estimated 100 yr flood depth | over 2 m estimated 100 yr flood depth | River Network and Water Feature

The flooded areas have been generated using a generalised technique and should not, by themselves, be used to infer that specific areas are or are not at risk of inundation. Flood risk at any specific location may be influenced by local factors - not least flood defences - that have not been taken into account.

### Guide to the Environmental Landuse Map

Area of Outstanding Natural Beauty | Nitrate Sensitive Area | Nitrate Vulnerability Zone | National Nature Reserve
Local Nature Reserve | Marine Nature Reserve | Site of Special Scientific Interest | Environmentally Sensitive Area
Forest Park | National Park

### Guide to the Geology Map

Lower Lias | Tournaisian and Visean (Carboniferous Limestone Series) | Triassic mudstones (including Keuper Marl, Dolomitic and Rhaetic)
Lower Old Red Sandstone, including Downtonian | Namurian (Millstone Grit Series) | CAMBRIAN
Upper Westphalian (including Pennant Measures) | Lower Westphalian (mainly Productive Coal Measures) | Upper Old Red Sandstone and Upper Devonian
Water / Unclassified Geology

### Guide to the River Quality Map

River Quality A | River Quality B | River Quality C
River Quality D | Canal Quality A | Canal Quality B
Canal Quality E | Canal Quality D | Canal Quality C
Unclassified Tidal River | Unclassified River | Sea

Institute of Hydrology | British Geological Survey Value Added Reseller | Ordnance Survey Value Added Reseller

Produced by Landmark Information Group Limited. Tel: 01392 441729 Fax: 01392 441709

# APPENDIX C

# HISTORICAL MAPS

## EnviroCheck Report on:

Freightliner Terminal Site
SWANSEA

## National Grid Reference :

269800, 193300

## Prepared For :

Gibb Ltd
Development House
Rood End Road
Oldbury
Warley
B69 4HW

## Your Reference :

Neil Parry, NVP/J410/P5174/355/

## Ordnance Survey County Series Published 1884

| County | Mapsheet | Scale | Year |
|---|---|---|---|
| Glamorganshire | 024_00 | 1:10,560 | 1884 |

## Ordnance Survey County Series Published 1900

| County | Mapsheet | Scale | Year |
|---|---|---|---|
| Glamorganshire | 024_NW | 1:10,560 | 1900 |
| Glamorganshire | 024_NE | 1:10,560 | 1900 |
| Glamorganshire | 024_SE | 1:10,560 | 1900 |
| Glamorganshire | 024_SW | 1:10,560 | 1900 |

## Ordnance Survey County Series Published 1921

| County | Mapsheet | Scale | Year |
|---|---|---|---|
| Glamorganshire | 024_NW | 1:10,560 | 1921 |
| Glamorganshire | 024_NE | 1:10,560 | 1921 |
| Glamorganshire | 024_SW | 1:10,560 | 1921 |
| Glamorganshire | 024_SE | 1:10,560 | 1921 |

## Ordnance Survey County Series Published 1938 to 1951

| County | Mapsheet | Scale | Year |
|---|---|---|---|
| Glamorganshire | 024_NW | 1:10,560 | 1938 |
| Glamorganshire | 024_NE | 1:10,560 | 1938 |
| Glamorganshire | 024_SW | 1:10,560 | 1938 |
| Glamorganshire | 024_SE | 1:10,560 | 1951 |

## Ordnance Survey Plan Published 1964

| National Grid Series | Mapsheet | Scale | Year |
|---|---|---|---|
| Sheet | SS69SE | 1:10,560 | 1964 |
| Sheet | SS79SW | 1:10,560 | 1964 |

## Ordnance Survey Plan Published 1979 to 1980

| National Grid Series | Mapsheet | Scale | Year |
|---|---|---|---|
| Sheet | SS69SE | 1:10,000 | 1979 |
| Sheet | SS79SW | 1:10,000 | 1980 |

## Ordnance Survey Plan Published 1980 to 1989

| National Grid Series | Mapsheet | Scale | Year |
|---|---|---|---|
| Sheet | SS79SW | 1:10,000 | 1980 |
| Sheet | SS69SE | 1:10,000 | 1989 |

# EnviroCheck

## EnviroCheck Report on:

Freightliner Terminal Site
SWANSEA

## National Grid Reference :

269800,193300

## Prepared For :

Gibb Ltd
Development House
Rood End Road
Oldbury
Warley
B69 4HW

## Your Reference :

Neil Parry, NVP/J410/P5174/355/

## Ordnance Survey County Series Published 1899

| County | Mapsheet | Scale | Year |
|---|---|---|---|
| Glamorganshire | 024_06 | 1:2,500 | 1899 |
| Glamorganshire | 024_07 | 1:2,500 | 1899 |

## Ordnance Survey County Series Published 1917 to 1919

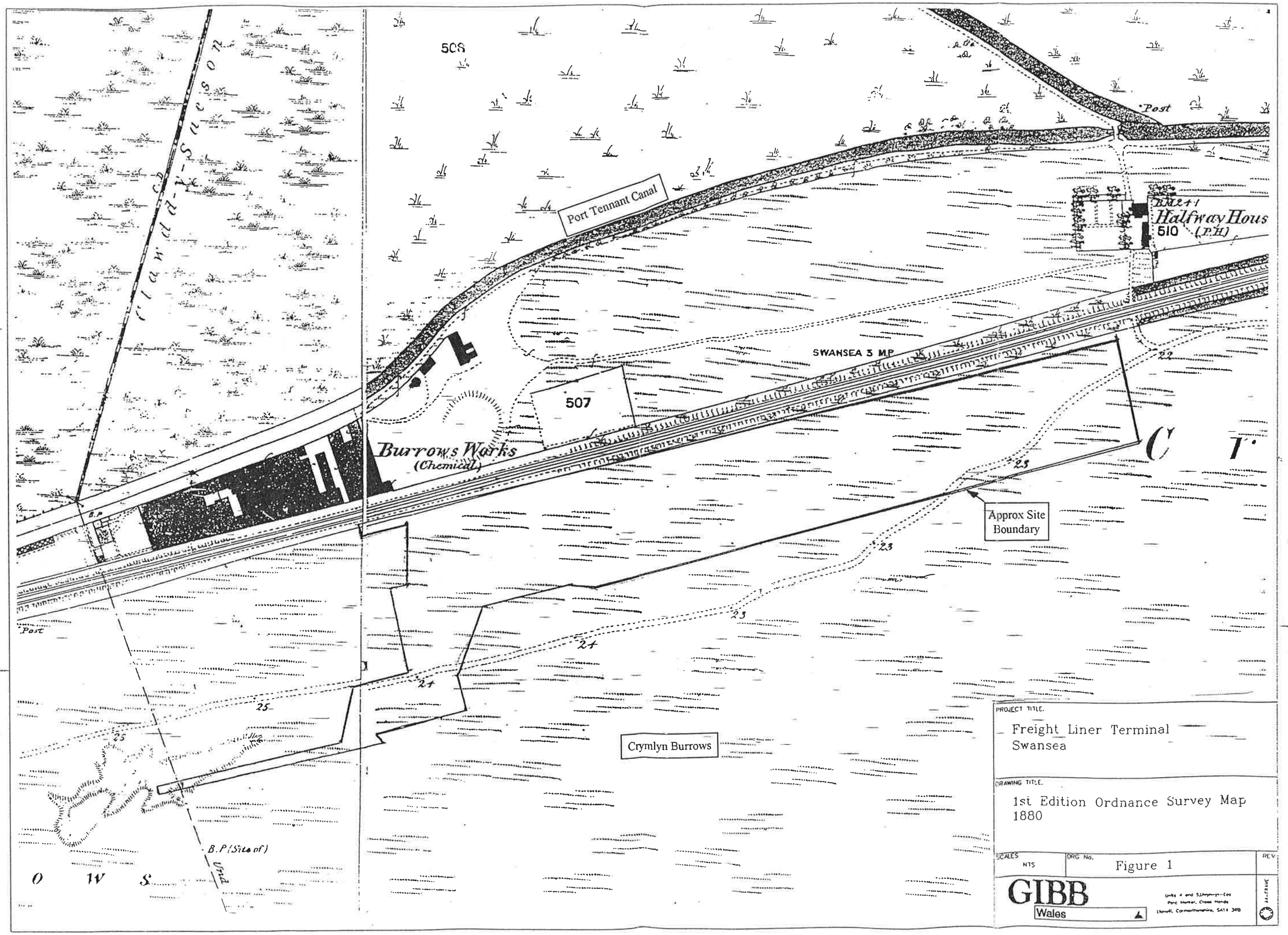
| County | Mapsheet | Scale | Year |
|---|---|---|---|
| Glamorganshire | 024_07 | 1:2,500 | 1917 |
| Glamorganshire | 024_06 | 1:2,500 | 1919 |

## Ordnance Survey County Series Published 1941

| County | Mapsheet | Scale | Year |
|---|---|---|---|
| Glamorganshire | 024_07 | 1:2,500 | 1941 |

# APPENDIX C

# HISTORICAL MAPS




PROJECT TITLE.

Freight Liner Terminal
Swansea

DRAWING TITLE.

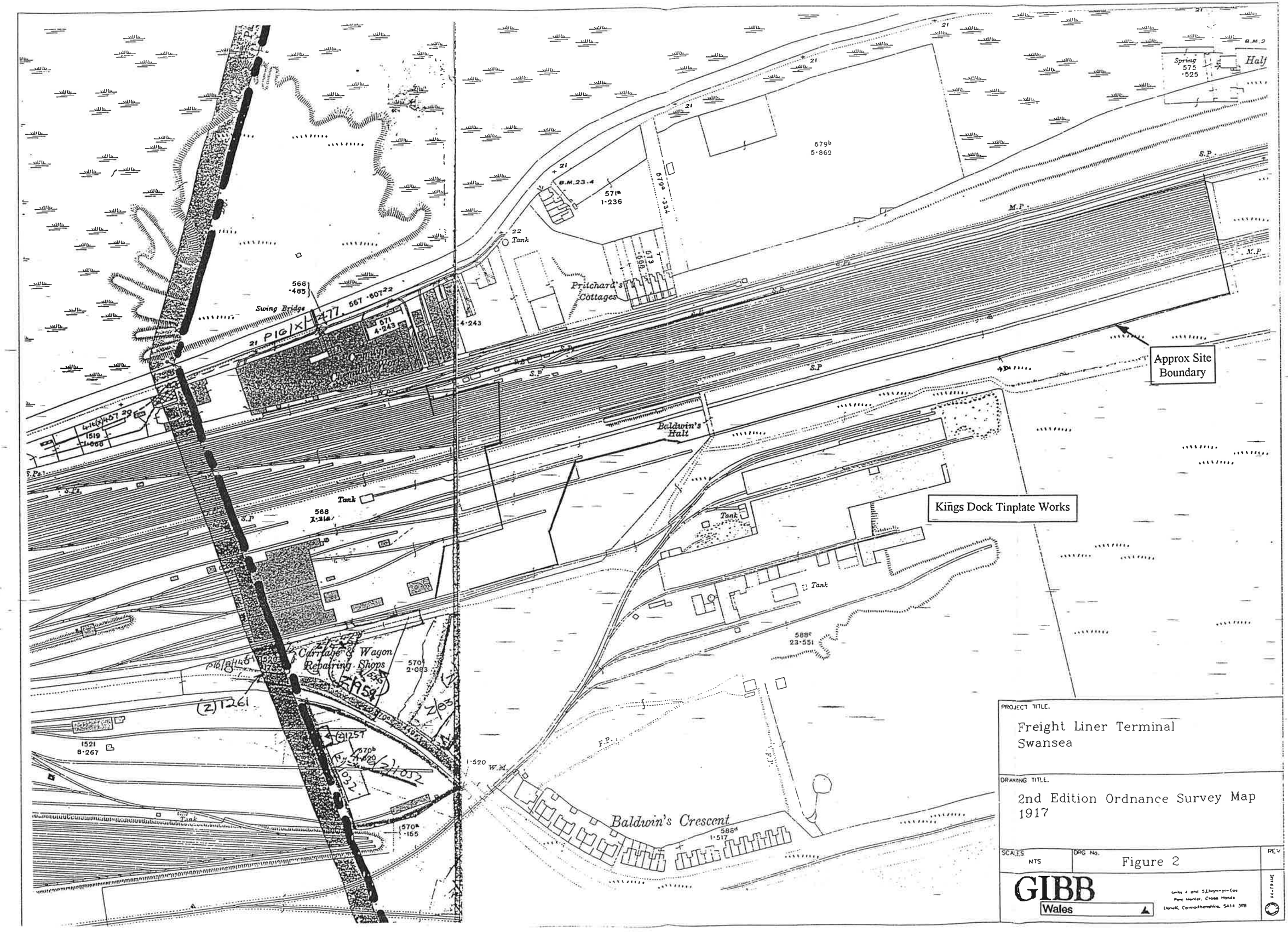
1st Edition Ordnance Survey Map
1880

| SCALES | ORG No. | REV. |
|---|---|---|
| NTS | Figure 1 | |

GIBB
Wales

Units 4 and 5 Heol-y-Cae
Parc Menter, Cross Hands
Llanelli, Carmarthenshire, SA14 3RB

A4 - FRAME




PROJECT TITLE.

Freight Liner Terminal
Swansea

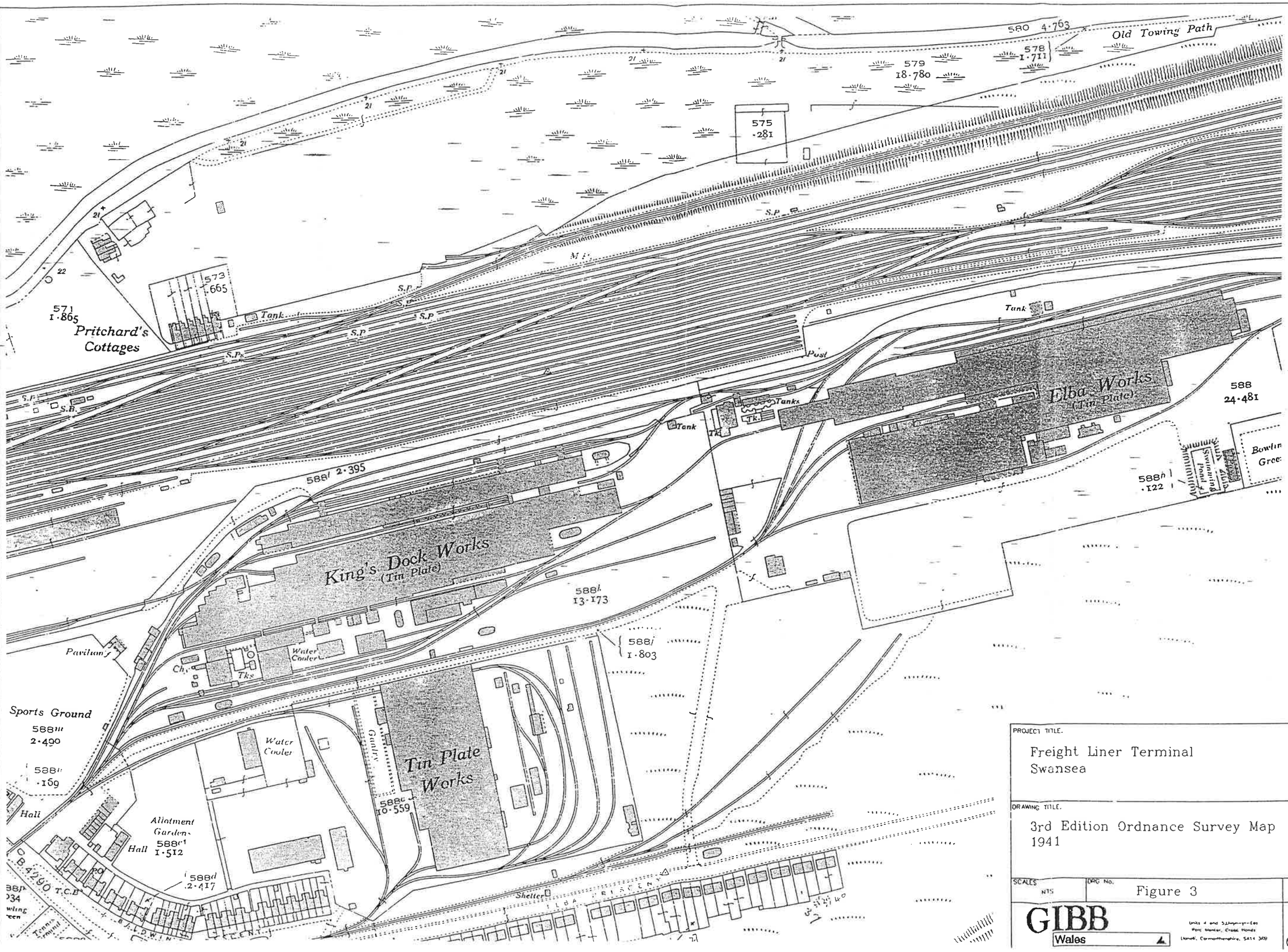
DRAWING TITLE.

2nd Edition Ordnance Survey Map
1917

| SCALE | DRG No. | REV |
|---|---|---|
| NTS | Figure 2 | |

GIBB Wales

Units 4 and 5 Llwyn-yr-Eos
Parc Menter, Cross Hands
Llanelli, Carmarthenshire, SA14 3YB




PROJECT TITLE.

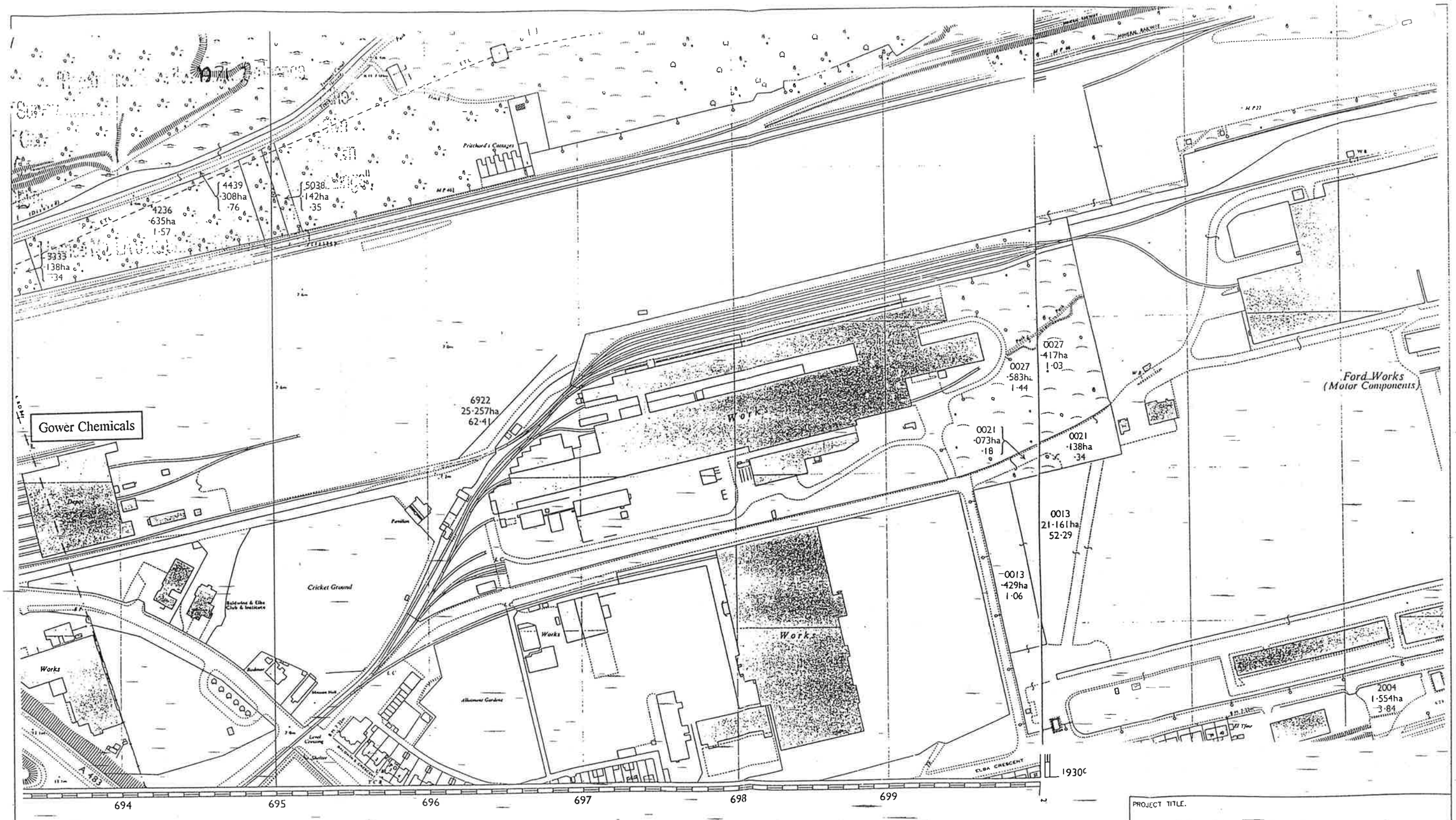
Freight Liner Terminal
Swansea

DRAWING TITLE.

3rd Edition Ordnance Survey Map
1941

SCALES NTS | DRG NO. Figure 3 | REV

GIBB
Wales




PROJECT TITLE.

Freight Liner Terminal
Swansea

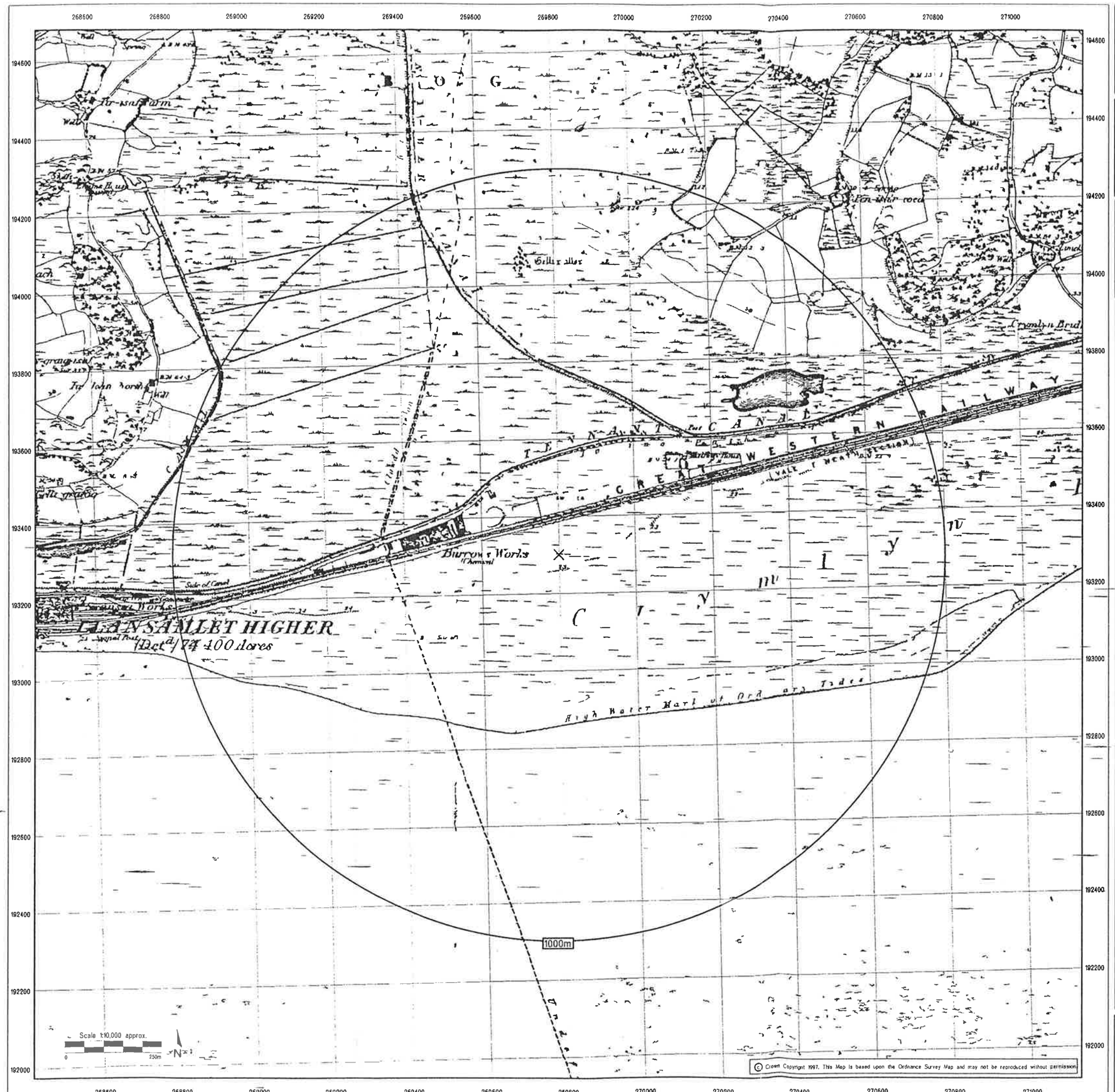
DRAWING TITLE.

4th Edition Ordnance Survey Map
1971

| SCALES | DRG No. | REV |
|---|---|---|
| NTS | Figure 4 | |

GIBB Wales

Units 4 and 5 Llwyn-yr-Eos
Parc Menter, Cross Hands
Llanelli, Carmarthenshire, SA14 3EB




# EnviroCheck

*Environmental Site Sensitivity Data*

## CLIENT DETAILS

Order No. EH12525-1

Customer Ref: Neil Parry, NVP/J410/P5174/355/
Gibb Ltd
Development House Rood End Road
Oldbury
Warley B69 4HW

## SITE DETAILS

Grid Reference 269800 193300

Freightliner Terminal Site

SWANSEA

## Historical Map Legend

Quarry
Shingle
Railway over Road
Road over Railway
Railway over River
Gravel Pit
Sand Pit
Level Crossing
Other Pits
Road over River or Canal
Road over Stream
Mixed Wood
Rough Pasture
Road over Stream
Marsh
Sunken Road
Raised Road
Sketched Contour
Arrow denotes flow of water
Instrumental Contour

## GLAMORGANSHIRE county

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given on the right therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

In the late 1940's, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

1884

Date(s) of Publication

Ordnance Survey
Value Added Reseller

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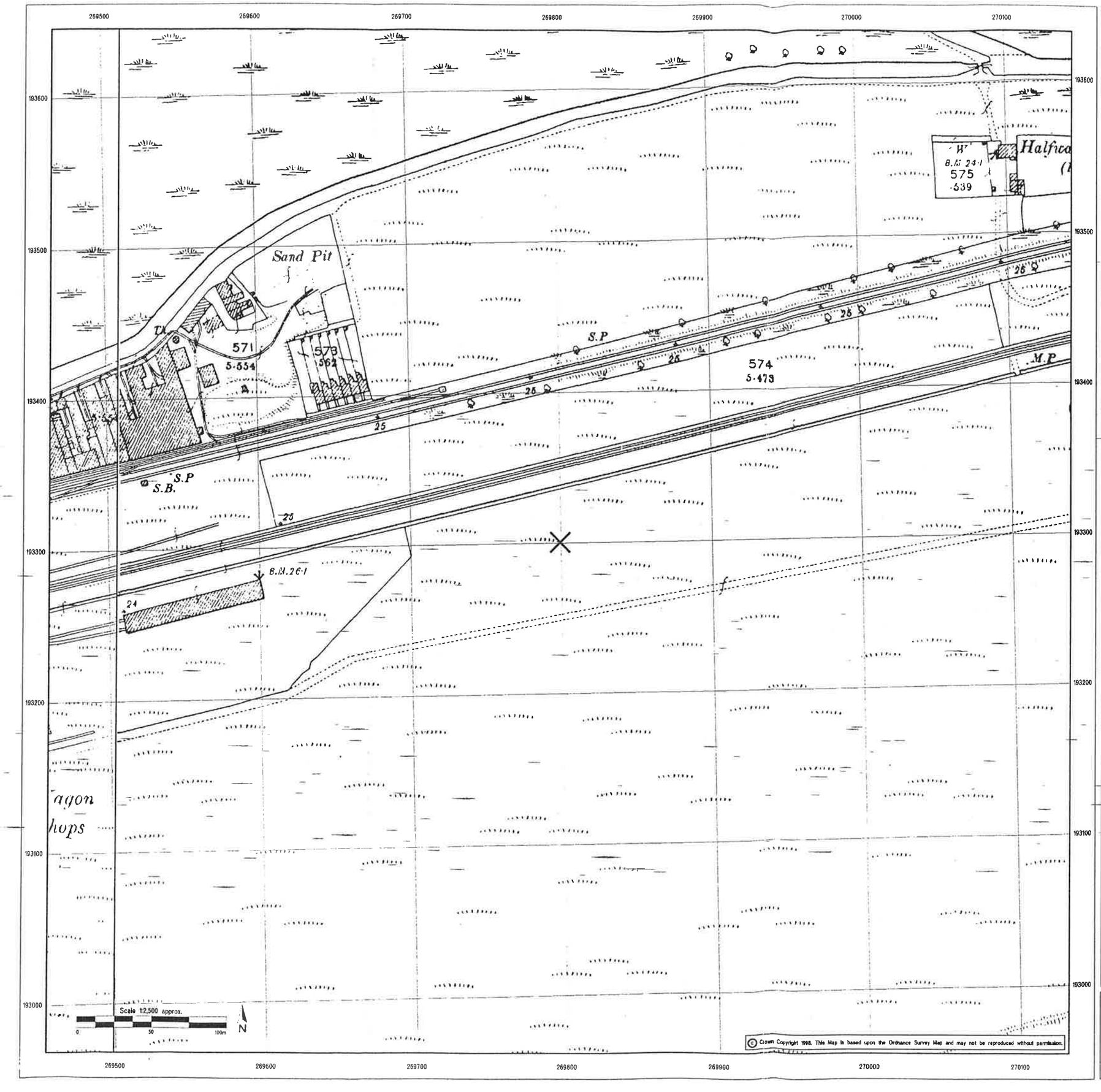


# EnviroCheck

*Environmental Site Sensitivity Data*

## CLIENT DETAILS

Order No. EHA12525_1

Customer Ref: Neil Parry, NVP/J410/P5174/355/
Gibb Ltd
Development House Rood End Road
Oldbury
Warley B69 4HW

## SITE DETAILS

Grid Reference 269800 193300

Freightliner Terminal Site

SWANSEA

## Historical Map Legend

- Quarry
- Shingle
- Railway over Road
- Road over Railway
- Railway over River
- Gravel Pit
- Sand Pit
- Level Crossing
- Other Pits
- Road over River or Canal
- Road over Stream
- Mixed Wood
- Rough Pasture
- Road over Stream
- Marsh
- Sunken Road
- Raised Road
- Sketched Contour
- Arrow denotes flow of water
- Instrumental Contour

## Glamorganshire

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given on the right is often some years later than the surveyed date. Before 1958, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

1899

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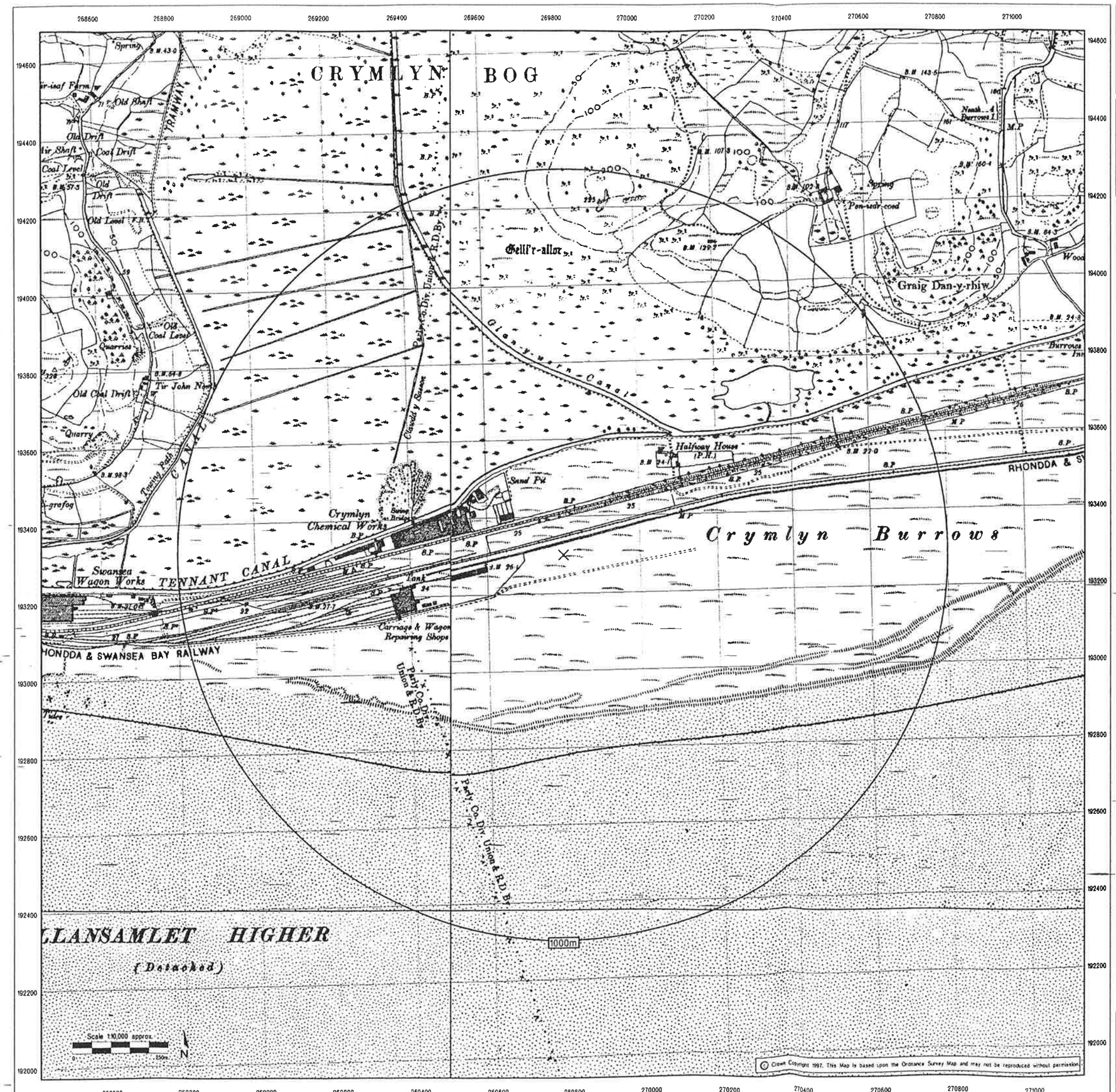


# EnviroCheck

*Environmental Site Sensitivity Data*

## CLIENT DETAILS

Order No. EH12525-1

Customer Ref: Neil Parry, NVP/J410/P5174/355/
Gibb Ltd
Development House Rood End Road
Oldbury
Warley B69 4HW

## SITE DETAILS

Grid Reference 269800 193300

Freightliner Terminal Site

SWANSEA

## Historical Map Legend

- Quarry
- Shingle
- Railway over Road
- Road over Railway
- Railway over River
- Gravel Pit
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- Level Crossing
- Other Pits
- Road over River or Canal
- Road over Stream
- Mixed Wood
- Rough Pasture
- Road over Stream
- Marsh
- Sunken Road
- Raised Road
- Sketched Contour
- Arrow denotes flow of water
- Instrumental Contour

GLAMORGANSHIRE county

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given on the right therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

In the late 1940's, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

| | |
|---|---|
| 1900 | 1900 |
| 1900 | 1900 |

Date(s) of Publication

Ordnance Survey
Value Added Reseller

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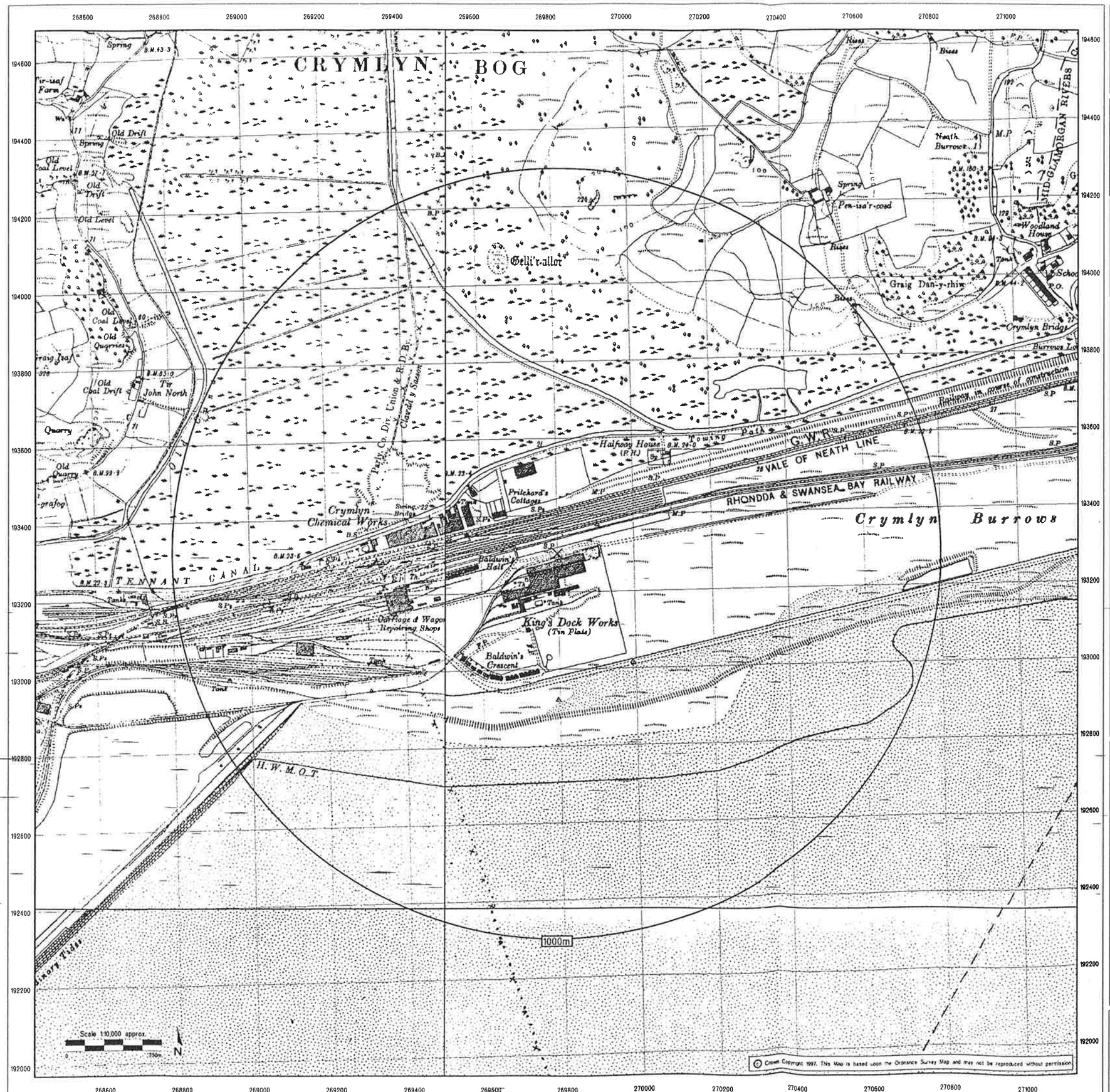




# EnviroCheck

*Environmental Site Sensitivity Data*

## CLIENT DETAILS

Order No. EH12525-1

Customer Ref: Neil Parry, NVP/J410/P5174/355/
Gibb Ltd
Development House Rood End Road
Oldbury
Warley B69 4HW

## SITE DETAILS

Grid Reference 269800 193300

Freightliner Terminal Site

SWANSEA

## Historical Map Legend

Quarry
Shingle
Railway over Road
Road over Railway
Railway over River
Gravel Pit
Sand Pit
Level Crossing
Other Pits
Road over River or Canal
Road over Stream
Mixed Wood
Rough Pasture
Road over Stream
Marsh
Sunken Road
Raised Road
Sketched Contour
Instrumental Contour
Arrow denotes flow of water

## GLAMORGANSHIRE county

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given on the right therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

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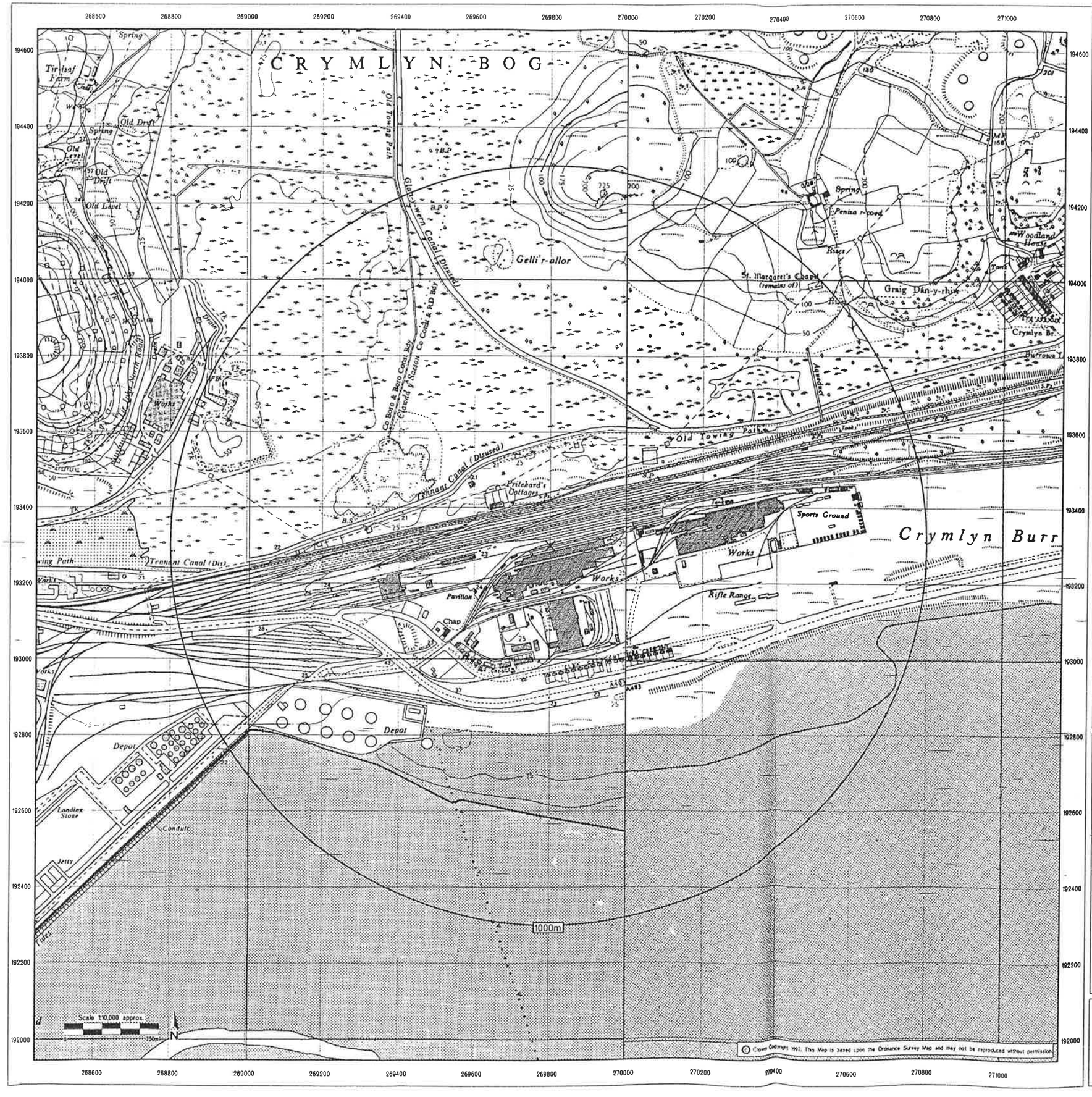
| | |
|---|---|
| 1921 | 1921 |
| 1921 | 1921 |

Date(s) of Publication

Ordnance Survey
Value Added Reseller

Landmark Information Group Limited
7 Abbey Court, Eagle Way, Sowton
Exeter EX2 7HY
LANDMARK
Telephone 01392 441729 Fax 01392 441709




# EnviroCheck

*Environmental Site Sensitivity Data*

## CLIENT DETAILS

Order No. EH12525-1

Customer Ref: Neil Parry, NVP/J410/P5174/355/
Gibb Ltd
Development House Rood End Road
Oldbury
Warley B69 4HW

## SITE DETAILS

Grid Reference 269800 193300

Freightliner Terminal Site

SWANSEA

## Historical Map Legend

Quarry
Shingle
Railway over Road
Road over Railway
Railway over River
Gravel Pit
Sand Pit
Level Crossing
Other Pits
Road over River or Canal
Road over Stream
Mixed Wood
Rough Pasture
Road over Stream
Marsh
Sunken Road
Raised Road
Sketched Contour
Arrow denotes flow of water
Instrumental Contour

## Ordnance Survey Plan

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given on the right therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

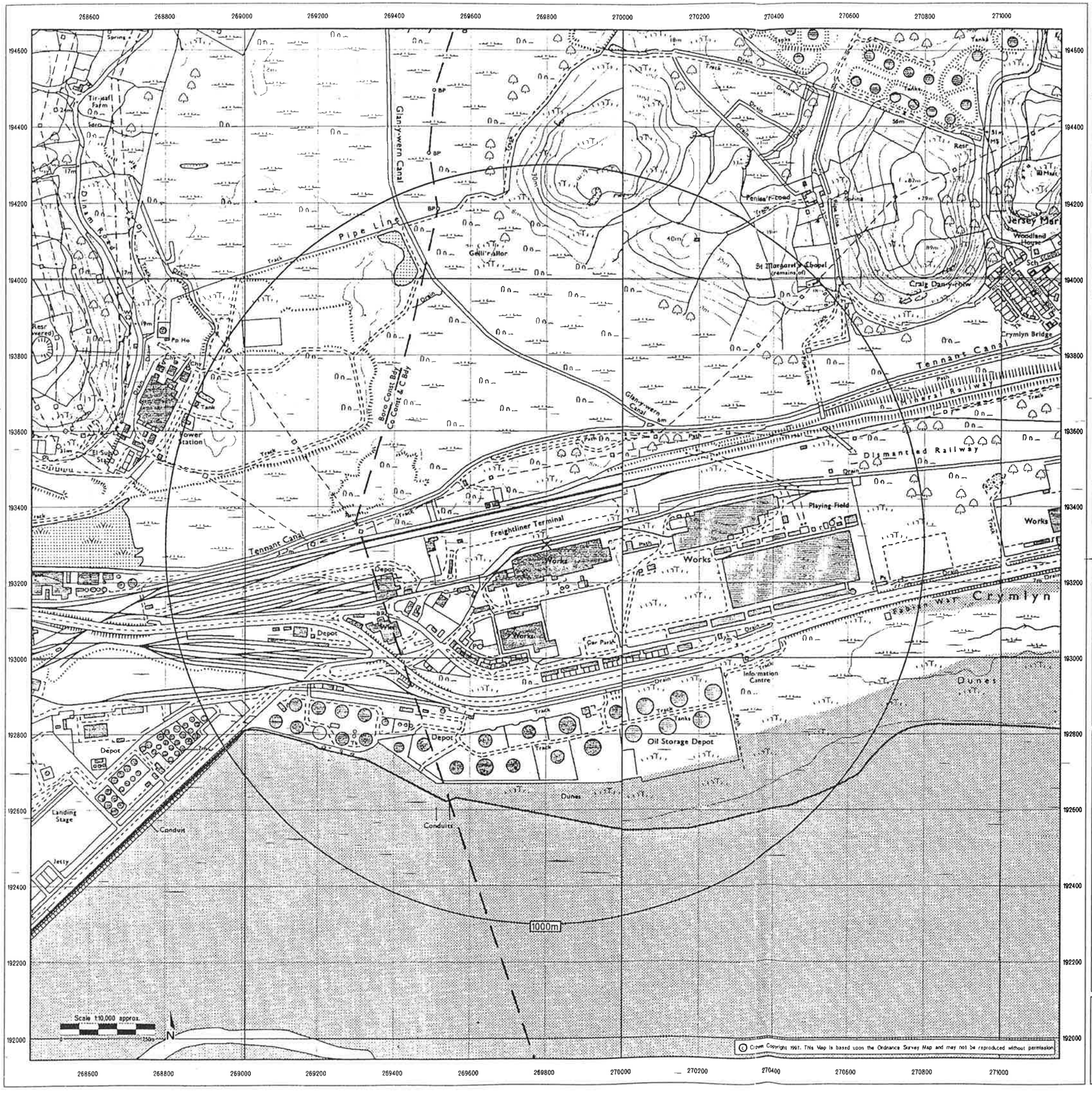
In the late 1940's, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

| 1964 | 1964 |
|---|---|

Date(s) of Publication

Ordnance Survey
Value Added Reseller

Landmark Information Group Limited
7 Abbey Court, Eagle Way, Sowton
Exeter EX2 7HY
LANDMARK
Telephone 01392 441729 Fax 01392 441709




# EnviroCheck

*Environmental Site Sensitivity Data*

## CLIENT DETAILS

Order No. EH12525-1

Customer Ref: Neil Parry, NVP/J410/P5174/355/
Gibb Ltd
Development House Rood End Road
Oldbury
Warley B69 4HW

## SITE DETAILS

Grid Reference 269800 193300

Freightliner Terminal Site

SWANSEA

## Historical Map Legend

Quarry
Shingle
Railway over Road
Road over Railway
Railway over River
Gravel Pit
Sand Pit
Level Crossing
Other Pits
Road over River or Canal
Road over Stream
Mixed Wood
Rough Pasture
Road over Stream
Marsh
Sunken Road
Raised Road
Sketched Contour
Instrumental Contour
Arrow denotes flow of water

## Ordnance Survey Plan

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given on the right therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

In the late 1940's a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

| 1979 | 1980 |
|---|---|

Date(s) of Publication

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| 1989 | 1980 |
|---|---|

Date(s) of Publication

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# APPENDIX D

## Borehole and Trial Pit Logs

E 0.0

# TRIAL PIT RECORD

PAGE 1 OF 1

TRIAL PIT NUMBER TP 1

C:\PROGRA~1\PLOTLOG\ELTP1.PL3 NVP-5 10-06-98

| ELEVATION (metres) | DEPTH (metres) | DESCRIPTION | SYMBOL | PID | SAMPLE TYPE | SAMPLE RECOVERY | BACKFILL | DEPTH (metres) |
|---|---|---|---|---|---|---|---|---|
| | | MADE GROUND: (Loose) light grey to black and ironstained very sandy fine to coarse angular gravel of porous slag and coal ash. | | | | | | |
| | | | | | Chem 1 | | | 0.60 |
| | 1.10 | Loose dark brown very silty organic SAND with rootlets (historic topsoil?) | | | | | | 1.00 |
| | 1.30 | Loose to medium dense yellow-brown slightly silty fine to coarse SAND | | | | | | 1.90 |
| | | | | | Chem 2 | | | 2.30 |
| | 2.60 | END OF PIT | | | | | | |

REMARKS:

Water seepage at 1.9m

Pit collapsing below 1.3m

| | |
|---|---|
| EXCAVATED BY: EXUMA | START DATE: 24/09/98 |
| LOGGED BY: NVP | COMPLETION DATE: 24/09/98 |
| CHECKED BY: | JOB NUMBER: E210 |
| EXCAVATION METHOD: JCB wheeled excavator | SITE: Ex Freightliner Site Neath |

GIBB Environmental

ELEVATION METRES (AOD)

E 0.0

# TRIAL PIT RECORD

PAGE 1 OF 1

TRIAL PIT NUMBER TP 2

C:\PROGRA~1\PLOTLOG\ELTP2 PL3 NVP-6 10-06-98

| ELEVATION (metres) | DEPTH (metres) | DESCRIPTION | SYMBOL | PID | SAMPLE TYPE | SAMPLE RECOVERY | BACKFILL | DEPTH (metres) |
|---|---|---|---|---|---|---|---|---|
| | | MADE GROUND: (Loose) black and dark brown very sandy fine to coarse angular gravel and cobbles of porous and vitreous slag and coal ash. | | | Chem 1 | | | 0.60<br>0.70 |
| | 0.80 | Loose to medium dense yellow-brown slightly silty fine to coarse SAND with some rootlets and dark brown very silty organic rich horizontal pockets spaced at approximately 0.5m intervals. | | | Chem 2 | | | 1.20<br>1.60 |
| | 3.50 | END OF PIT | | | | | | |

REMARKS:

Water seepage at 1.6m

Pit collapsing below 1.0m

ELEVATION METRES (AOD)

| | |
|---|---|
| EXCAVATED BY: EXUMA | START DATE: 24/09/98 |
| LOGGED BY: NVP | COMPLETION DATE: 24/09/98 |
| CHECKED BY: | JOB NUMBER: E210 |
| EXCAVATION METHOD: JCB wheeled excavator | SITE: Ex Freightliner Site Neath |

GIBB Environmental

E 0.0

# TRIAL PIT RECORD

PAGE 1 OF 1

TRIAL PIT NUMBER TP 3

C:\PROGRA~1\PLOTLOG\FLTP3.PL3 NVP-5 10-06-98

| ELEVATION (metres) | DEPTH (metres) | DESCRIPTION | SYMBOL | PID | SAMPLE TYPE | SAMPLE RECOVERY | BACKFILL | DEPTH (metres) |
|---|---|---|---|---|---|---|---|---|
| | | MADE GROUND: (Loose) dark brown to black very sandy fine to coarse angular gravel of porous & vitreous slag and coal ash. | | | Chem 1 | | | 0.30 |
| | 0.50 | MADE GROUND: Light brown silty clay with roots and ash. | | | Chem 2 | | | 0.50 |
| | 0.65 | MADE GROUND: (Medium dense to dense) Black sandy fine to coarse angular gravel of ash and porous & vitreous slag with some cobble sized slag, coarse limestone gravel, occasional rootlets, bricks and metal fragments (probably iron). | | | | | | 0.65 |
| | 0.80 | Loose to medium dense yellow-brown slightly silty fine to coarse SAND | | | | | | 1.60 |
| | | | | | | | | 1.90 |
| | 2.60 | Medium dense grey-green slightly silty fine to coarse SAND. | | | | | | |
| | 2.80 | END OF PIT | | | | | | |

REMARKS:

Water seepage at 1.9m

Pit left open between 11:50 and 16:30, water rose to 1.60m.

Pit collapsing below 1.0m

| | |
|---|---|
| EXCAVATED BY: EXUMA | START DATE: 24/09/98 |
| LOGGED BY: NVP | COMPLETION DATE: 24/09/98 |
| CHECKED BY: | JOB NUMBER: E210 |
| EXCAVATION METHOD: JCB wheeled excavator | SITE: Ex Freightliner Site Neath |

GIBB Environmental

ELEVATION METRES (AOD)

E 0.0

# TRIAL PIT RECORD

PAGE 1 OF 1

TRIAL PIT NUMBER TP 4

C:\PROGRA~1\PLOTLOG\FLTP4.PI3 NVP-5 10-06-98

| ELEVATION (metres) | DEPTH (metres) | DESCRIPTION | SYMBOL | PID | SAMPLE TYPE | SAMPLE RECOVERY | BACKFILL | DEPTH (metres) |
|---|---|---|---|---|---|---|---|---|
| | | MADE GROUND: (Loose) black very sandy fine to coarse angular gravel of vitreous slag with some porous slag and coal ash. | | | Chem 1 | | | 0.40 |
| | | | | | | | | 0.60 |
| | 0.90 | Loose to medium dense yellow-brown slightly silty fine to coarse SAND | | | | | | 1.25 |
| | 1.90 | Loose to medium dense grey-green fine to coarse silty SAND | | | | | | |
| | 2.50 | Spongy black to brown slightly sandy clayey PEAT with many fine fibrous plant remains | | | Chem 2 | | | 2.50 |
| | 2.60 | Medium dense yellow brown, discoloured grey green slightly silty fine to coarse SAND | | | | | | 2.30 |
| | 2.80 | END OF PIT | | | | | | |

REMARKS:

Water seepage at 1.25m

Pit collapsing below 1.3m

| | |
|---|---|
| EXCAVATED BY: EXUMA | START DATE: 24/09/98 |
| LOGGED BY: NVP | COMPLETION DATE: 24/09/98 |
| CHECKED BY: | JOB NUMBER: E210 |
| EXCAVATION METHOD: JCB wheeled excavator | SITE: Ex Freightliner Site Neath |

GIBB Environmental

ELEVATION METRES (AOD)

E 0.0

# TRIAL PIT RECORD

PAGE 1 OF 1

TRIAL PIT NUMBER TP 5

C:\PROGRA~1\PLOTLOG\FLTP5.PI3 NVP-5 10-06-98

| ELEVATION (metres) | DEPTH (metres) | DESCRIPTION | SYMBOL | PID | SAMPLE TYPE | SAMPLE RECOVERY | BACKFILL | DEPTH (metres) |
|---|---|---|---|---|---|---|---|---|
| | | MADE GROUND: (Loose) Dark brown to black very sandy fine to coarse angular gravel of porous slag and coal ash with much cobble and boulder sized slag. | | | Chem 1 | | | 0.40 |
| | | | | | | | | 0.60 |
| | 0.90 | Loose to medium dense yellow-brown slightly silty fine to coarse SAND | | | | | | |
| | | | | | | | | 1.60 |
| | 1.70 | Loose to medium dense yellow-brown, discoloured grey-green slight;y silty fine to coarse SAND | | | Chem 2 | | | 1.8 |
| | | | | | | | | 2.10 |
| | 2.50 | END OF PIT | | | | | | |

REMARKS:

Water seepage at 1.9m, rising to 1.6m

Pit collapsing below 1.0m

ELEVATION METRES (AOD)

| | |
|---|---|
| EXCAVATED BY: EXUMA | START DATE: 24/09/98 |
| LOGGED BY: NVP | COMPLETION DATE: 24/09/98 |
| CHECKED BY: | JOB NUMBER: E210 |
| EXCAVATION METHOD: JCB wheeled excavator | SITE: Ex Freightliner Site Neath |

GIBB Environmental

E 0.0

# TRIAL PIT RECORD

PAGE 1 OF 1

TRIAL PIT NUMBER TP 6

C:\PROGRA~1\PLOTLOG\FLTP6.PL3 NVP-5 10-06-98

| ELEVATION (metres) | DEPTH (metres) | DESCRIPTION | SYMBOL | PID | SAMPLE TYPE | SAMPLE RECOVERY | BACKFILL | DEPTH (metres) |
|---|---|---|---|---|---|---|---|---|
| | 0.00 | MADE GROUND: Light grey coarse angular limestone gravel (Rail Ballast) | | | | | | |
| | 0.40 | MADE GROUND: (Loose) black very sandy fine to coarse angular porous & vitreous slag and coal ash with some cobble sized slag | | | Chem 1 | | | 0.50<br>0.70 |
| | 0.90 | Loose to medium dense yellow-brown slightly silty fine to coarse SAND | | | Chem 2 | | | 1.20<br>1.40 |
| | 1.70 | END OF PIT | | | | | | |

REMARKS:

Water seepage at 1.4m

Pit collapsing from the surface

| | |
|---|---|
| EXCAVATED BY: EXUMA | START DATE: 24/09/98 |
| LOGGED BY: NVP | COMPLETION DATE: 24/09/98 |
| CHECKED BY: | JOB NUMBER: E210 |
| EXCAVATION METHOD: JCB wheeled excavator | SITE: Ex Freightliner Site Neath |

GIBB Environmental

ELEVATION METRES (AOD)

E 0.0

# TRIAL PIT RECORD

PAGE 1 OF 1

TRIAL PIT NUMBER TP 7

C:\PROGRA~1\PLOTLOG\FLTP7.PL3 NVP-6 10-06-98

| ELEVATION (metres) | DEPTH (metres) | DESCRIPTION | SYMBOL | PID | SAMPLE TYPE | SAMPLE RECOVERY | BACKFILL | DEPTH (metres) |
|---|---|---|---|---|---|---|---|---|
| | | MADE GROUND: Concrete, reinforced with a single layer of 6mm mesh. | | | | | | |
| | 0.25 | MADE GROUND: Very sandy fine to coarse limestone gravel partially cemented (lean mix concrete) | | | | | | |
| | 0.45 | MADE GROUND: (Loose) light grey to black and ironstained very sandy fine to coarse angular gravel of porous slag and coal ash. | | | Chem 1 | | | 0.45 |
| | | | | | | | | 0.70 |
| | 1.15 | Loose to medium dense yellow-brown slightly silty fine to coarse SAND | | | | | | |
| | | | | | Chem 2 | | | 1.60 |
| | | | | | | | | 2.20 |
| | 2.60 | END OF PIT | | | | | | |

REMARKS:

Damp below 2.0m

Pit collapsing below 1.5m

| | |
|---|---|
| EXCAVATED BY: EXUMA | START DATE: 24/09/98 |
| LOGGED BY: NVP | COMPLETION DATE: 24/09/98 |
| CHECKED BY: | JOB NUMBER: E210 |
| EXCAVATION METHOD: JCB wheeled excavator | SITE: Ex Freightliner Site Neath |

GIBB Environmental

ELEVATION METRES (AOD)

E 0.0

# TRIAL PIT RECORD

PAGE 1 OF 1

TRIAL PIT NUMBER TP 8

C:\PROGRA~1\PLOTLOG\FLTP8.PL3 NVP-7 10-07-98

| ELEVATION (metres) | DEPTH (metres) | DESCRIPTION | SYMBOL | PID | SAMPLE TYPE | SAMPLE RECOVERY | BACKFILL | DEPTH (metres) |
|---|---|---|---|---|---|---|---|---|
| | 0.08 | MADE GROUND: Black bitumen-bound tarmac | | | | | | |
| | 0.20 | MADE GROUND: Very sandy fine to coarse limestone gravel partially cemented (lean mix concrete) | | | | | | |
| | | MADE GROUND: (Loose) light grey to black and ironstained very sandy fine to coarse angular gravel of porous slag and coal ash. | | | Chem 1 | | | 0.30<br>0.40 |
| | 1.10 | Loose dark brown very silty organic SAND with rootlets (historic topsoil?) | | | | | | |
| | 1.30 | Loose to medium dense yellow-brown slightly silty fine to coarse SAND | | | Chem 2 | | | 1.60<br>1.90<br>2.00 |
| | 2.50 | END OF PIT | | | | | | |

REMARKS:

Water seepage at 1.9m

Pit collapsing below 1.0m

| | |
|---|---|
| EXCAVATED BY: EXUMA | START DATE: 24/09/98 |
| LOGGED BY: NVP | COMPLETION DATE: 24/09/98 |
| CHECKED BY: | JOB NUMBER: E210 |
| EXCAVATION METHOD: JCB wheeled excavator | SITE: Ex Freightliner Site Neath |

GIBB Environmental

ELEVATION METRES (AOD)

E 0.0

# TRIAL PIT RECORD

PAGE 1 OF 1

TRIAL PIT NUMBER TP 9

C:\PROGRA~1\PLOTLOG\FLTP9.PL3 NVP-7 10-07-98

| ELEVATION (metres) | DEPTH (metres) | DESCRIPTION | SYMBOL | PID | SAMPLE TYPE | SAMPLE RECOVERY | BACKFILL | DEPTH (metres) |
|---|---|---|---|---|---|---|---|---|
| | 0.20 | MADE GROUND: Concrete, reinforced with a single layer of 6mm mesh. | | | | | | |
| | | MADE GROUND: Very sandy fine to coarse limestone gravel partially cemented (lean mix concrete) | | | | | | |
| | 0.60 | MADE GROUND: (Loose) light grey to black and ironstained very sandy fine to coarse angular gravel of porous slag and coal ash. | | | Chem 1 | | | 0.80 |
| | | | | | | | | 1.10 |
| | 1.40 | Loose to medium dense yellow-brown slightly silty fine to coarse SAND | | | | | | |
| | 1.80 | Loose to medium dense yellow brown, discoloured grey green slightly silty fine to coarse SAND. | | | | | | |
| | 2.60 | Spongy black to brown slightly sandy clayey PEAT with many fine fibrous plant remains. | | | Chem 2 | | | 2.60 |
| | 2.70 | Medium dense yellow brown discoloured grey green slightly silty fine to coarse SAND | | | | | | 2.70 |
| | 2.90 | END OF PIT | | | | | | |

REMARKS:

Damp below 2.0m

Pit collapsing below 1.3m

| | |
|---|---|
| EXCAVATED BY: EXUMA | START DATE: 24/09/98 |
| LOGGED BY: NVP | COMPLETION DATE: 24/09/98 |
| CHECKED BY: | JOB NUMBER: E210 |
| EXCAVATION METHOD: JCB wheeled excavator | SITE: Ex Freightliner Site Neath |

GIBB Environmental

ELEVATION METRES (AOD)

E 0.0

# TRIAL PIT RECORD

PAGE 1 OF 1

TRIAL PIT NUMBER TP 10

C:\PROGRA~1\PLOTLOG\FILTP10.PL3 NVP-7 10-07-98

| ELEVATION (metres) | DEPTH (metres) | DESCRIPTION | SYMBOL | PID | SAMPLE TYPE | SAMPLE RECOVERY | BACKFILL | DEPTH (metres) |
|---|---|---|---|---|---|---|---|---|
| | 0.00 | MADE GROUND: Light grey coarse angular limestone gravel (Rail Ballast) | | | | | | |
| | 0.10 | MADE GROUND: (Loose) black very sandy fine to coarse angular porous & vitreous slag and coal ash with some cobble and boulder sized slag and cobble sized brick | | | Chem 1 | | | 0.60<br>0.70 |
| | 1.10 | Loose to medium dense yellow-brown slightly silty fine to coarse SAND | | | Chem 2 | | | 1.60<br>2.00 |
| | 2.30 | END OF PIT | | | | | | |

REMARKS:

Water seepage at 2.0m

Pit collapsing from 1.2m

ELEVATION METRES (AOD)

| | |
|---|---|
| EXCAVATED BY: EXUMA | START DATE: 24/09/98 |
| LOGGED BY: NVP | COMPLETION DATE: 24/09/98 |
| CHECKED BY: | JOB NUMBER: E210 |
| EXCAVATION METHOD: JCB wheeled excavator | SITE: Ex Freightliner Site Neath |

GIBB Environmental

E 0.0

# TRIAL PIT RECORD

PAGE 1 OF 1

TRIAL PIT NUMBER TP 11

C:\PROGRA~1\PLOTLOG\TP11.PL3 NVP-5 10-07-98

| ELEVATION (metres) | DEPTH (metres) | DESCRIPTION | SYMBOL | PID | SAMPLE TYPE | SAMPLE RECOVERY | BACKFILL | DEPTH (metres) |
|---|---|---|---|---|---|---|---|---|
| | | MADE GROUND: (Loose) black very sandy fine to coarse angular gravel of porous slag and coal ash with some cobble sized bricks and some medium to coarse elongated gravel sized lumps of previously molten metal (zinc?) | | | | | | |
| | 0.65 | Loose to medium dense yellow-brown slightly silty fine to coarse SAND | | | | | | |
| | 1.55 | Spongy dark grey to brown sandy, silty, clayey PEAT with some fine fibrous plant remains | | | | | | |
| | 1.80 | END OF PIT | | | | | | |

REMARKS:

Pit damp below 1.55m

Pit collapsing below 1.3m

ELEVATION METRES (AOD)

| | |
|---|---|
| EXCAVATED BY: EXUMA | START DATE: 29/09/98 |
| LOGGED BY: NVP | COMPLETION DATE: 29/09/98 |
| CHECKED BY: | JOB NUMBER: E210 |
| EXCAVATION METHOD: JCB wheeled excavator | SITE: Ex Freightliner Site Neath |

GIBB Environmental

| | |
|---|---|
| Date : | 15/09/98 |
| Operator: | FF |

**Meteorological and Site Conditions**

| | |
|---|---|
| State of ground | |
| Wind | |
| Wind Direction | |
| Cloud Cover | |
| Precipitation | |
| Temperature(deg.C) | |
| Barometric Pressure(mb) | |

| Equipment Used: | GI Infrared Gas Analyser | GMI Landsurveyor X | GMI Co2 Portable |
|---|---|---|---|
| | Other: FID. | | |

Survey Information:

| BH | Water level (m) | O2 (%v/v) | CH4 (%v/v) | Co2 (%v/v) | VOC, ppm | Others/Comments Depth to base of hole (m) |
|---|---|---|---|---|---|---|
| G2 | 0.80 | 20.90 | 0.00 | 0.00 | | 1.50 |
| | 1.00 | 21.00 | 0.00 | 0.00 | | 2.50 |
| | 1.25 | 20.70 | 0.00 | 0.00 | | 3.50 |
| | 1.40 | 20.70 | 0.00 | 0.00 | | 4.50 |
| | 1.90 | 20.70 | 0.00 | 0.00 | | 5.50 |
| | 2.00 | 20.60 | 0.00 | 0.00 | | 6.50 |
| | 2.20 | 20.70 | 0.00 | 0.00 | | 7.50 |
| | 2.65 | 20.80 | 0.00 | 0.00 | | 8.50 |
| | 2.70 | 20.80 | 0.00 | 0.00 | | 9.50 |
| E1 | 1.80 | 20.90 | 0.00 | 0.00 | | 3.00 |
| E3 | DRY | 20.80 | 0.00 | 0.00 | | 1.00 |
| | DRY | 20.80 | 0.00 | 0.00 | | 2.00 |
| | 2.00 | 20.80 | 0.00 | 0.00 | | 3.00 |
| | 2.70 | 20.80 | 0.00 | 0.00 | | 4.00 |
| | 2.50 | 20.80 | 0.00 | 0.00 | | 5.00 |
| | 3.00 | 20.80 | 0.00 | 0.00 | | 6.00 |

Remarks:

The concentrations of gases recorded above are subject to the accuracy, as specified by the manufacturer, of the instrument adopted. If concentration accuracies of less than +/- 2% are required, it is recommended that gas samples are recovered and laboratory analyses are undertaken.

| | | |
|---|---|---|
| Gas Monitoring Record | Project: Jersey Marine, Swansea | Contract: 158214 |
| Exploration Associates | Gibb, Enviroment Engineering | Figure: |

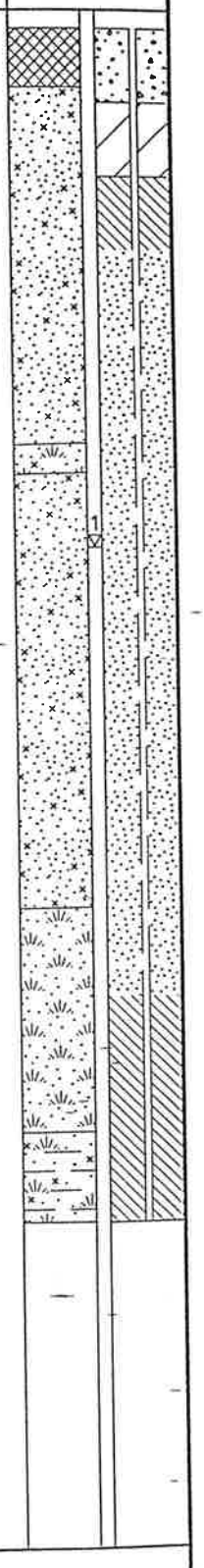
## Sampling

| Depth | Type | Casing Depth | Date/ Water | SPT N (Cu) |
|---|---|---|---|---|
| | | | 28/09 1998 | |
| 0.25 | B | NIL | | |
| 0.40 | D | NIL | | |
| 1.50-1.95 | CD | 1.50 | 1.50 | 36 |
| 1.50-1.95 | B | | | |
| 2.50-2.95 | CD | 2.50 | 1.90 | 28 |
| 2.50-2.95 | B | | | |
| 3.50-3.95 | CD | 3.50 | 2.00 | 30 |
| 3.50-3.95 | B | | | |
| 4.50-4.95 | CD | 4.50 | 2.00 | 26 |
| 4.50-4.95 | B | | | |
| 5.25-5.75 | B | | | |
| 5.90 | D | | | |
| 6.00-6.45 | CD | 6.00 | 2.20 | 2 |
| 6.00-6.45 | B | | | |
| 6.75-7.25 | B | | | |
| 7.40 | D | | | |
| 7.50-7.95 | CD | 6.50 | 3.40 | 3 |
| 7.50-8.00 | B | | | |
| 3.50 | W | 8.00 | 3.40 | |
| 8.00 | | 8.00 | 29/09 | |

## Strata

| Description | Depth (Thickness) | Level |
|---|---|---|
| | G.L. | |
| MADE GROUND: (Medium dense) black slightly silty sandy fine to coarse angular gravel of pulverised fly ash with vitreous and scoraceous slag with occasional cobbles. | (0.40) | |
| | 0.40 | |
| Dense yellow brown slightly silty fine to coarse SAND with occasional coarse sand to fine gravel of lignite mudstone and white to black shell fragments. ... at 0.40m with some boulders (<350mm) of welded slag | (2.40) | |
| | 2.80 | |
| Spongey grey mottled black slightly silty sandy PEAT with fine fibrous plant remains. | 3.00 | |
| Dense yellow brown discoloured grey green slightly silty fine to coarse SAND with occasional coarse sand to fine gravel of lignite mudstone and white to black shell fragments. | (2.90) | |
| ... from 5.25m with occasional fibrous decayed plant remains | | |
| | 5.90 | |
| Spongey ~~very~~ soft black to brown locally sandy ~~PEAT~~ with many fibrous plant remains. | (1.50) | |
| ... from 6.75m to 7.40m becomes plastic very soft locally slightly sandy very silty ~~PEAT~~ | | |
| | 7.40 | |
| Very soft blue grey slightly sandy very silty CLAY locally with occasional fibrous peaty remains. | (0.60) | |
| | 8.00 | |
| End of Borehole. | | |

Legend



Equipment: Light cable percussion

Borehole Dia (mm): 200 to 8.00m

Casing Dia (mm): 200 to 8.00m

## Groundwater

| No. | Struck | Behaviour | Sealed |
|---|---|---|---|
| 1 | 3.50 | No obvious strike. Ceased drilling at 3.50m depth standing water rose from 3.20m to 2.00m in 20mins. | |

Drilled by FF
Logged by RB
Checked by

**Remarks**

Water added to assist boring from 1.20m to 3.50m
Inspection pit excavated to 1.20m (1.50Hrs).
Installation of a 50mm nominal diameter UPVC standpipe, slotted at 0.5mm in a 2mm sand bed from 6.50 to 1.50m with a sump to 8.00m

See key sheet and appendices for explanations.

Form 1/0

**Borehole Record**

Exploration Associates

**Project**

Jersey Marine, Swansea G.I.
GIBB. Environmental Engineering

**Contract** 158214

**Borehole** E1(1 of 1)

| Sampling | | | | | Strata | | | |
|---|---|---|---|---|---|---|---|---|
| Depth | Type | Casing Depth | Date/ Water | SPT N (Cu) | Description | Depth (Thickness) | Level | Legend |
| | | | 29/09 1998 | | | G.L. | | |
| 0.25 | B | NIL | | | MADE GROUND: (Medium dense) black very sandy fine to coarse angular gravel of sloggy bituminous waste ash and coal with occasional cobbles. | (0.50) | | |
| 0.50 | B | NIL | | | | 0.50 | | |
| | | 1.00 | DRY | | Dense Yellow brown slightly silty fine to coarse SAND (with a strong chemichal bituminous odour from 1.00m to 6.00m). | | | |
| 1.00 | | 1.00 | 30/09 DRY | | | | | |
| 1.50-1.95 | CB | 1.50 | 1.20 | 33 | ... from 1.50m to 2.00m with occasional cobble to boulder sized red welded pumiced/scoraceous slag (foreshore wash?) ... from 1.50m becomes grey green. | | | |
| 2.50-2.95 | SD | 2.50 | 2.00 | 22 | | | | |
| 2.50-2.95 | B | | | | | | | |
| 3.50-3.95 | SD | 3.50 | 2.50 | 3 | | | | |
| 3.50-3.95 | B | | | | | | | |
| | | | | | | (7.40) | | |
| 4.50-4.95 | CB | 4.50 | 2.00 | 5 | ... from 4.30m with some to occasional fine to coarse rounded gravel of predominantly sandstone and occasional cobbles with a single subrounded cobble of red welded pumiced /scoraceous slag. | | | |
| 5.25-5.75 | B | | | | | | | |
| 6.00-6.45 | SD | 6.00 | 2.20 | 17NR | ... from 6.00m with shell fragments | | | |
| 6.75-7.25 | B | | | | | | | |
| 7.50-7.95 | SD | 7.50 | 2.25 | 8 | ... from 7.50m to 7.80m with shells | | | |
| 7.50-7.80 | B | | | | | | | |
| 7.90 | B | 8.00 | 2.25 | | | 7.90 | | |
| 8.00 | | | | | | 8.00 | | |
| 2.00 | W | | | | Soft blue grey slightly sandy very silty CLAY with occasional fine to coarse rounded gravel of mudstone and sandstone. End of Borehole. | | | |

Equipment: Light cable percussion

Borehole Dia (mm) 200 to 8.00m

Casing Dia (mm) 200 to 8.00m

**Groundwater**

| No. | Struck | Behaviour | Sealed |
|---|---|---|---|
| 1 | 2.00 | Rose to 1.00m in 20 mins 1.60/1.30/1.10 in 5/10/15 mins | |

Drilled by FF
Logged by RB
Checked by

**Remarks**

Water added to assist boring from 1.00m to 2.00m
Jet washed rig before accessing borehole. Inspection pit excavated to 1.20m (30mins). Contamination samples obtained from 2.50m to 3.50m (3No). Installation of a 50mm nominal diameter UPVC standpipe, slotted at 0.5mm and installed in a 2mm sand bed from 6.00m to 2.00m with a sump to 8.00m.

See key sheet and appendices for explanations.

Form 1/0

**Borehole Record**

Exploration Associates

**Project**

Jersey Marine, Swansea G.I.
GIBB, Environmental Engineering

**Contract** 158214

**Borehole** E2(1 of 1)

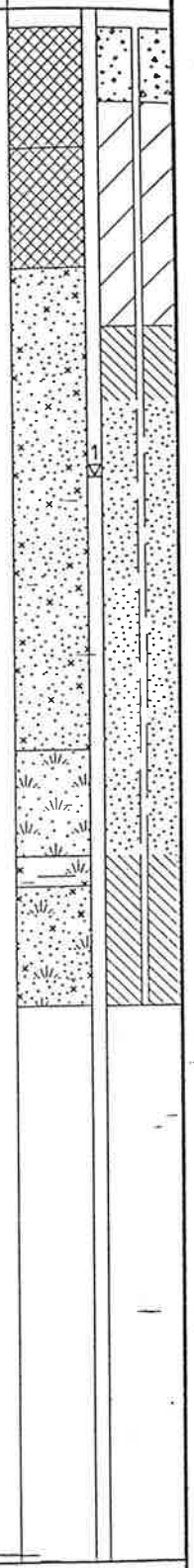
## Sampling

| Depth | Type | Casing Depth | Date/ Water | SPT N (Cu) |
|---|---|---|---|---|
| | | | 28/09 1998 | |
| 0.50-1.00 | B | NIL | DRY | |
| 1.20-1.50 | CD | 1.20 | DRY | 50/ |
| 1.20-1.50 | B | | | 75 |
| 2.00-2.50 | CD | 2.00 | DRY | 46 |
| 2.00-2.50 | B | | | |
| 3.00-3.50 | CD | 3.00 | 2.00 | 46 |
| 3.00-3.50 | B | | | |
| 4.00-4.50 | CD | 4.00 | 2.70 | 34 |
| 4.00-4.50 | B | | | |
| 4.80-5.00 | D | | | |
| 5.00-5.50 | CD | 5.00 | 2.50 | 19 |
| 4.70-5.50 | B | | | |
| 6.00-6.50 | B | | | |
| 6.50-7.00 | CD | 6.50 | 3.00 | 25 |
| 6.50 | | 6.50 | 3.00 29/09 | |

## Strata

| Description | Depth (Thickness) |
|---|---|
| | G.L. |
| MADE GROUND: (Very Dense) grey slightly sandy fine medium to coarse angular gravel of predominantly scoraceous slag | (0.80) |
| | 0.80 |
| MADE GROUND: Very dense black sandy fine to coarse angular gravel of pulverised fly ash with scoraceous and vitreous slag brick with occasional cobbles and boulders** | (0.80) |
| | 1.60 |
| Dense yellow brown discoulered grey slightly silty fine to coarse SAND with occasional fine to medium sub-rounded gravel of sandstone and mudstone with occasional fine gravel sized shell fragments | (3.20) |
| ...at 4.00m with occasional fine fibrous peaty inclusions | |
| | 4.80 |
| Spongey black to brown localty slightly sandy PEAT with many fibrous plant remains ...from 5.00m to 5.50m becomes firm plastic slightly sandy very silty PEAT with some fibrous organic remains | (0.70) |
| | 5.50 |
| Soft grey very silty CLAY with fibrous vegetative matter**. | 5.70 (0.80) |
| Dense brown slightly silty fine to coarse SAND with occasional fibrous plat remains and soft peaty inclusions. | 6.50 |
| End of Borehole. | |

Legend




Equipment: Light cable percussion

Borehole Dia (mm): 200 to 6.50m

Casing Dia (mm): 200 to 6.50m

## Groundwater

| No. | Struck | Behaviour | Sealed |
|---|---|---|---|
| 1 | 3.00 | No obvious strikes, water maintained between 2.00 and 3.00m during drilling. | |

Drilled by PO
Logged by RB
Checked by

**Remarks**

See key sheet and appendices for explanations.

Chiselled from 1.30m to 1.60m (45 mins)
Water added to assist boring from 1.60m to 5.50m
Inspection pit excavated to 1.20m (2hrs).
Gas tests taken from 1.00m to 6.00m at 1.00m intervals.
Installation of a 50mm nominal diameter UPVC. stand pipe, slotted at 0.5mm in a 2.0mm sand bed from 5.50m to 2.50m with a sump to 6.50m.

Form 1/0

**Borehole Record**

Exploration Associates

**Project**

Jersey Marine, Swansea G.I.
GIBB. Environmental Engineering

**Contract** 158214

**Borehole** E3(1 of 1)

| Sampling | | | | | Strata | | |
|---|---|---|---|---|---|---|---|
| Depth | Type | Casing Depth | Date/ Water | SPT N (Cu) | Description | Depth (Thickness) | Level |
| | | | 29/09 1998 | | MADE GROUND: Very dense grey reinforced concrete. | G.L. | |
| 0.30-0.60 | B | NIL | | | | 0.30 | |
| 0.60-1.20 | B | NIL | | | MADE GROUND: Very dense black to grey slightly sandy fine to coarse angular gravel of predominantly scoraceous slag with many cobbles. | 0.60 | |
| 1.20-1.65 | C | 1.20 | DRY | 50/ 85 | MADE GROUND: Very dense black sandy fine to coarse angular gravel of pulverised fly ash with ash slag (vitreous and scoraceous) siltstone brick and shells with occasional cobbles and boulders (<300mm) | (1.20) | |
| 1.20-1.60 | B | | | | | | |
| 2.00-2.45 | SD | 2.00 | DRY | 49 | | 1.80 | |
| 2.50-3.00 | B | | | | Dense locally very dense yellow brown slightly silty fine to coarse SAND with occasional fine gravel of mudstone and rare slag (reworked natural / wind blown) | | |
| 3.00-3.45 | SD | 3.00 | 2.20 | 56 | | | |
| 3.50-4.00 | B | | | | | (3.70) | |
| 4.00-4.45 | SD | 4.00 | 2.00 | 39 | ...from 4.00m slag absent with occasional fibrous plant remains | | |
| 4.50-5.00 | B | | | | ...from 4.50m to 5.00m with peaty inclusions. | | |
| 5.00-5.45 | SD | 5.00 | 2.00 | 49 | | | |
| 5.00 | | 5.00 | 3.50 30/09 3.00 | | | 5.50 | |
| 5.50-5.70 | B | | | | Plastic firm dark brown to black slightly sandy very silty PEAT with many fine fibrous plant remains. | 5.70 | |
| 5.70-6.00 | B | | | | | (0.90) | |
| 6.00-6.45 | C | 6.00 | 3.00 | 50/ 20 | Very dense dark grey very sandy fine to coarse rounded GRAVEL of predominantly sandstone | | |
| 6.00-6.50 | B | | | | | 6.60 | |
| 6.60-7.00 | B | | | | | (0.40) | |
| 7.00-7.45 | C | 7.00 | 3.00 | 50/ 40 | Spongey (firm) dark brown to black slightly sandy silty PEAT with many fibrous plant remains. | 7.00 | |
| 7.00-7.50 | B | | | | | (0.80) | |
| 7.80-8.00 | B | | | | Very dense black slightly sandy sub-rounded to rounded COBBLES of sandstone and quartz with some fine to coarse sub-rounded to rounded gravel. | 7.80 | |
| 8.00-8.45 | SD | 8.00 | 4.70 | 8 | | 8.00 | |
| 8.00-8.50 | B | | | | Soft blue grey slightly sandy very silty CLAY with occasional fibrous plant remains and peaty inclusions with occasional fine to coarse rounded gravel. | | |
| 9.00-9.45 | SD | 9.00 | 5.10 | 7 | | | |
| 9.00-9.50 | B | | | | Soft locally grading to very soft slightly sandy very silty CLAY ...from 9.00m to 9.50m with some fine to coarse gravel of predominantly sandstone with fine to medium gravel sized inclusions of fibrous brown peat ...at 10.00m becomes very loose slightly | | |

Legend

Equipment: Light cable percussion

Borehole Dia (mm): 200 to 18.00m; 150 to 20.2m

Casing Dia (mm): 200 to 18.00m; 150 to 20.20m

**Groundwater**

| No | Struck | Behaviour | Sealed |
|---|---|---|---|
| 1 | 5.70 | Rose to 3.70m in 20 mins 5.00/4.50/4.00 in 5/10/~~15~~ mins. | |

Drilled by PO
Logged by RB
Checked by

**Remarks**

Chiselled from 1.30m to 1.60m (45 mins), 6.10m to 6.30m (30 mins), 7.20m to 7.50m (45 mins)
Water added to assist boring from 1.20m to 5.70m
Excavate inspection pit to 1.20m (75mins). Gas testing at 1.00m centres from 1.00m to 5.00m.

See key sheet and appendices for explanations.

Form 1/0

**Borehole Record**

Exploration Associates

**Project**

Jersey Marine, Swansea G.I.
GIBB, Environmental Engineering

**Contract** 158214

**Borehole** G1(1 of 3)

| Sampling | | | | | Strata | | |
|---|---|---|---|---|---|---|---|
| Depth | Type | Casing Depth | Date/ Water | SPT N (Cu) | Description | Depth (Thickness) | Level |
| 10.00-10.45 | S | 10.00 | 30/09 4.50 | 4 | sandy very clayey SILT | | |
| 10.00-10.50 | B | | | | | | |
| 11.50-11.95 | S | 11.50 | 5.00 | 3 | ...at 11.50m becomes sandy | | |
| 12.50-13.00 | B | | | | ...at 12.50m becomes very soft blue grey sandy very silty CLAY with lenses of fine to coarse sand | | |
| 13.00-13.45 | S | 13.00 | 3.90 | 2 | ...at 13.00m becomes slightly sandy very silty CLAY with very closely spaced partings with a coating <1mm of fine to medium sand | (10.50) | |
| 14.00-14.50 | B | | | | ...at 14.00m becomes sandy | | |
| 14.50-14.95 | S | 14.50 | 4.20 | 0 | ...at 14.50m grades to very loose sandy very clayey SILT | | |
| 15.50-16.00 | B | | | | ...at 15.50m grades to sandy very silty CLAY / very clayey SILT with occasional shell fragments | | |
| 16.00-16.45 | S | 16.00 | 4.20 | 4 | | | |
| 17.00-17.50 | B | | | | | | |
| 17.50-17.95 | S | 17.50 | 4.50 | 4 | ...at 17.50m slightly sandy | | |
| 18.00 | | 18.00 | 4.00 01/10 | | | | |
| | | 18.00 | | | | 18.50 | |
| | | | | | Very dense grey slightly clayey slightly sandy sub-rounded to rounded COBBLES of predominantly sandstone with some fine to coarse sub-rounded to rounded gravel. ...from 19.00m becomes slightly sandy fine to coarse GRAVEL of sandstone (grey and red) quartz mudstone and siltstone with some cobbles | (1.70) | |

Legend

Equipment: Light cable percussion

Borehole Dia (mm)
200 to 18.00m
150 to 20.12m

Casing Dia (mm)
200 to 18.00m
150 to 20.20m

Groundwater
No. Struck Behaviour Sealed

Drilled by PO
Logged by RB
Checked by

Remarks

See key sheet and appendices for explanations.

Form 1/0

Borehole Record

Exploration Associates

Project
Jersey Marine, Swansea G.I.
GIBB Environmental Engineering

Contract 158214

Borehole G1(2 of 3)

| Sampling | | | | | Strata | | | |
|---|---|---|---|---|---|---|---|---|
| Depth | Type | Casing Depth | Date/ Water | SPT N (Cu) | Description | Depth (Thickness) | Level | Legend |
| | | | 01/10 | | | 20.20 | | |
| | | | | | End of Borehole. | | | |

Equipment: light cable percussion

Borehole Dia (mm)
200 to 18.00m
150 to 20.2m

Casing Dia (mm)
200 to 18.00m
150 to 20.20m

**Groundwater**
No. Struck Behaviour Sealed

Drilled by PO
Logged by RB
Checked by

**Remarks**

See key sheet and appendices for explanations.

Form 1/0

**Borehole Record**

Exploration Associates

**Project**
Jersey Marine, Swansea G.I.
GIBB. Environmental Engineering

**Contract** 158214

**Borehole** G1(3 of 3)

| Sampling | | | | | Strata | | | |
|---|---|---|---|---|---|---|---|---|
| Depth | Type | Casing Depth | Date/ Water | SPT N (Cu) | Description | Depth (Thickness) | Level | Legend |
| | | | 06/10 1998 DRY | | MADE GROUND: Black gravelly ash fill ** | G.L. (0.40) | 7.24 | |
| 0.40 | B | | | | | 0.40 | 6.84 | |
| 0.75-1.25 | B | | | | MADE GROUND: Black mottled yellow fine to coarse sand with occasional fine to medium subrounded gravel of slag | (1.60) | | |
| 1.50-1.95 | B | 1.50 | 0.80 | 14 | | | | |
| 1.50-1.95 | B | | | | | | | |
| | | | | | | 2.00 | 5.24 | |
| | | | | | Medium dense brown fine to coarse SAND | | | |
| 2.50-2.95 | B | 2.50 | 1.00 | 12 | | | | |
| 2.50-2.95 | B | | | | | | | |
| 2.50-2.95 | B | | | | | | | |
| 3.50-3.95 | B | 3.50 | 1.25 | 11 | | | | |
| 3.50-3.95 | B | | | | | | | |
| 3.50-3.95 | B | | | | | | | |
| 4.10 | B | | | | ... from 4.10 occasional subrounded coarse gravel and cobbles of sandstone | | | |
| 4.50-4.95 | C | 4.50 | 1.40 | 50/ 110 | | | | |
| 4.50-4.95 | B | | | | | | | |
| 4.10 | W | 5.00 | 2.20 | | | (5.60) | | |
| 5.00 | | | 07/10 | | | | | |
| | | 5.00 | 1.40 | | 5.10 to 6.30 some gravel and cobbles | | | |
| 5.50-5.95 | C | 5.50 | 1.90 | 50/ 125 | | | | |
| 5.50-5.95 | B | | | | | | | |
| 6.50-6.95 | C | 6.50 | 2.00 | 27 | | | | |
| 6.50-6.95 | B | | | | | | | |
| 7.50-7.95 | C | 7.50 | 2.20 | 4 | | 7.60 | -0.36 | |
| 7.50-7.95 | B | | | | Soft grey slightly sandy very silty CLAY with occasional lenses of peat | | | |
| 8.50-8.95 | C | 8.50 | 2.65 | 7 | | | | |
| 8.50-8.95 | C | | | | | (2.65) | | |
| | | | | | ...from 9.20 very sandy | | | |
| 9.50-9.95 | C | 9.50 | 2.70 | 2 | | | | |
| 9.50-9.95 | B | | | | | | | |

Equipment: Dando 150

Borehole Dia (mm): 200 to 17.50m

Casing Dia (mm): 200 to 17.50m

**Groundwater**

| No. | Struck | Behaviour | Sealed |
|---|---|---|---|
| 1 | 4.10 | Rose to 1.70m in 20 mins 3.20/2.50/2.00 in 5/10/15 mins | |

Ground Level: 7.24 m OD

Coordinates: 269610.12 mE, 193233.82 mN

Drilled by: FF

Logged by: OT

Checked by:

**Remarks**

See key sheet and appendices for explanations

Chiselled from 4.20m to 4.50m (60 mins), 4.60m to 5.00m (90 mins), 5.00m to 5.50m (90 mins), 5.80m to 6.20m (75 mins)
Jet wash rig and equipment 45 mins
Move to borehole location 90 mins
Dig inspection pit 60 mins
9 No. Gas tests taken see seperate sheet
Instructed by Engineer to terminate borehole due to location of near by badger set waiting 60 mins

Form 1/0

**Borehole Record**

Exploration Associates

**Project**

Jersey Marine, Swansea G.I.
GIBB. Environmental Engineering

**Contract** 158214

**Borehole** G2(1 of 2)

| Sampling | | | | | Strata | | | |
|---|---|---|---|---|---|---|---|---|
| Depth | Type | Casing Depth | Date/ Water | SPT N (Cu) | Description | Depth (Thickness) | Level | Legend |
| | | | 07/10 | | | | | |
| 10.25-10.75 | B | 10.50 | 3.30 | | | 10.25 | -3.01 | |
| 10.50 | | 10.50 | 08/10 2.60 | | Loose grey very silty SAND | | | |
| 11.00-11.45 | S | 11.00 | 3.00 | 3 | | | | |
| 11.00-11.45 | D | | | | | | | |
| 12.50-12.95 | S | 12.50 | 3.20 | 2 | | | | |
| 12.50-12.95 | D | | | | | | | |
| 13.25-13.75 | B | | | | | | | |
| | | | | | | (7.25) | | |
| 14.00-14.45 | S | 14.00 | 3.40 | 9 | | | | |
| 14.00-14.45 | D | | | | | | | |
| 14.00-14.45 | B | | | | | | | |
| 14.75-15.25 | B | | | | | | | |
| 15.50-15.95 | S | 15.50 | 3.60 | 6 | | | | |
| 15.50-15.95 | D | | | | | | | |
| 15.50-15.95 | B | | | | | | | |
| 16.25-16.75 | B | | | | | | | |
| 17.00-17.45 | S | 17.00 | 3.80 | 7 | | | | |
| 17.00-17.45 | D | | | | | | | |
| | | 17.50 | 3.80 | | | | | |
| 17.50 | | | | | | 17.50 | -10.26 | |
| | | | | | End of Borehole. | | | |

Equipment: Dando 150

Borehole Dia (mm) 200 to 17.50m

Casing Dia (mm) 200 to 17.50m

**Groundwater**
No. Struck Behaviour Sealed

Ground Level 7.24 m OD
Coordinates 269610.12 mE
193233.82 mN

Drilled by FF
Logged by OT
Checked by

**Remarks**

See key sheet and appendices for explanations

Form 1/0

**Borehole Record**

Exploration Associates

**Project**
Jersey Marine, Swansea G.I.
GIBB. Environmental Engineering

**Contract** 158214

**Borehole** G2(2 of 2)

| Sampling | | | | | Strata | | | |
|---|---|---|---|---|---|---|---|---|
| Depth | Type | Casing Depth | Date/ Water | SPT N (Cu) | Description | Depth (Thickness) | Level | Legend |
| | | | 02/10 1998 | | MADE GROUND: Reinforced concrete ** | G.L. | 8.08 | |
| | | | | | | 0.30 | 7.78 | |
| 0.60-1.20 | B | | | | MADE GROUND: Very compacted hardcore ** | 0.60 | 7.48 | |
| 1.20 | C | 1.20 | DRY | 50/ | MADE GROUND: Very dense black to grey slightly sandy fine to coarse angular gravel of ash, slag and brick fragments and wooden objects and occasional cobbles (and boulders **) | (1.30) | | |
| 1.20-1.70 | B | | | 95 | | | | |
| 2.00 | S | 2.00 | 1.80 | 47 | | 1.90 | 6.18 | |
| 2.00-2.50 | B | | | | Dense to locally very dense yellwo brown slightly silty fine to coarse SAND | | | |
| 3.00 | S | 3.00 | 2.00 | 52 | | | | |
| 3.00-3.50 | B | | | | | (3.60) | | |
| 4.00 | S | 4.00 | 3.00 | 49 | | | | |
| 4.00-4.50 | B | | | | | | | |
| 5.00 | D | | | | ... from 5.00 to 5.50 with peaty inclusions | | | |
| 5.00 | U(3[illegible]) | 5.00 | 4.20 | | | | | |
| 5.45-5.50 | D | | | | | 5.50 | 2.58 | |
| | | | | | Plastic firm dark brown slightly sandy very clayey PEAT with some fine fiberous plant remains. | (0.40) | | |
| 6.00 | S | 6.00 | 4.00 | 34 | | 5.90 | 2.18 | |
| 6.00-6.50 | B | | | | Dense grey brown slightly silty fine to coarse SAND with occasional fiberous plant remains and peaty inclusions | | | |
| 7.00 | S | 7.00 | 3.20 | 35 | | | | |
| 7.00-7.50 | B | | | | | (2.70) | | |
| 8.00 | S | 8.00 | 2.50 | 40 | ... from 8.00 becoming grey | | | |
| 8.00 | | 8.00 | 2.50 05/10 2.00 | | | | | |
| 8.60 | D | | | | | 8.60 | -0.52 | |
| 8.60-9.00 | B | | | | Soft grey slightly clayey slightly sandy SILT with occasional shell fragments | | | |
| 9.00 | U(15[illegible]) | 9.00 | 2.70 | | | | | |
| 9.45-9.50 | D | | | | | (1.90) | | |
| 9.60-10.00 | B | | | | | | | |

Equipment: Light Cable Percussion

Borehole Dia (mm): 200 to 21.70m

Casing Dia (mm): 200 to 21.70m

**Groundwater**

| No. | Struck | Behaviour | Sealed |
|---|---|---|---|
| 1 | 20.50 | Rose to 17.90m in 20 mins 19.20/18.70/18.30 in 5/10/15 mins | |

Ground Level 8.08 m OD

Coordinates 269784.53 mE 193357.98 mN

Drilled by WO

Logged by RB

Checked by

**Remarks**

See key sheet and appendices for explanations

Chiselled from 1.30m to 1.70m (90 mins), 20.30m to 20.60m (60 mins), 20.80m to 21.00m (45 mins), 21.20m to 21.35m (85 mins), 21.35m to 21.70m (300 mins), 21.70m to 22.00m (120 mins)
Set up on position 115 mins
Dig inspection pit 120 mins
Set up and carry out piston test 45 mins

Form 1/0

**Borehole Record**

Exploration Associates

**Project**

Jersey Marine, Swansea G.I.
GIBB. Environmental Engineering

**Contract** 158214

**Borehole** G3(1 of 3)

| Sampling | | | | | Strata | | | |
|---|---|---|---|---|---|---|---|---|
| Depth | Type | Casing Depth | Date/ Water | SPT N (Cu) | Description | Depth (Thickness) | Level | Legend |
| 10.00 | U(97) | 10.00 | 05/10 3.20 | | | | | |
| 10.45-10.50 | D | | | | | 10.50 | -2.42 | |
| | | | | | Loose grey very silty fine to coarse SAND | | | |
| 11.00 | D | | | | | | | |
| 11.00-11.50 | B | | | | | | | |
| 11.50 | S | 11.50 | 3.00 | 4 | | | | |
| 12.90 | D | | | | | | | |
| 13.00 | U(36) | 13.00 | 3.00 | | | | | |
| 13.45-13.50 | D | | | | | | | |
| 14.50-15.00 | B | | | | | | | |
| 15.00 | S | 15.00 | 8.00 | | | (9.70) | | |
| 16.50 | P | 16.50 | | | | | | |
| 17.50-18.00 | B | | | | | | | |
| 18.00 | S | 18.00 | 12.00 | 8 | | | | |
| 19.00-19.50 | B | | | | | | | |
| 19.50 | S | 19.50 | 13.50 | 2 | | | | |
| 20.00 | | 20.00 | 18.90 06/10 | | | | | |

Equipment: Light Cable Percussion

Borehole Dia (mm) 200 to 21.70m

Casing Dia (mm) 200 to 21.70m

**Groundwater**
No. Struck Behaviour Sealed

Ground Level 8.08 m OD
Coordinates 269784.53 mE
193357.98 mN

Drilled by WO
Logged by RB
Checked by

**Remarks**

See key sheet and appendices for explanations

Form 1/0

**Borehole Record**

Exploration Associates

**Project**
Jersey Marine, Swansea G.I.
GIBB. Environmental Engineering

**Contract** 158214

**Borehole** G3(2 of 3)

| Sampling | | | | | Strata | | | |
|---|---|---|---|---|---|---|---|---|
| Depth | Type | Casing Depth | Date/ Water | SPT N (Cu) | Description | Depth (Thickness) | Level | Legend |
| | | 20.00 | 06/10 | | | 20.20 | -12.12 | |
| 20.50-21.00 | B | | | | Dense brown slightly sand fine to coarse subangular to subrounded GRAVEL and occasional cobbles of sandstone | | | |
| 21.00 | D | 21.00 | 17.50 | 50/ 10 | | (1.80) | | |
| 21.00-21.70 | B | | | | | | | |
| 21.70 | D | 21.70 | 18.00 | 50/ 20 | | 22.00 | -13.92 | |
| | | 21.70 | 18.00 | | End of Borehole. | | | |
| 21.70 | | | | | | | | |

Equipment: Light Cable Percussion

Borehole Dia (mm) 200 to 21.70m

Casing Dia (mm) 200 to 21.70m

**Groundwater**
No. Struck Behaviour Sealed

Ground Level 8.08 m OD
Coordinates 269784.53 mE
193357.98 mN

Drilled by WO
Logged by RB
Checked by

**Remarks**

See key sheet and appendices for explanation

Form 1/0

**Borehole Record**

Exploration Associates

**Project**
Jersey Marine, Swansea G.I.
GIBB. Environmental Engineering

**Contract** 158214

**Borehole** G3(3 of 3)

# APPENDIX E

## Previous Ground Investigations

NAMAS
TESTING
No. 0980

Earlswood Materials Laboratory,
Newby House,
Neath Abbey Business Park,
Neath Abbey, Neath
SA10 7DR
Tel: Swansea (01792) 812333
Fax: Swansea (01792) 817447
*All correspondence to be addressed to the Laboratory Manager*

# Freightliner Access Road

## Jersey Marine

## Ground Investigation Report

**Laboratory Reference No.: 01437/R784/RLS**

Client:
Head of Engineering
Design and Construction Consultancy
Technical Services Department
Neath Port Talbot County Borough Council
Civic Centre
Penllergaer
Swansea

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# 1. INTRODUCTION

Earlswood Materials Laboratory was instructed by the Head of Engineering of Neath Port Talbot County Borough Council to undertake a ground investigation for a proposed new access to the Freightliner depot at Jersey Marine. This report describes the investigations carried out, presents the results obtained, and makes recommendations for design and construction of the proposed works.

## 2. SITE DESCRIPTION

The site is located to the north of A483 Fabian Way at Jersey Marine, between the Gower Chemicals works and the Ford plant. The location and topography of the site is shown on Drawing W2507/TP1 enclosed with this report.

The proposed access road route commences at a junction with Elba Crescent at the south of the Gower Chemicals site. It then follows an existing road running parallel to the railway track serving the Ford plant for approximately 70m. It then crosses the railway track and then runs parallel to the north side of the track to finish in an area of dense scrub land. The area around the site is generally level and is mainly occupied by various industrial premises including Gower Chemicals, Ford, Shell UK and ERF Trucks.

Historic Ordinance Survey maps at 25" to 1 mile Scale dated 1880 and 1917 have been consulted to determine former land use on the site. The 1880 map indicates that the site was an area of rough grazing land. The 1917 map indicates railway locomotive sheds, workshops and associated yards in the area to the north of the present railway line, and fields to the south. The present Gower Chemicals works occupies the former railway sheds and workshops.

## 3. GEOLOGY

The 1:10560 Scale geological map (SS69SE) indicates that the site is underlain by Blown Sand overlying the Middle Coal Measures. It is possible that Alluvium may be present between the Blown Sand and the ~~Alluvium~~ Middle Coal Measures.

# 4. GROUND INVESTIGATION

## 4.1 Fieldwork

Ground investigation fieldwork was undertaken on 24th and 25th September 1996, and comprised four trial pits (TP1, 2, 4, and 5) and one road core (at location TP3). The trial pit and road core locations are shown on drawing W2507/TP1 enclosed with this report.

The trial pits are logged by an engineering geologist in accordance with BS5930:1981, and the logs are presented in the Appendix A.

## 4.2 Laboratory Testing

California bearing ratio (CBR) tests were carried out on selected soil samples in accordance with BS1377:Part 4:1990 Clause 7.4.

The road core was logged, and the compressive strength of the concrete was determined in accordance with BS1881:Part 120:1993.

Selected soil samples were screened for contamination. This testing was undertaken by Anchem Analytical Laboratories. Additional analysis of mineral oils was undertaken by Hyder Environmental.

The results of laboratory testing are presented in Appendix B.

## 5. GROUND CONDITIONS

The ground conditions revealed by the investigation comprised Made Ground overlying Blown Sand.

### 5.1 Made Ground

The Made Ground is between 0.6m and 2.4m thick and consists mainly of medium dense, dark grey or black, usually gravelly, sand containing slag, clinker, coke, brick, concrete, ash and glass fragments.

The results of California Bearing Ratio tests indicate that the CBR value of the Made Ground may be assumed to be greater than 15%.

The results of chemical tests indicate that the Made Ground in the vicinity of the existing level crossing is heavily contaminated with oil, with concentrations up to 2.3% being measured. Loss of ignition results of around 40% were measured, indicating a high content of combustible material, which may include organic matter and coal.

Further analysis identified that the oils consist mainly of hydrocarbons typical of diesel fuel oil and lubricating oil. Samples also contained various polyaromatic hydrocarbons typical of coal tar, with total polyaromatic hydrocarbon contents of 48 and 18mg/kg being measured, indicating slight contamination by coal tar.

### 5.2 Blown Sand

Deposits of Blown Sand were encountered beneath the Made Ground, consisting mainly of loose to medium dense orange brown fine to medium sand.

The CBR value of this stratum is expected to be in excess of 15%.

### 5.3 Ground Water

Ground water was encountered at depths between 1.6 and 2.1m.

## 6. ENGINEERING DISCUSSION AND RECOMMENDATIONS

The formation for the proposed road is likely to be mainly within the Made Ground, but the underlying sand may be encountered in some cases. Provided that compaction is applied to the formation, a CBR of 15% is achievable in both cases. Therefore, a capping layer will not be required.

The Made Ground should be treated as contaminated, the principal contaminates being diesel fuel and lubricating oil. It is recommended that any exposed surfaces are covered as soon as practicable with pavement materials or 500mm thickness of clean, inert soil cover. The area of Made Ground exposed at any time should be kept to the minimum practicable. A substantial proportion of the materials making up the Made Ground are potentially combustible and therefore care must be taken to avoid fires on, or close to, the Made Ground.

It is recommended that site operatives wear overalls, boots, and gloves at all times to minimise skin contact with the soil. It is also recommended that eating, drinking and smoking is prohibited within working areas. Washing facilities should be provided on site, and should be used before meal breaks and before personnel leave the site, to minimise the risk of ingestion of contaminants.

R.L.Seedhouse
Geotechnical Engineer

P.T.E.Tucker
Laboratory Manager

Date: 6th November 1996

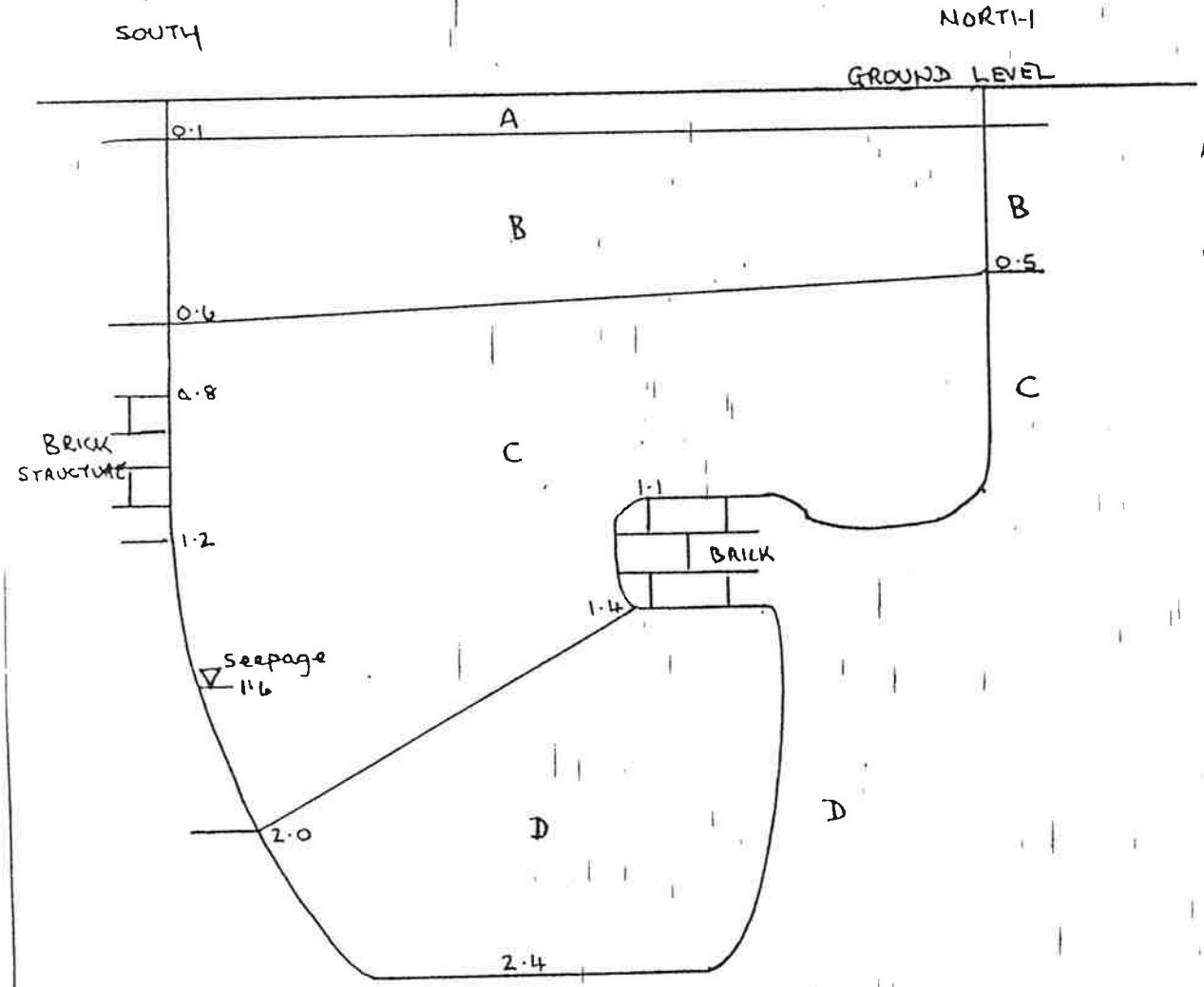
## REFERENCES


1. GEOLOGICAL SURVEY OF GREAT BRITAIN (England and Wales) 1:10,560 scale sheet SN679SE
2. BS5930:1981. Code of practice for site investigations.
3. BS1377:1990 British Standard methods of test for soils for civil engineering purposes.
4. BS1881:Part120:1993. Testing concrete: Method for determination of the compressive strength of concrete cores.

# Appendix

## Trial Pit Logs

TP1, TP2, TP4, TP5




A Bitumen bound surfacing materials

B Dense slag aggregate of gravel size with some sand fines

C Grey black gravelly (clinker, coke, sandstone) sand (mainly natural with sand size fragments of coke) – medium dense? Pieces of brick and concrete.

D Grey black fine medium sand (mainly natural with sand size fragments of coke and ash) with some limestone aggregate and lumps of lean mix concrete. – medium dense?

E Orange brown fine to medium SAND – loose to medium dense? (BLOWN SAND)

PIT DIMENSIONS: 2.2m x 0.70m x 2.4m

ALL DEPTHS ARE IN METRES BELOW GROUND LEVEL

FREIGHTLINER ACCESS
TRIAL PIT 1
FIGURE

SCALE 1:200

# Earlswood Materials Laboratory

Job No.: 01437

**TP2**

Sheet 1 of 1

Equipment:
Hand excavated pit.

Job: **Freightliner Access Road**

Client: Neath Port Talbot C.B.C.

Ground Level | Coordinates | Dates 27/06/1996 27/06/1996

| Strata Descriptions | Red. Level | Legend | Depth | Sample Depth | Sample No. | SPT /CPT | Core Recovery TCR SCR RQD | Remarks | Water Records Levels | Water Records Piezo. |
|---|---|---|---|---|---|---|---|---|---|---|
| Bitumem bound surfacing materials (MADE GROUND) | | | (0.30) 0.30 | | | | | | | |
| Black sand and fine medium (with coarse) gravel of mainly ash and coke (MADE GROUND) | | | (0.30) 0.60 | 0.30 - 0.60 | B 1 | | | | | |
| Black sandy to very sandy (mainly natural with coke and clinker) angular mainly sandstone gravel aggregate (MADE GROUND) | | | (0.30) 0.90 | 0.60 - 0.90 | B 3 | | | | | |
| Orange fine to medium SAND - medium dense? (BLOWN SAND) | | | | | | | | | | |
| End of Borehole | | | | | | | | | | |

## Remarks

Pit dimensions: 0.45m X 0.70m X1.0m. Pit dry.

## Key

- U Undisturbed sample
- P Piston sample
- B Bulk disturbed sample
- D Small disturbed sample
- W Water sample
- S SPT (split spoon)
- C SPT (solid cone)
- ▽ Water strike
- ▼ Water level

Logged By: JCO

Scale 1:50

# Earlswood Materials Laboratory

Job No.: 01437

**TP4**

Sheet 1 of 1

Equipment:
Pit excavated by JCB.

Job: **Freightliner Access Road**

Client: **Neath Port Talbot C.B.C.**

Ground Level | Coordinates | Dates: 24/09/1996, 24/09/1996

| Strata Descriptions | Red. Level | Legend | Depth | Sample Depth | Sample No. | SPT /CPT | Core Recovery TCR SCR RQD | Remarks | Water Records Levels | Water Records Piezo. |
|---|---|---|---|---|---|---|---|---|---|---|
| Dark grey silty gravelly fine medium sand - medium dense to dense? (MADE GROUND) | | | (0.30) 0.30 | 0.40 | 1 B | | | | | |
| Grey black gravelly silty sand of mainly ash and clinker with glass pieces - medium dense? (MADE GROUND) | | | (0.30) 0.60 | | | | | | | |
| Orange brown fine medium SAND - medium dense (BLOWN SAND) | | | (1.50) | 1.50 | 2 D | | | | | |
| End of Borehole | | | 2.10 | | | | | Seepage | ▽ 24/09/1996 Depth=2.10 Casing:0.00 | |

## Remarks

Pit dimensions: 1.0m X 1.8m X 2.1m.
Groundwater seepage at 2.1m depth.
Pit sides became very unstable once groundwater encountered.

## Key

- U Undisturbed sample
- P Piston sample
- B Bulk disturbed sample
- D Small disturbed sample
- W Water sample
- S SPT (split spoon)
- C SPT (solid cone)
- ▽ Water strike
- ▼ Water level

Logged By: JCO

Scale 1:50

# Earlswood Materials Laboratory

Job No.: 01437

**TP5**

Sheet 1 of 1

Equipment:
Pit excavated by JCB.

Job: **Freightliner Access Road**

Client: Neath Port Talbot C.B.C.

Ground Level | Coordinates | Dates: 24/09/1996, 24/09/1996

| Strata Descriptions | Red. Level | Legend | Depth | Sample Depth | Sample No. | SPT /CPT | Core Recovery TCR SCR RQD | Remarks | Water Records Levels | Water Records Piezo. |
|---|---|---|---|---|---|---|---|---|---|---|
| Grey black fine to medium slightly gravelly fine medium sand (natural with much coke fines) with many roots and rootlets - loose to medium dense? (MADE GROUND) | | | (0.50) 0.50 | 0.40 | 1 B | | | | | |
| Orange brown fine to medium SAND - medium dense? (BLOWN SAND) | | | (1.50) 2.00 | | | | | | | |
| End of Borehole | | | | | | | | | | |

## Remarks

Pit dimensions: 1.0m X 2.5m X 2.0m.
Groundwater seepage at 2.0m depth.
Sides became very unstable once groundwater encountered.

## Key

- U Undisturbed sample
- P Piston sample
- B Bulk disturbed sample
- D Small disturbed sample
- W Water sample
- S SPT (split spoon)
- C SPT (solid cone)
- ▽ Water strike
- ▼ Water level

Logged By: JCO

Scale 1:50

# Appendix B.

## Laboratory Test Results.

# SUMMARY OF CALIFORNIA BEARING RATIO TESTS

Scheme: Freightliner Access, Jersey Marine



Key: VH Vibrating hammer compaction (3 layers)
BS2.5 British Standard 2.5kg drop hammer
BS4.5 British Standard 4.5kg drop hammer

T = Top B = Bottom A= Average

| Hole No. | Sample No. | Depth (m) | Compaction Method | Surcharge (Equivalent Construction) (mm) | Bulk Density ($Mg/m^3$) | Dry Density ($Mg/m^3$) | Moisture Content % | CBR Value % |
|---|---|---|---|---|---|---|---|---|
| TP1 | B2 | 1.0 | BS2.5 | 150 | 1.75 | 1.47 | T 18<br>B 18<br>A 18 | T<br>B 62<br>A |
| TP2 | B1 | 0.3-0.6 | BS2.5 | 150 | 1.55 | 1.32 | T 17<br>B 18<br>A 18 | T 37<br>B 36<br>A 37 |
| TP4 | B1 | 0.4- | BS2.5 | 150 | 1.52 | 1.32 | T 16<br>B 13<br>A 15 | T 25<br>B 44<br>A 34 |

LABORATORY CORE REPORT
Page of
Date 25-Sep-1996

LABORATORY REPORT No.: 01437/01437/1
Sample No.: Z0147/01437/1

| | | | |
|---|---|---|---|
| Scheme | **Freightliner Access, Jersey Marine** | | |
| Client | *HEAD OF ENGINEERING (NPTCBC)* | | |
| Location | *T3* | | |
| Surface Material | **Concrete** | | |
| Logged By | *GM* | | |
| Operators | *GJE & NPD* | | |
| Date Drilled | *24-Sep-1996* | Core Diameter | *150 mm* |
| Road Condition | *Sound* | Road Texture | *Rough* |

| Layer Ref. | Layer Thickness mm | Layer Type | Agg. Size mm | Grading | Binder Type | Main Aggregate | Voids | Recovery |
|---|---|---|---|---|---|---|---|---|
| *A* | *220* | *Other (see remarks)* | *20.0* | *Well Graded* | *Cement* | *Limestone* | *Few or None* | *Totally intact* |
| *B* | *90* | *Granular Sub-Base* | *40.0* | *Well Graded* | *None* | *Slag* | *Few or None* | *Total but broken/fragmented* |
| *C* | *130* | *Granular Sub-Base* | *40.0* | *Well Graded* | *None* | *Limestone* | *Few or None* | *Incomplete* |

Remarks: *LAYER A IS A CONCRETE SLAB WITH 8mm DIAMETER REINFORCEMENT, 140mm FRO TOP SURFACE*

*HEAD OF ENGINEERING (NPTCBC)*
*DEPT.OF TECHNICAL SERVICES*
*CIVIC CENTRE*
*PENLLERGAER*
*SWANSEA* *SA4 1GH*

*P.T.E.Tucker*
*Laboratory Manager*

LABORATORY TEST REPORT
Page 1 of 1
Date 25-Sep-1996

LABORATORY REPORT No.: 01437/96/L01437
Sample No. : *L01437*

COMPRESSIVE STRENGTH OF CONCRETE CORES TO B.S. 1881: PART 120 1983

| | | | |
|---|---|---|---|
| Scheme<br>Client<br>Site Ref.<br>Location | **Freightliner Access, Jersey Marine**<br>*HEAD OF ENGINEERING (NPTCBC)*<br>**FREIGHTLINER ACCESS ROAD, JERSEY MARINE**<br>*T3* | | |
| Material<br>Specification | **FIELDWORK** | | |
| Contractor<br>Source | | | Ticket No: |
| Date Supplied<br>Date Sampled | *24-Sep-1996* | Date Received<br>Date Tested | *24-Sep-1996*<br>*25-Sep-1996* |

**TEST RESULTS**

| | |
|---|---|
| CORE NO. | 1 |
| DENSITY Kg/m3 | 2381 |
| % VOIDS | 1.5% |
| AGE | UNKNOWN |
| STRENGTH N/mm2 | 57.5 |
| ESTIMATED IN SITU CUBE STRENGTH N/mm2 | 56.5 |
| METHOD OF END PREPARATION | CUT & GROUND |

Remarks :

*MR S.REES*
*HEAD OF ENGINEERING (NPTCBC)*
*DEPT.OF TECHNICAL SERVICES*
*CIVIC CENTRE*
*PENLLERGAER*
*SWANSEA* *SA4 1GH*

*P.T.E.Tucker*
*Laboratory Manager*

NAMAS TESTING No. 0934

# ANCHEM ANALYTICAL LABORATORIES

A·A·L

Unit 5a D'Arcy Business Park
D'Arcy Way Llandarcy Neath SA10 6EJ
Tel : 0792 323223 Fax : 0792 323236

Mr. P. Tucker,
Neath Port Talbot County B.C.,
Earlswood Materials Laboratory,
Neath Abbey Business Park,
Neath.

**Laboratory Analysis Report**

| | |
|---|---|
| No. | 17272/96/RJL |
| Date | 21st October 1996 |
| Sample No. | 14636/1 to 4 |
| Date sample tested | 3rd to 18/10/96 |
| Date sample received | 2/10/96 |

## Sample

4 Soil Samples from Freightliner Access, Jersey Marine off Elba Crescent, 01437, labelled:-

14636/1 - T1 B2 1.0.
14636/2 - T2 0.3 - 0.6.
14636/3 - T4 B1 0.4.
14636/4 - T5 B1 0.4.

Not sampled by us.

We have analysed the above samples as requested in accordance with documented in-house procedures and our results are as follows:-

Signed _____ (G.D. Cottle)

on behalf of Anchem Analytical Laboratories

## Laboratory Analysis Report No. 17272/96/RJL (Cont.)

| | 14636/1 | 14636/2 | 14636/3 | 14636/4 |
|---|---|---|---|---|
| pH | 8.0 | 8.0 | 7.9 | 7.6 |
| % Material passing a 2mm sieve | 50 | 52 | 64 | 94 |
| % Total Sulphate (as $SO_3$) | <0.01 | 0.04 | 0.08 | <0.01 |
| % Loss on Ignition * | 12.3 | 38.8 | 40.5 | 8.6 |
| % Material Recovered at SG 1.6* | 7 | 24 | 38 | 4 |
| Total Cyanide (as CN) * | <1 | <1 | 1 | <1 |
| Total Phenolic Compounds * | 2 | 2 | 1 | 6 |
| Toluene Soluble Material * | <50 | 51000 | 12000 | <50 |
| Mineral Oil * | - | 6300 | 763 | - |
| Total Oil * | - | 23000 | 4500 | - |
| Total Cadmium (as Cd) | 1.0 | <1 | 5.5 | 1.8 |
| Total Lead (as Pb) | 158 | 180 | 1970 | 214 |
| Total Chromium (as Cr) | 121 | 153 | 83 | 49 |
| Hexavalent Chromium (as Cr) * | <1 | <1 | <1 | <1 |
| Total Mercury (as Hg) * | 0.1 | <0.1 | 2.0 | 0.3 |
| Total Selenium (as Se) * | 0.5 | 0.7 | 1.6 | 0.7 |
| Total Copper (as Cu) | - | - | - | 109 |
| Total Nickel (as Ni) | - | - | - | 30 |
| Total Zinc (as Zn) | - | - | - | 395 |

Results are quoted in mg/Kg (p.p.m.) unless otherwise stated and are expressed on air dried material passing a 2mm test sieve, with the exception of total phenolic compounds which is expressed on an "as received" basis. pH And total sulphate analysis based on 9.5 and 5.5 of British Standard 1377:Part 3:1990, electrometric and gravimetric analysis respectively. Metals with the exception of Chromium VI refer to aqua regia soluble species, analysis by A.A.S. Mercury and selenium analysed by vapour generation A.A.S. Toluene soluble material refers to oil, pitch, tar, grease compounds etc. Total oil and mineral oil refer to tetrachloroethylene soluble species and are calculated using HMSO parameters, analysis by FTIR. The material recovered at S.G. 1.6 consisted mainly of bituminous and non carbonaceous material with a low content of coal.

* - These analyses are not included within the scope of our NAMAS accreditation.

Signed.....
(G.D. Cottle)

# ANCHEM ANALYTICAL LABORATORIES

Unit 5a D'Arcy Business Park D'Arcy Way Llandarcy Neath SA10 6EJ Tel: 01792 323223 Fax: 01792 323236

| | |
|---|---|
| Mr. P. Tucker, | **Laboratory Analysis Report No.** 17271/96/RJL |
| Neath Port Talbot County B.C., | **Date.** 21st October 1996 |
| Earlswood Material Laboratory, | **Date Sample Received.** 2/10/96 |
| Neath Abbey Business Park, | **Date Sample Tested.** 17/10/96. |
| Neath, SA10 7DR. | **Sample No.** 14636/2 & 3 |

## Sample

2 Soil Samples, labelled:-
Freightliner Access Jersey Marine off Elba Crescent.
14636/2 - T2 0.3 - 0.6, 01437.
14636/3 - T4 B1 0.4, 01437.

Not sampled by us.

An analysis has been carried out the above samples as requested and the results are as follows:-

PAH

| | 14636/2 | 14636/3 |
|---|---|---|
| Benzo (b) fluoranthene | 21.5 | 0.57 |
| Benzo (k) fluoranthene | 12.8 | 0.22 |
| Benzo (a) pyrene | 31.6 | 0.54 |
| Benzo (ghi) perylene | 19.8 | 0.67 |
| Fluoranthene | 69.2 | 0.93 |
| Indeno (1,2,3, - cd) pyrene | 14.6 | 0.35 |
| Total PAH | 170 | 3.3 |

All results are quoted in mg/Kg (p.p.m.).

Signed: G.D. Cottle (G.D. Cottle)
On Behalf of Anchem Analytical Laboratories.

Hyder Environmental
Southern Laboratories
Mid Glamorgan Science Park
2 Technology Drive
Bridgend CF31 3NA

Tel: +44 (0)1656 647 557
Fax: +44 (0)1656 646 525

Hyder Consulting

# TEST CERTIFICATE

**SAMPLE REF NO: S1223039**

Earlswood Materials Laboratory
Newby House
Neath Abbey Business Park
Neath Abbey
Neath

**Report Date** 31-Oct-96

**Date Received** 24-Oct-96
**Date Completed** 31-Oct-96

SAMPLE DESCRIPTION 01437 T2 0.3-0.6M

| Determinand | Result | Units | Method | Lab No |
|---|---|---|---|---|
| Dried Solids % Total | 78.5 | % | | 1 |
| GC Mass Spec. - see attached report | | - | | 1 |
| Persistant Mineral Oil Dry Weight | 1760 | mg/kg | | 1 |

T. Down
Operations Manager-South



Further information on methods of analysis available on request
† Indicates determinand analysed by external sub-contractor
N - see attached comments
Laboratory Accreditation Nos 1(Bridgend) = 1229 2(Runcorn) = 0897

Hyder Consulting

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Earlswood Materials Laboratory
Newby House
Neath Abbey Business Park
Neath Abbey
Neath
SA10 7DR

DS/RG/F1/6411

31 October 1996

## GCMS ANALYSIS

**DATE TAKEN:** 29/10/96 **SAMPLE DESCRIPTION:** 01437 T2 0.3-0.6M

Sample S1223039 was found to contain the following:

| DETERMINAND | RESULT | UNITS |
|---|---|---|
| $D_8$ Naphthalene (Internal Std) | 1000 | µg/kg |
| Naphthalene | 1050 | µg/kg |
| Methyl Naphthalene Isomer | 858 | µg/kg |
| Methyl Naphthalene Isomer | 332 | µg/kg |
| 1,1'-Biphenyl | 352 | µg/kg |
| Dimethyl Naphthalene Isomers | 2059 | µg/kg |
| 1,2-Dihydro Acenaphthalene | 1058 | µg/kg |
| Methyl Biphenyl Isomer | 200 | µg/kg |
| Dibenzofuran | 995 | µg/kg |
| Trimethyl Naphthalene Isomers | 1835 | µg/kg |
| 9H-Fluorene | 1672 | µg/kg |
| Methyl Biphenyl Isomer | 275 | µg/kg |
| Methyl Biphenyl Isomer | 179 | µg/kg |
| Methyl Dibenzofuran Isomer | 1191 | µg/kg |
| Methyl Fluorene Isomer | 305 | µg/kg |
| Methyl Fluorene Isomer | 337 | µg/kg |
| Methyl Fluorene Isomer | 198 | µg/kg |

Compounds found were identified by library searching against NIST library and quantified relative to $D_8$ Naphthalene, the internal standard.

D SIMONS
Organic Chemistry Manager



Further information on methods of analysis on request
*Indicates determinand not covered by NAMAS Accreditation
†Indicates determinand analysed by external sub-contractor

Hyder Consulting

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Earlswood Materials Laboratory
Newby House
Neath Abbey Business Park
Neath Abbey
Neath
SA10 7DR

DS/RG/F1/6411

31 October 1996

## GCMS ANALYSIS

**DATE TAKEN:** 29/10/96 **SAMPLE DESCRIPTION:** 01437 T2 0.3-0.6M

Sample S1223039 was found to contain the following:

| DETERMINAND | RESULT | UNITS |
|---|---|---|
| 9H-Fluoren-9-Ol | 231 | µg/kg |
| Dibenzothiophene | 440 | µg/kg |
| Phenanthrene | 7722 | µg/kg |
| Anthracene | 1915 | µg/kg |
| Methyl Anthracene Isomers | 1892 | µg/kg |
| Methyl Anthracene Isomers | 1833 | µg/kg |
| Methyl Phenanthrene Isomer | 795 | µg/kg |
| 2-Phenylnaphthalene | 997 | µg/kg |
| Fluoranthene | 6822 | µg/kg |
| Pyrene | 5605 | µg/kg |
| Methyl Pyrene Isomers | 2638 | µg/kg |
| Triphenylene | 796 | µg/kg |
| Benz A Anthracene | 1366 | µg/kg |
| Benzo J Fluoranthene Isomer | 584 | µg/kg |
| Benzo J Fluoranthene Isomer | 140 | µg/kg |
| Benzo J Fluoranthene Isomer | 148 | µg/kg |

All the above are PAH compounds typical of coal tar. In addition to the above the sample was found to contain approximately 30,000 micrograms per kilogram of hydrocarbons typical of diesel or fuel oil.
Compounds found were identified by library searching against NIST library and quantified relative to $D_8$-Naphthalene, the internal standard.

D SIMONS
Organic Chemistry Manager



Further information on methods of analysis on request
*Indicates determinand not covered by NAMAS Accreditation
†Indicates determinand analysed by external sub-contractor

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# TEST CERTIFICATE

**SAMPLE REF NO: S1223040**

Earlswood Materials Laboratory
Newby House
Neath Abbey Business Park
Neath Abbey
Neath

**Report Date** 31-Oct-96

**Date Received** 24-Oct-96
**Date Completed** 31-Oct-96

SAMPLE DESCRIPTION 01437 T4 B1 0.4M

| Determinand | Result | Units | Method | Lab No |
|---|---|---|---|---|
| Dried Solids % Total | 86.8 | % | | 1 |
| GC Mass Spec. - see attached report | | - | | 1 |
| Persistant Mineral Oil Dry Weight | 607 | mg/kg | | 1 |

T. Down
Operations Manager-South



Further information on methods of analysis available on request
† Indicates determinand analysed by external sub-contractor
N - see attached comments
Laboratory Accreditation Nos 1(Bridgend) = 1229 2(Runcorn) = 0897

Hyder Consulting

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Neath Abbey Business Park
Neath Abbey
Neath
SA10 7DR

DS/RG/F1/6411

31 October 1996

## GCMS ANALYSIS

**DATE TAKEN:** 30/10/96 **SAMPLE DESCRIPTION:** 01437 T4 0.4M

Sample S1223040 was found to contain the following:

| DETERMINAND | RESULT | UNITS |
|---|---|---|
| $D_8$ Naphthalene (Internal Std) | 100 | µg/kg |
| Naphthalene | 337 | µg/kg |
| Methyl Naphthalene Isomer | 717 | µg/kg |
| Methyl Naphthalene Isomer | 168 | µg/kg |
| 1,1'-Biphenyl | 221 | µg/kg |
| Dimethyl Naphthalene Isomers | 1839 | µg/kg |
| 1,2-Dihydro Acenaphthalene | 315 | µg/kg |
| Dibenzofuran | 245 | µg/kg |
| Trimethyl Naphthalene Isomers | 766 | µg/kg |
| Methyl Biphenyl Isomer | 175 | µg/kg |
| Methyl Dibenzofuran Isomer | 138 | µg/kg |
| Methyl Dibenzofuran Isomer | 336 | µg/kg |
| Methyl Fluorene Isomer | 146 | µg/kg |
| Methyl Fluorene Isomer | 186 | µg/kg |
| 9H-Fluoren-9-One | 148 | µg/kg |
| Dibenzothiophene | 163 | µg/kg |
| Phenanthrene | 1937 | µg/kg |
| Anthracene | 349 | µg/kg |
| Methyl Anthracene Isomer | 2002 | µg/kg |
| Dimethyl Phenanthrene Isomer | 291 | µg/kg |

Compounds found were identified by library searching against NIST library and quantified relative to $D_8$ Naphthalene, the internal standard.

D SIMONS
Organic Chemistry Manager



Further information on methods of analysis on request
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†Indicates determinand analysed by external sub-contractor

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DS/RG/F1/6411

31 October 1996

## GCMS ANALYSIS

**DATE TAKEN:** 30/10/96 **SAMPLE DESCRIPTION:** 01437 T4 0.4M

Sample S1223040 was found to contain the following:

| DETERMINAND | RESULT | UNITS |
|---|---|---|
| Fluoranthene | 2713 | µg/kg |
| Pyrene | 2406 | µg/kg |
| Triphenylene | 1020 | µg/kg |
| Benz A Anthracene | 1025 | µg/kg |

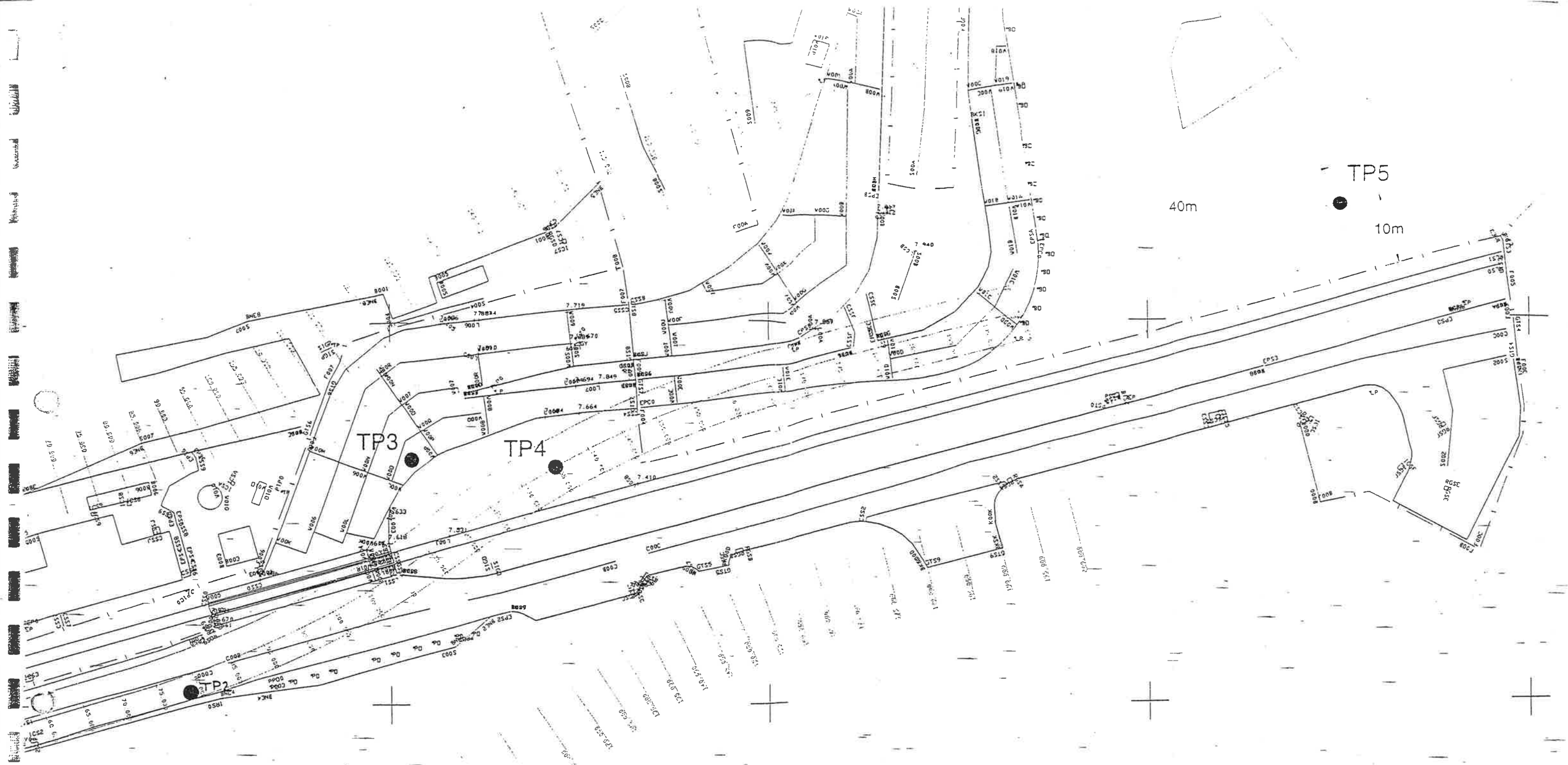
All the above are PAH compounds typical of coal tar. In addition to the above the sample was found to contain approximately 40,000 micrograms per kilogram of hydrocarbons typical of diesel or fuel oil, and approximately 560,000 micrograms per kilogram of hydrocarbons typical of a lubricating oil eg. engine oil.

Compounds found were identified by library searching against NIST library and quantified relative to $D_8$ Naphthalene, the internal standard.

D SIMONS
Organic Chemistry Manager



Further information on methods of analysis on request
*Indicates determinand not covered by NAMAS Accreditation
†Indicates determinand analysed by external sub-contractor




# LAYOUT PLAN

Scale 1:500

Golder Associates (UK) Ltd.
CONSULTING GEOTECHNICAL AND MINING ENGINEERS

# REPORT TO NEATH BOROUGH COUNCIL ON GROUND INVESTIGATION AT THE FREIGHTLINER TERMINAL SITE, JERSEY MARINE

Distribution:

1 copy - Neath Borough Council

1 copy - Golder Associates

March 1989

8853018

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## 1. INTRODUCTION

Golder Associates (UK) Ltd. have been instructed by Neath Borough Council, letter reference PH/VLH.10.20, dated 11th August 1988, to undertake a ground investigation at the former Freightliner Terminal site, Jersey Marine (Figure 1). The object of the ground investigation was to determine the nature and extent of the superficial deposits present within the site in order to allow an assessment of the foundation requirements on the site.

This report contains a factual account of the ground investigation undertaken, including trial pit and borehole logs and laboratory test results. Engineering recommendations relating to the geotechnical aspects of foundation design and construction are also included.

## 2. THE SITE AND PROPOSED DEVELOPMENT

The site is located to the west of Jersey Marine in the vicinity of Crymlyn Burrows (Figure 2). A number of railway sidings occupy the north of the site beyond which is a large expanse of marshy land referred to as Crymlyn Bog. The southern site boundary is located adjacent to Ford Motor Corporation's Swansea Motor Components factory. The southern areas of the site are occupied by dense tree and shrub growth. The eastern site boundary borders waste land which is occupied by dense trees and shrubs with some evidence of recent tipping of made ground. The western boundary borders derelict land previously occupied by offices of the former Freightliner company.

The site is relatively flat lying and occupies approximately 6.8 hectares. The site is roughly rectangular in shape and is extensively covered with a concrete hardstanding. The proposed development will comprise the construction of a number of single storey light industrial developments of conventional portal frame design. Site infrastructure, comprising the construction of access roads and parking areas and installation of services will also be required. The proposed site layout is shown in Figure 2.

## 3. GEOLOGY

A general review of the site geology has been undertaken by examination of the 1:10,560 geological map of the area (Reference 1). The site is shown to be underlain by extensive superficial deposits, a significant proportion of which comprise wind blown sand of recent origin. Bedrock comprising essentially sandstone and mudstone of the Lower Pennant Measures of the Upper Coal Measures Series, is present beneath these deposits at depths in excess of 20m. A borehole drilled within Ford Motor Corporation's factory, approximately 130m south of the site, encountered up to 17m of superficial deposits comprising sand and clay overlying sandstone and mudstone bedrock. The ground investigation described in this report encountered similar conditions to those described above.

It is considered unlikely that the site is underlain by shallow coal mineworkings and therefore the threat posed to surface development by mining related ground subsidence is considered remote.

## 4. GROUND INVESTIGATION

### 4.1 General

Fieldwork, comprising the excavation of fourteen trial pits and five cable percussion boreholes, was undertaken in April and November 1988 respectively. The trial pit and borehole locations are shown in Figure 2. The fieldwork was undertaken at all times under the supervision of a member of Golder Associates engineering staff, who supervised the excavation and logged all the trial pits and boreholes. Detailed trial pit and borehole logs are given in Appendix I. All fieldwork was carried out in accordance with BS 5930 (Reference 2).

### 4.2 Trial Pits

The trial pits were excavated to determine the ground conditions at shallow depth and obtain soil samples for laboratory testing. A total of fourteen trial pits were excavated by a JCB MK 3 belonging to Stadium Transport Ltd. of Neath. The pits were excavated to a maximum depth of 3.08m. Large bulk samples were taken at various depths and generally at each significant change of soil type. Special attention was paid at all times to the recording of groundwater entries and pit wall stability.

4.3 Cable Percussion Boreholes

Five cable percussion boreholes were drilled at the positions shown on Figure 2, by BB Drilling Ltd. of Nottingham. Standard penetration tests were undertaken at approximately 1m intervals to approximately 10m below ground level and thereafter at approximately 1.5m intervals to determine the consistency/relative density of the superficial deposits. In general, large bulk samples were taken over the test range for detailed logging and laboratory testing chiselling techniques were occasionally employed. In order to aid boring in the made ground. Water was added to the borings in order to maintain a positive water head and prevent disturbance at the base of boreholes in sand and silt deposits and to assist borehole advancement and sample recovery. The majority of boreholes were terminated at 20m below existing ground level.

Groundwater entries and levels were recorded in two boreholes, however, since water was added during boring it was not always possible to establish accurately the groundwater table. The depths of strata encountered, samples taken, in-situ tests carried out and test results are given on the borehole logs, Appendix I.

4.4 Laboratory Testing

Laboratory testing was carried out on large bulk samples recovered from the trial pits and boreholes. The following tests were undertaken:

- Atterberg limits and moisture content determinations on samples displaying cohesive properties.

- Particle size distribution tests by sieve and hydrometer analysis on granular and cohesive samples respectively.

- Chemical tests to determine the sulphate, pH and organic matter content of samples of natural and made ground deposits.

The chemical tests and hydrometer analyses were undertaken by Thyssen Ltd. of Llanelli and University College, Swansea. The natural moisture content, Atterberg limit tests and the particle size distribution tests by sieve analysis were undertaken by Golder Associates (UK) Ltd. All laboratory tests were carried out in accordance with BS 1377 (Reference 3). The laboratory test results are presented in Appendix II.

## 5. GROUND CONDITIONS

### 5.1 General

The results of this investigation indicate that the general ground conditions at the site comprise made ground of variable thickness and composition, overlying thick natural deposits of recent and alluvial origin. Groundwater was encountered at shallow depth in all the trial pits and boreholes. A geological section through the site is shown in Figure 3.

### 5.2 Made Ground

Made ground was encountered in all the trial pits and the majority of boreholes. The deposit is characteristically heterogeneous in composition and variable in thickness and comprises three general material types as follows:

- Loose gravel, cobble and boulder sized angular ash, slag and coal fragments
- Loose silty fine to medium sand with some to occasional cobble and boulder sized brick and masonry fragments
- Medium dense silty fine to medium sand

The full thickness of the made ground deposits was determined in all the trial pits and boreholes. A maximum recorded thickness of 3.5m was encountered in borehole 2, however, in the majority of cases this deposit ranges in thickness from 1 to 1.5m.

Standard penetration tests (SPT) were undertaken at various depths in these deposits and the results indicate a medium dense to dense relative density with 'N' values in the range of 21 to 33 and a mean of 25. It should be stressed that a relatively small number of tests were carried out and therefore the results may not be exactly representative of the conditions across the entire site.

A single particle size distribution test by sieve analysis was undertaken on a sample of made ground recovered from borehole 2. The result of this analysis confirms the deposit as comprising essentially a sandy fine to coarse gravel. Due to unavoidable sampling bias material larger than cobble size is excluded from the test. Due to the heterogeneous nature of made ground material it is likely that material of cobble size or greater should be present within the made ground at this site. The particle size distribution test curve is given in Appendix II.

Five chemical tests were undertaken on selected samples of made ground. Total sulphate concentrations lie in the range 0.019 to 0.45 percent and pH values in the range 7 to 9.9. The results are given in Appendix II.

5.3 Recent Deposits

Recent deposits were encountered below the made ground deposits in all the boreholes and trial pits. The deposit is characterised by moderately thick deposits of wind blown sand with peat bands and occasional clay and silt horizons. The following material types have been identified at the site:

- Medium dense to dense slightly silty fine to medium sand with occasional fine to coarse subrounded gravel, cobbles and shell fragments (wind blown sand).
- Spongy odorous peat with partially decayed wood fragments.
- Firm very silty clay/clayey silt.

This deposit was fully penetrated by all the boreholes. A maximum recorded thickness of 12.50m was encountered in borehole 1A, however, in the majority of cases typical thicknesses lie in the range of 4.5 to 8m. A thick peat band was encountered in all the boreholes at 3.5 to 5.5m below existing ground level. The peat is typically thickest in the western and central areas of the site where boreholes 1A, 1, 2 and 3, encountered a 1 to 1.5m thick peat band at 3.5 to 4m below existing ground level. Elsewhere, the peat band is much thinner e.g. 0.5m thick in borehole 4.

Standard penetration tests were undertaken at various depths within these deposits. The resulting 'N' values exhibit a wide range from 4 to 44 and a mean of 21, thus confirming a medium dense relative density. The majority

of these tests were undertaken in the wind blown sand. A single test undertaken in clay/silt material in borehole 1A recorded an 'N' value of 11. A plot of SPT 'N' value versus depth is shown in Figure 4.

A number of particle size distribution tests by sieve analysis were undertaken on selected bulk samples of the wind blown sand. The results confirm the deposit as comprising essentially a silty fine to medium sand with occasional fine to medium gravel. The curves exhibit a uniform grading, confirming the sand to be of wind blow origin. The particle size distribution test curves are given in Appendix II. Two chemical tests were undertaken on samples of wind blown sand. Total sulphate concentrations lie in the range 0.014 to 0.019 percent and pH value in the range 8.4 to 9.4. Three organic matter content tests were undertaken on samples of peat recovered from the boreholes. The resulting organic matter contents, determined by loss on ignition at 600 degrees centigrade, lie in the range 37.36 to 65.90 percent. Chemical test results are given in Appendix II.

## 5.4 Alluvial Deposits

Alluvial deposits were encountered in all the boreholes at depth below the made ground and recent deposits. The full thickness of these deposits was not determined. A maximum recorded thickness of 13m was encountered in borehole 4. The deposit can be broadly divided into two principal material types as follows:

- Loose and medium dense/soft and firm sandy clayey and very clayey silt, and slightly to very silty clay with occasional to some fine to coarse gravel, shell fragments with occasional organic traces.

- Loose and medium dense silty fine to medium sand.

Standard penetration tests were undertaken in these deposits at various depths. The resulting 'N' values lie in the range 4 to 29 with a mean of 15, thus confirming a medium dense relative density. A plot of SPT 'N' value versus depth for the alluvial deposits is shown in Figure 5. Based on these results, it is possible to estimate the equivalent undrained shear strength of these materials by use of the following approximate empirical relationship (Reference 4):

shear strength = 6 'N' ($kN/m^2$)

where 'N' = SPT result

This applies to materials with plasticity indices up to 15, as is the case for the alluvial deposits at this site. The resulting equivalent undrained shear strengths lie in the range of approximately 30 to 130 $kN/m^2$, indicating a consistency ranging from soft to firm/stiff.

Five natural moisture content and Atterberg limit tests were undertaken on selected samples of cohesive material recovered from the boreholes. Natural moisture contents lie in the range 30 to 40 percent. Liquid and plastic limits lie in the range 24 to 37 and 12 to 27 percent respectively.

Particle size distribution tests by hydrometer analysis were undertaken on two samples of silt/clay. The resulting test curves are presented in Appendix II. As shown, the samples comprise essentially a sandy and very sandy clayey silt with some to occasional gravel.

## 5.5 Groundwater

Groundwater was encountered in all the trial pits and boreholes. Moderately strong and strong seepage rates were observed from the recent deposits and at the interface between the made ground and the underlying recent deposits at depths ranging from 1 to 2m below existing ground level. Water was added during boring of the cable percussion boreholes in order to maintain a positive water head and hence reduce disturbance at the base of the borehole. In such cases, it was not possible to identify the depth of any groundwater seepage.

Groundwater levels are subject to seasonal variations and therefore the levels recorded during the fieldwork period should be regarded as a guide only. We do not anticipate significant tidal variations in the ground water level at this site.

## 6. ENGINEERING RECOMMENDATIONS

### 6.1 General

The proposed development consists of a number of light industrial single storey buildings and associated access roads. The future use of the units is not known at present thus a design load of 30 kN/m² has been estimated as a conservative upper limit for the purpose of foundation recommendations. The size of the buildings is in the order of 45 by 18m.

Ground conditions at the site consist of made ground overlying recent deposits of wind blown sand and peat which in turn overlie alluvial deposits of a silty clayey nature. A high ground water table at 1m below ground level was encountered on the site.

### 6.2 Foundation Design and Construction

The assumed ground profile and associated engineering parameters utilised in analysing the foundation design are given in Figure 6. The allowable bearing capacity of the medium dense wind blown sand below the made ground will be approximately 100 kN/m² which is adequate to support the anticipated imposed loads.

The major problem associated with building on the proposed site is the order of magnitude of settlement resulting from the imposed load. The settlement is made up of three components:

- immediate settlement
- consolidation settlement
- secondary compression

The various options for foundation design are discussed below together with a critique of their anticipated performance with particular emphasis on settlement.

6.2.1 Conventional Spread Foundations

For low loadings of 30 kN/m² conventional strip footings of say 1m wide at a nominal depth of 0.5m are generally adequate for transferring imposed loads to the ground. However, in this case the anticipated total settlements will be in the order of 75mm. This gives a considerable range of differential settlement, and angular distortion up to 1:150. Since the future use of the buildings is not known at present it is not possible to comment on whether or not this is a tolerable value. It is however, not recommended to utilise strip footings at this site since the associated settlements could prove detrimental to structural integrity of the buildings.

6.2.2 Narrow Strip (trench fill) Foundations

To avoid the detrimental effects of excessive settlement due to the peat it may be possible to found on the medium dense sandy deposits below the peat layer. To construct this foundation, a trench could be excavated to a

depth below the peat and filled with suitably compacted lean mix concrete. Following this, conventional spread foundations could be placed directly onto the concrete trench fill.

However, construction of this foundation configuration is likely to be impractical due to the depth of excavation for the trenches: in some parts of the site up to 6m below ground level, and the need to dewater on a large-scale and/or provide shuttering to stabilise the excavation.

6.2.3 Raft Foundation

Often a raft is chosen as a foundation solution when large differential settlements are thought to be problematic. Calculations based on a large flexible raft 45m by 18m, close to ground surface, have yielded total settlements in the order of 100mm. The zone of influence of such a large loaded area extends to the firm clays of the alluvial deposits at a depth of approximately 10m, and their compression adds significantly to the resulting large settlements.

An alternative configuration is that such a raft be split into three discrete rigid rafts of smaller dimensions, 15m x 18m. Analysis of this configuration shows that total settlements are in the order of 65mm and differential settlements leading to angular distortion of up to 1:200 are still possible.

It is therefore not recommended to adopt this option, as tolerable settlements are not known at present.

6.2.4 Small Diameter Driven Piles to Alluvial Deposits

As is the case at this site, where poor ground conditions are encountered close to the ground surface, the appropriate solution may be to found the structure on piles driven to a suitable depth to mobilise adequate strength to support the structure.

An analysis for driven reinforced concrete piles to support a load of 30 kN/m² over an area of one factory unit shows that a suitable configuration would be 0.5m diameter piles on a grid spacing of 3m centres in the order of 15 to 20m long. This configuration will mobilise the required carrying capacity with an associated factor of safety of approximately 3. No significant settlements are associated with this option, and although it is likely to be an acceptable solution, the cost of piling and associated work is generally quite high, and may not be warranted as a cost effective solution in this case.

6.2.5 Ground Treatment Prior to Construction

Ground treatment prior to construction in the form of preloading would cause the majority of the predicted settlement (see Section 6.2.3) to take place within a pre-determined time period. Settlement in the granular material is not time dependent and will take place immediately the preload is placed. Consolidation settlement and secondary compression are both time dependent, and the latter, although of relatively small magnitude, will continue to occur after 100 per cent consolidation has taken place.

The calculated time period for 90 per cent consolidation of the compressible layers will be approximately 40 days, during which most of the settlement will have taken place. Further settlement will occur after this period associated with the remainder of the consolidation settlement plus secondary compression, but will only contribute approximately an additional 10 per cent to the total settlement.

The preloading should impose a load equal to or greater than the anticipated uniformly distributed load from the buildings. It is recommended that during the preloading stage, monitoring should be carried out of the excess pore water pressures in selected strata, including the compressible peat layer, in addition to monitoring of total and relative settlements within the strata. This will enable an accurate determination of the progress of the consolidation settlement to be made, which is necessary to provide instructions to remove the preload and then commence construction. The anticipated time period of 40 days is based on assumed material properties and may vary according to actual material properties existing on site.

On removal of the preload and prior to construction some rebound of the ground will occur, and will be in the order of 30 per cent of the total settlement occurring under the preload. Thus the overall effect of the preloading procedure will cause 70 per cent of the predicted settlement to have occurred by the start of construction phase. Upon removal of the preload, the natural ground surface should be proof rolled and prepared

(e.g. by the addition of a base fill if required) for structural foundations. Large raft foundations would then be a suitable foundation with associated total settlements in the order of approximately 25mm.

## 6.3 Recommendations

In the previous sub-section, various options for foundation design are considered. Strip footings and narrow trench fill foundations are dismissed due to the likelihood of excessive settlement and construction difficulties and costs respectively. The option of a raft bearing on natural untreated ground is unsatisfactory also due to likelihood of excessive settlements.

A piled foundation is likely to incur a relatively high cost. The high cost of piling is associated with the structural design of the piles, pile caps and capping beams together with material costs, and the cost of the relatively high degree of supervision required in their installation. Alternatively, preloading requires only occasional monitoring and would not involve additional foundation material costs greater than that required for a raft foundation. The major cost asseciated with preloading is the acquisition and importation of fill onto the site, but is likely to be lower than the cost of design and installation of piles. A suitable fill material would consist of general hardcore, builder's rubble or similar material, but excluding any organic materials or household refuse. Preload fill should be placed only over the areas of the proposed structures or roadways.

Alternatively it may prove worthwhile to investigate the option of utilising the existing hardstanding which covers a large area of the site to support the proposed structures. An appraisal of the current condition of the concrete and mesh reinforcement could offer an opportunity for substantially reducing the cost of foundations should it be possible to found directly on the hardstanding. The relatively light loads of the proposed single storey industrial units may not exceed loads previously imposed on the hardstanding. Past usage of the site as a freight terminal handling containers suggests that the existing slab may offer adequate support for the anticipated development. It is therefore recommended that further investigation into this aspect of the site be carried out as part of a detailed foundation design for structures on the site, as if it proves possible to found the factory units on the hardstanding without the need for ground treatment or piling, this will result in a considerable cost saving to the project.

## 6.4 Stability of Excavations

Excavations which may be necessary on site for the installation of services may be made stable by forming temporary side slopes of 1.5 horizontal to 1 vertical. However, this is only the case for excavation up to 1m below present ground level. For depths below this level, significant seepage rates due to the ground water level being at shallow depth, may require additional stabilisation measures. Pumping from a sump located at the bottom of the excavation may be adequate to control seepage in some excavations. It is anticipated that temporary or permanent sheeting will

be required for excavations in excess of approximately 1.5m deep or for excavations which are to be left open for a long period of time. Seepage rates into excavations will be dependent on the prevailing weather conditions and may vary with tidal conditions.

6.5 Subsurface Concrete

The results of chemical tests to determine sulphate levels indicate concentrations in the range 0.014 to 0.45 percent. Based on the upper value recorded in this range, it is recommended that Class 2 concrete should be used in cases where subsurface concrete is to be used.

GOLDER ASSOCIATES (UK) LTD.

M J Doherty

M. J. Doherty, C. Eng.

P H Seymour

P. H. Seymour, C. Eng.

LIST OF REFERENCES

1. British Geological Survey of Great Britain. Geological Map Sheet No. SS 96 SE. Scale 1:10,560.

2. British Standards Institute 5930, 'Site Investigation', 1981.

3. British Standards Institute 1377, 'Methods of Testing Soils for Civil Engineering Purposes', 1975.

4. Site Investigation - A Handbook for Engineers C.R.I. Clayton, N.E. Simons, M. C. Matthews. Granada 1982.

APPENDIX I - RESULTS OF FIELD WORK

Key to Trial Pit and Borehole Logs
Trial Pit Logs
Borehole Logs

KEY TO TRIAL PIT AND BOREHOLE LOGS

| | |
|---|---|
| D | disturbed sample, jar |
| B | disturbed sample, bulk |
| U102 | undisturbed sample, 102mm diameter |
| U102* | undisturbed sample, no recovery |
| S(56) | standard penetration test ('N' value - blows/300mm) |
| S(100)* | standard penetration test, full 300mm penetration not achieved, 'N' value obtained by extrapolation. |
| S(50r) | standard penetration test, refusal to driving, (penetration of less than 75mm for 50 blows) |
| C(46) | cone penetration test ('N' value - blows/300mm) |
| V(30) | field vane test (undrained shear strength - kN/m ). |

NOTES:

1. Shell and auger boring techniques have been used in this investigation. These methods inevitably result in some mixing of layered soils. In addition, fine materials may be washed from granular soils during the drilling.

2. The groundwater levels shown on the exploratory hole records are those observed at the time of the investigation. The rate of boring may not allow the recording of equilibrium water levels. Groundwater levels may be subject to seasonal variation.

KEY TO TRIAL PIT AND BOREHOLE LOGS (Cont'd...)

3. It was frequently not possible to inspect strata in situ because of unstable conditions in the trial pits. The density of cohesionless strata and shear strengths of cohesive strata have therefore been estimated from excavated spoil and may vary from those in situ.

4. Any comments made in this report are based on information at exploratory hole locations and it should be noted that variations may exist between these holes.

5. It should be noted that a comprehensive study of all available historical records e.g. old Ordnance Survey maps, has not been carried out. The comments provided in this report are based on the results of exploratory holes, together with a review of selected data.

| | | | |
|---|---|---|---|
| PROJECT | Freight Liner, Jersey Marine | | TRIAL PIT No. 1 |
| CLIENT | Neath Borough Council | CONTRACTOR Stadium Transport | SHEET 1 OF 1 |
| MACHINE TYPE | JCB MkIII | LOCATION See site plan | LOGGED BY GduP |
| SIZE OF PIT | 1 x 5 x 0.5 | GROUND SURFACE ELEVATION, m.O.D. | DRAWN BY GduP |
| DATE EXCAVATED | 18.4.88 | FINAL DEPTH, m 3.08 | |

| DOWNHOLE DEPTH, m | SAMPLES/TESTS DEPTH, m FROM | TO | No. | TYPE | SYMBOLIC LOG | ELEVATION, m.O.D | DEPTH, m | GEOLOGICAL DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | Loose black fine to coarse angular gravel composed of ash and coal particles many cobbles and occasional boulders. (MADE GROUND) |
| 1 | 1.00 | 1.50 | 1 | B | | | | |
| 2 | 2.00 | 3.00 | 2 | B | | | 2.00 | Medium dense pale to dark brown slightly silty fine to medium SAND with some rootlets. (RECENT DEPOSITS) |
| 3 | | | | | | | 3.08 | |

REMARKS

1. Strong groundwater seepage at 1.3m.

| | | | |
|---|---|---|---|
| SCALE 1 : 25 | Golder Associates | TRIAL PIT LOG | PROJECT No. 8853018 |

| | | | |
|---|---|---|---|
| PROJECT | Freight Liner, Jersey Marine | | TRIAL PIT No. 2 |
| CLIENT | Neath Borough Council | CONTRACTOR Stadium Transport | SHEET 1 OF 1 |
| MACHINE TYPE | JCB MkIII | LOCATION See site plan | LOGGED BY GdaP |
| SIZE OF PIT | 1 x 5 x 0.5 | GROUND SURFACE ELEVATION, mOD | DRAWN BY GdaP |
| DATE EXCAVATED | 18.4.88 | FINAL DEPTH, m 2.44 | |

| DOWNHOLE DEPTH, m | SAMPLES/TESTS: DEPTH, m FROM | SAMPLES/TESTS: DEPTH, m TO | SAMPLES/TESTS: No. | SAMPLES/TESTS: TYPE | SYMBOLIC LOG | ELEVATION, mOD | DEPTH, m | GEOLOGICAL DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | |
| 1 | 1.10 | 2.44 | 1 | B | | | 1.10 | Loose black silty sand with many cobble and boulder sized brick and masonry fragments (MADE GROUND) |
| 2 | | | | | | | 2.44 | Medium dense yellow brown fine to medium SAND and with some rootlets (RECENT DEPOSITS) |
| 3 | | | | | | | | |

REMARKS

1. Groundwater seepage at 1.5m.

| | | | |
|---|---|---|---|
| SCALE 1:25 | Golder Associates | TRIAL PIT LOG | PROJECT No. 8853018 |

| | | | |
|---|---|---|---|
| PROJECT | Freight Liner, Jersey Marine | | TRIAL PIT No. 3 |
| CLIENT | Neath Borough Council | CONTRACTOR Stadium Transport | SHEET 1 OF 1 |
| MACHINE TYPE | JCB MkIII | LOCATION See site plan | LOGGED BY GduP |
| SIZE OF PIT | 1 x 5 x 0.5 | GROUND SURFACE ELEVATION, m O.D. | DRAWN BY GduP |
| DATE EXCAVATED | 18.4.88 | FINAL DEPTH, m 3.30 | |

| DOWNHOLE DEPTH, m | SAMPLES/TESTS DEPTH, m FROM | TO | No. | TYPE | SYMBOLIC LOG | ELEVATION, m O.D. | DEPTH, m | GEOLOGICAL DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0 | 0.00 | 0.92 | 1 | B | | | | Loose black sandy gravel sized ash with occasional cobbles (MADE GROUND) |
| | 0.92 | 2.30 | 2 | B | | | 0.92 | Medium dense yellow brown fine to medium SAND (RECENT DEPOSITS) |
| 1 | | | | | | | | |
| 2 | | | | | | | 2.30 | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |

REMARKS

1. Strong groundwater seepage at 2.3m.
2. Unstable pit walls at 2.3m

| | | | |
|---|---|---|---|
| SCALE 1 : 25 | Golder Associates | TRIAL PIT LOG | PROJECT No. 8853018 |

| | | | |
|---|---|---|---|
| PROJECT | Freight Liner, Jersey Marine | | TRIAL PIT No. 4 |
| CLIENT | Neath Borough Council | CONTRACTOR Stadium Transport | SHEET 1 OF 1 |
| MACHINE TYPE | JCB MkIII | LOCATION See site plan | LOGGED BY GdaP |
| SIZE OF PIT | 1 x 5 x 0.5 | GROUND SURFACE ELEVATION, m O.D. | DRAWN BY GdaP |
| DATE EXCAVATED | 18.4.88 | FINAL DEPTH, m 1.80 | |

| DOWNHOLE DEPTH, m | SAMPLES/TESTS DEPTH, m FROM | TO | No. | TYPE | SYMBOLIC LOG | ELEVATION, m O.D | DEPTH, m | GEOLOGICAL DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0 | 0.00 | 1.00 | 1 | B | | | 1.00 | Loose black sandy gravel composed of ash with occasional cobbles. (MADE GROUND) |
| 1 | | | | | | | 1.80 | Medium dense yellow brown fine to medium SAND (RECENT DEPOSITS) |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |

REMARKS

1. Strong groundwater seepage at 1.0m.

| | | | |
|---|---|---|---|
| SCALE 1. 25 | Golder Associates | TRIAL PIT LOG | PROJECT No. 8853018 |

| | | | |
|---|---|---|---|
| PROJECT | Freight Liner, Jersey Marine | | TRIAL PIT No. 5 |
| CLIENT | Neath Borough Council | CONTRACTOR Stadium Transport | SHEET 1 OF 1 |
| MACHINE TYPE | JCB MkIII | LOCATION See site plan | LOGGED BY GduP |
| SIZE OF PIT | 1 x 5 x 0.5 | GROUND SURFACE ELEVATION, mO.D. | DRAWN BY GduP |
| DATE EXCAVATED | 18.4.88 | FINAL DEPTH, m 2.40 | |

| DOWNHOLE DEPTH, m | SAMPLES/TESTS: DEPTH, m FROM | SAMPLES/TESTS: DEPTH, m TO | SAMPLES/TESTS: No. | SAMPLES/TESTS: TYPE | SYMBOLIC LOG | ELEVATION, mO.D. | DEPTH, m | GEOLOGICAL DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0 | 0.00 | 1.00 | 1 | B | | | 1.00 | Loose black sandy gravel composed of ash with occasional cobbles (MADE GROUND) |
| 1 | | | | | | | 2.40 | Medium dense yellow brown/light grey fine to medium SAND with some rootlets and pockets of dense brown silty SAND (RECENT DEPOSITS) |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |

REMARKS

1. Strong groundwater seepage at 1.0m.

| | | | |
|---|---|---|---|
| SCALE 1:25 | Golder Associates | TRIAL PIT LOG | PROJECT No. 8853018 |

| | | | |
|---|---|---|---|
| PROJECT | Freight Liner, Jersey Marine | | TRIAL PIT No. 6 |
| CLIENT | Neath Borough Council | CONTRACTOR Stadium Transport | SHEET 1 OF 1 |
| MACHINE TYPE | JCB MkIII | LOCATION See site plan | LOGGED BY Gdul |
| SIZE OF PIT | 1 x 5 x 0.5 | GROUND SURFACE ELEVATION, mO.D. | DRAWN BY Gdul |
| DATE EXCAVATED | 18.4.88 | FINAL DEPTH, m 1.20 | |

| DOWNHOLE DEPTH, m | SAMPLES/TESTS DEPTH, m FROM | TO | No. | TYPE | SYMBOLIC LOG | ELEVATION, m.O.D. | DEPTH, m | GEOLOGICAL DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0 | 0.00 | 1.40 | 1 | B | | | | |
| | | | | | | | 1.40 | Loose black sandy gravel composed of ash with occasional cobbles. (MADE GROUND) |
| | | | | | | | 1.70 | Medium dense yellow brown/light grey fine to medium SAND with some rootlets and pockets of dense brown silty SAND (RECENT DEPOSITS) |
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |

REMARKS

1. Strong groundwater seepage at 1.4m.

| | | | |
|---|---|---|---|
| SCALE 1:25 | Golder Associates | TRIAL PIT LOG | PROJECT No. 8853018 |

| | | | |
|---|---|---|---|
| PROJECT | Freight Liner, Jersey Marine | | TRIAL PIT No. 7 |
| CLIENT | Neath Borough Council | CONTRACTOR Stadium Transport | SHEET 1 OF 1 |
| MACHINE TYPE | JCB MKIII | LOCATION See site plan | LOGGED BY GduP |
| SIZE OF PIT | 1 x 5 x 0.5 | GROUND SURFACE ELEVATION, mO.D. | DRAWN BY GduP |
| DATE EXCAVATED | 18.4.88 | FINAL DEPTH, m 1.50m | |

| DOWNHOLE DEPTH, m | SAMPLES/TESTS: DEPTH, m FROM | SAMPLES/TESTS: DEPTH, m TO | SAMPLES/TESTS: No. | SAMPLES/TESTS: TYPE | SYMBOLIC LOG | ELEVATION, m O.D. | DEPTH, m | GEOLOGICAL DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | |
| 1 | | | | | | | 1.30 | Loose black sandy gravel composed of ash with occasional cobbles. (MADE GROUND) |
| | | | | | | | 1.50 | Medium dense yellow brown/light grey SAND with some rootlets and pockets of dense brown silty SAND. (RECENT DEPOSITS) |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |

REMARKS

1. Strong groundwater seepage at 1.3m.
2. Pit walls unstable beneath 1.3m.
3. No samples taken.

| | | | |
|---|---|---|---|
| SCALE 1 . 25 | Golder Associates | TRIAL PIT LOG | PROJECT No. 8853018 |

| | | | |
|---|---|---|---|
| PROJECT | Freight Liner, Jersey Marine | | TRIAL PIT No. 8 |
| CLIENT | Neath Borough Council | CONTRACTOR Stadium Transport | SHEET 1 OF 1 |
| MACHINE TYPE | JCB MkIII | LOCATION See site plan | LOGGED BY GdaP |
| SIZE OF PIT | 1 x 5 x 0.5 | GROUND SURFACE ELEVATION, m O.D. | DRAWN BY GdaP |
| DATE EXCAVATED | 18.4.98 | FINAL DEPTH, m 1.80 | |

| DOWNHOLE DEPTH, m | SAMPLES/TESTS DEPTH, m FROM | SAMPLES/TESTS DEPTH, m TO | SAMPLES/TESTS No. | SAMPLES/TESTS TYPE | SYMBOLIC LOG | ELEVATION, m O.D. | DEPTH, m | GEOLOGICAL DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | 1.20 | Loose black sandy gravel composed of ash with occasional cobbles. (MADE GROUND) |
| 1 | | | | | | | 1.80 | Medium dense yellow brown/light grey fine to medium SAND with some rootlets and pockets of dense brown silty SAND (RECENT DEPOSITS) |
| 2 | | | | | | | | |
| 3 | | | | | | | | |

REMARKS

1. Strong groundwater seepage at 1.2m.
2. Pit walls unstable below 1.2m.
3. No samples taken.

| | | | |
|---|---|---|---|
| SCALE 1:25 | Golder Associates | TRIAL PIT LOG | PROJECT No. 8853018 |

| | | | |
|---|---|---|---|
| PROJECT | Freight Liner, Jersey Marine | | TRIAL PIT No. 9 |
| CLIENT | Neath Borough Council | CONTRACTOR Stadium Transport | SHEET 1 OF 1 |
| MACHINE TYPE | JCB MkIII | LOCATION See site plan | LOGGED BY GdeP |
| SIZE OF PIT | 1 x 5 x 0.5 | GROUND SURFACE ELEVATION, mOD | DRAWN BY GdeP |
| DATE EXCAVATED | 18.4.88 | FINAL DEPTH, m 2.20 | |

| DOWNHOLE DEPTH, m | SAMPLES/TESTS: DEPTH, m FROM | SAMPLES/TESTS: DEPTH, m TO | SAMPLES/TESTS: No. | SAMPLES/TESTS: TYPE | SYMBOLIC LOG | ELEVATION, mOD | DEPTH, m | GEOLOGICAL DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | |
| | | | | | | | 1.30 | Loose black sandy gravel composed of ash with occasional cobbles. (MADE GROUND) |
| 1 | | | | | | | | |
| | | | | | | | 2.20 | Medium dense yellow brown/light grey fine to medium SAND with some rootlets and pockets of dense brown silty SAND (RECENT DEPOSITS) |
| 2 | | | | | | | | |
| 3 | | | | | | | | |

REMARKS

1. Groundwater seepage at 1.8m.
2. Pit walls unstable below 1.8m.
3. No samples taken.

| SCALE 1:25 | Golder Associates | TRIAL PIT LOG | PROJECT No. 8853018 |
|---|---|---|---|

# APPENDIX F

## Analytical Results

# FREIGHTLINER SITE
## PROVISIONAL GROUNDWATER TESTING RESULTS

| Laboratory Ref | GW65570 | GW65571 | GW65572 | GW65573 | GW65566 | GW65568 |
|---|---|---|---|---|---|---|
| Client Ref | E1 | E2 | E3 | E4 | E5 | E6 |
| Sample Date | 01-Oct-98 | 01-Oct-98 | 01-Oct-98 | 01-Oct-98 | 29-Sep-98 | 29-Sep-98 |
| Arsenic (mg/l) | 0.009 | 0.051 | 0.028 | 0.043 | <0.005 | <0.005 |
| Boron (mg/l) | 0.13 | 0.19 | 0.18 | 0.16 | 0.16 | 0.12 |
| Cadmium (mg/l) | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Chromium (mg/l) | < 0.03 | < 0.03 | 0.07 | < 0.03 | < 0.03 | < 0.03 |
| Chromium 6 (mg/l) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Copper (mg/l) | 0.02 | 0.04 | 0.32 | 0.03 | < 0.05 | 0.03 |
| Lead (mg/l) | < 0.05 | 0.06 | 0.18 | < 0.05 | < 0.05 | < 0.05 |
| Mercury (µg/l) | <0.02 | 0.14 | 0.04 | 0.03 | <0.02 | <0.02 |
| Nickel (mg/l) | 0.03 | 0.06 | 0.1 | < 0.03 | < 0.03 | < 0.03 |
| Oil ID GCFID (mg/l) | < 0.15 | < 0.15 | < 0.15 | < 0.15 | < 0.15 | < 0.15 |
| Selenium (mg/l) | < 0.002 | < 0.002 | < 0.002 | < 0.002 | < 0.002 | < 0.002 |
| Zinc (mg/l) | 0.08 | 0.26 | 0.61 | 0.05 | 0.03 | 0.03 |

# PROVISIONAL RESULTS - GROUNDWATER

| Laboratory Ref | GW65570 | GW65571 | GW65572 | GW65573 | GW65566 | GW65568 | GW65569 |
|---|---|---|---|---|---|---|---|
| Client Ref | E1 | E2 | E3 | E4 | E5 | E6 | Trip Blank |
| Sample Date | 01/10/98 | 01/10/98 | 01/10/98 | 01/10/98 | 29/09/98 | 29/09/98 | 29/09/98 |
| Units | ug/l | ug/l | ug/l | ug/l | ug/l | ug/l | ug/l |
| DETERMINAND | | | | | | | |
| DICHLORODIFLUOROMETHANE | LT 2.0 | LT 2.0 | LT 2.0 | LT 2.0 | LT 2.0 | LT 2.0 | LT 2.0 |
| CHLOROMETHANE | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 |
| VINYL CHLORIDE | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 |
| TRICHLOROFLUOROMETHANE | 62.0 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 |
| 1,1-DICHLOROETHENE | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 |
| DICHLOROMETHANE | LT 25 | LT 25 | LT 25 | LT 25 | LT 25 | LT 25 | LT 25 |
| TRANS-1,2-DICHLOROETHENE | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 |
| 1,1-DICHLOROETHANE | 1.7 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| 2,2-DICHLOROPROPANE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| CIS-1,2,DICHLOROETHENE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| BROMOCHLOROMETHANE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| TRICHLOROMETHANE | LT 1.0 | LT 1.0 | 3.4 | LT 1.0 | 35.0 | 11.8 | LT 1.0 |
| 1,1,1-TRICHLOROETHANE | 3.2 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| 1,1-DICHLOROPROPENE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| TETRACHLOROMETHANE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| BENZENE | LT 1.0 | 1.1 | LT 1.0 | 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| 1,2-DICHLOROETHANE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| TRICHLOROETHENE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| 1,2-DICHLOROPROPANE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| DIBROMOMETHANE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| BROMODICHLOROMETHANE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | 10.4 | 3.9 | LT 1.0 |
| TRANS-1,3-DICHLOROPROPENE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| TOLUENE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| CIS-1,3-DICHLOROPROPENE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| 1,1,2-TRICHLOROETHANE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| TETRACHLOROETHENE | 1.2 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| 1,3-DICHLOROPROPANE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| DIBROMOCHLOROMETHANE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | 2.0 | 1.1 | LT 1.0 |
| 1,2-DIBROMOETHANE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| CHLOROBENZENE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| 1,1,1,2-TETRACHLOROETHANE | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 |
| ETHYLBENZENE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| M/P XYLENE | LT 2.0 | 7.7 | LT 2.0 | 4.5 | LT 2.0 | LT 2.0 | LT 2.0 |
| O-XYLENE | LT 1.0 | 2.5 | LT 1.0 | 2.3 | LT 1.0 | LT 1.0 | LT 1.0 |
| STYRENE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| TRIBROMOMETHANE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| ISOPROPYLBENZENE | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 |
| BROMOBENZENE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| 1,1,2,2-TETRACHLOROETHANE | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 |
| 1,2,3-TRICHLOROPROPANE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| N-PROPYLBENZENE | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 |
| 2-CHLOROTOLUENE | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 |
| 1,3,5-TRIMETHYLBENZENE | LT 1.5 | 33.9 | LT 1.5 | 31.7 | LT 1.5 | LT 1.5 | LT 1.5 |
| 4-CHLOROTOLUENE | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 |
| TERT-BUTYLBENZENE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| 1,2,4-TRIMETHYLBENZENE | LT 1.5 | 17.6 | LT 1.5 | 9.8 | LT 1.5 | LT 1.5 | LT 1.5 |
| SEC-BUTYLBENZENE | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 |
| 1,4-DICHLOROBENZENE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| P-ISOPROPYLTOLUENE | LT 1.0 | 6.4 | LT 1.0 | 6.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| 1,3-DICHLOROBENZENE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| 1,2-DICHLOROBENZENE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| N-BUTYLBENZENE | LT 1.0 | 6.6 | LT 1.0 | 6.1 | LT 1.0 | LT 1.0 | LT 1.0 |
| 1,2-DIBROMO-3-CHLOROPROPANE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| 1,2,4-TRICHLOROBENZENE | LT 3.0 | LT 3.0 | LT 3.0 | LT 3.0 | LT 3.0 | LT 3.0 | LT 3.0 |
| HEXACHLOROBUTADIENE | LT 2.0 | LT 2.0 | LT 2.0 | LT 2.0 | LT 2.0 | LT 2.0 | LT 2.0 |
| NAPHTHALENE | LT 3.5 | LT 3.5 | LT 3.5 | LT 3.5 | LT 3.5 | LT 3.5 | LT 3.5 |
| 1,2,3-TRICHLOROBENZENE | LT 3.0 | LT 3.0 | LT 3.0 | LT 3.0 | LT 3.0 | LT 3.0 | LT 3.0 |
| **TOTAL** | **68** | **76** | **3** | **61** | **47** | **17** | **0** |

## VOC RESULTS FROM TRIAL PITS

| DETERMINAND | SO63984 TP1 @ 0.6-1.0m ug/kg | SO63985 TP1 @ 1.9-2.3m ug/kg | SO63986 TP2 @ 0.6-0.7m ug/kg | SO63987 TP2 @ 1.2-1.6m ug/kg | SO63988 TP3 @ 0.3-0.5m ug/kg | SO63989 TP3 @ 0.5-0.65m ug/kg | SO63990 TP4 @ 0.4-0.6m ug/kg | SO63991 TP4 @ 2.5-2.6m ug/kg | SO63992 TP5 @ 0.4-0.6m ug/kg | SO63993 TP5 @ 1.8-2.1m ug/kg | SO63994 TP6 @ 0.5-0.7m ug/kg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DICHLORODIFLUOROMETHANE | LT 2.0 | LT 20 | LT 2.0 | LT 200 | LT 2.0 | LT 4.0 | LT 20 | LT 2.0 | LT 4.0 | LT 2.0 | LT 20 |
| CHLOROMETHANE | LT 1.5 | LT 15 | LT 1.5 | LT 150 | LT 1.5 | LT 3.0 | LT 15 | LT 1.5 | LT 3.0 | LT 1.5 | LT 15 |
| VINYL CHLORIDE | LT 1.5 | LT 15 | LT 1.5 | LT 150 | LT 1.5 | LT 3.0 | LT 15 | LT 1.5 | LT 3.0 | LT 1.5 | LT 15 |
| TRICHLOROFLUOROMETHANE | LT 1.5 | LT 15 | LT 1.5 | LT 150 | LT 1.5 | LT 3.0 | LT 15 | LT 1.5 | LT 3.0 | LT 1.5 | LT 15 |
| 1,1-DICHLOROETHENE | LT 1.5 | LT 15 | LT 1.5 | LT 150 | LT 1.5 | LT 3.0 | LT 15 | LT 1.5 | LT 3.0 | LT 1.5 | LT 15 |
| DICHLOROMETHANE | LT 25 | LT 250 | LT 25 | LT 2500 | LT 25 | LT 50 | LT 250 | LT 25 | LT 50 | LT 25 | LT 250 |
| TRANS-1,2-DICHLOROETHENE | LT 1.5 | LT 15 | LT 1.5 | LT 150 | LT 1.5 | LT 3.0 | LT 15 | LT 1.5 | LT 3.0 | LT 1.5 | LT 15 |
| 1,1-DICHLOROETHANE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 | LT 2.0 | LT 1.0 | LT 10 |
| 2,2-DICHLOROPROPANE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 | LT 2.0 | LT 1.0 | LT 10 |
| CIS-1,2,DICHLOROETHENE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 | LT 2.0 | LT 1.0 | LT 10 |
| BROMOCHLOROMETHANE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 | LT 2.0 | LT 1.0 | LT 10 |
| TRICHLOROMETHANE | LT 1.0 | 88.1 | LT 1.0 | LT 100 | LT 1.0 | 8.6 | 10.6 | LT 1.0 | 8.6 | LT 1.0 | 35.7 |
| 1,1,1-TRICHLOROETHANE | 4.4 | 49.3 | 3.2 | LT 100 | 3.1 | 10.3 | 51.5 | 3.7 | 11.2 | 3.5 | 45.3 |
| 1,1-DICHLOROPROPENE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 | LT 2.0 | LT 1.0 | LT 10 |
| TETRACHLOROMETHANE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 | LT 2.0 | LT 1.0 | LT 10 |
| BENZENE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 | LT 2.0 | LT 1.0 | LT 10 |
| 1,2-DICHLOROETHANE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 | LT 2.0 | LT 1.0 | LT 10 |
| TRICHLOROETHENE | 1.5 | 16.4 | 1.1 | LT 100 | LT 1.0 | 2.8 | 13.5 | LT 1.0 | 2.8 | LT 1.0 | 12.6 |
| 1,2-DICHLOROPROPANE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 | LT 2.0 | LT 1.0 | LT 10 |
| DIBROMOMETHANE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 | LT 2.0 | LT 1.0 | LT 10 |
| BROMODICHLOROMETHANE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 | LT 2.0 | LT 1.0 | LT 10 |
| TRANS-1,3-DICHLOROPROPENE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 | LT 2.0 | LT 1.0 | LT 10 |
| TOLUENE | 3.0 | 231 | 3.2 | LT 100 | 2.0 | 20.5 | 63.9 | 3.0 | 13.3 | 3.3 | 60.2 |
| CIS-1,3-DICHLOROPROPENE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 | LT 2.0 | LT 1.0 | LT 10 |
| 1,1,2-TRICHLOROETHANE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 | LT 2.0 | LT 1.0 | LT 10 |
| TETRACHLOROETHENE | LT 1.0 | 10.7 | LT 1.0 | LT 100 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 | LT 2.0 | LT 1.0 | LT 10 |
| 1,3-DICHLOROPROPANE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 | LT 2.0 | LT 1.0 | LT 10 |
| DIBROMOCHLOROMETHANE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 | LT 2.0 | LT 1.0 | LT 10 |
| 1,2-DIBROMOETHANE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 | LT 2.0 | LT 1.0 | LT 10 |
| CHLOROBENZENE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 | LT 2.0 | LT1.0 | LT 10 |
| 1,1,1,2-TETRACHLOROETHANE | LT 1.5 | LT 15 | LT 1.5 | LT 150 | LT 1.5 | LT 3.0 | LT 15 | LT 1.5 | LT 3.0 | LT 1.5 | LT 15 |
| ETHYLBENZENE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 | LT 2.0 | LT 1.0 | LT 10 |
| M/P XYLENE | 2 | 32.5 | LT 2.0 | LT 200 | LT 2.0 | 4.7 | 21 | LT 2.0 | LT 4.0 | LT 2.0 | 20.2 |
| O-XYLENE | LT 1.0 | 11.8 | LT 1.0 | LT 100 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 | LT 2.0 | LT 1.0 | LT 10 |
| STYRENE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 | LT 2.0 | LT 1.0 | LT 10 |
| TRIBROMOMETHANE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 | LT 2.0 | LT 1.0 | LT 10 |
| ISOPROPYLBENZENE | LT 1.5 | LT 15 | LT 1.5 | LT 150 | LT 1.5 | LT 3.0 | LT 15 | LT 1.5 | LT 3.0 | LT 1.5 | LT 15 |
| BROMOBENZENE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 | LT 2.0 | LT 1.0 | LT 10 |
| 1,1,2,2-TETRACHLOROETHANE | LT 1.5 | LT 15 | LT 1.5 | LT 150 | LT 1.5 | LT 3.0 | LT 15 | LT 1.5 | LT 3.0 | LT 1.5 | LT 15 |
| 1,2,3-TRICHLOROPROPANE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 | LT 2.0 | LT 1.0 | LT 10 |
| N-PROPYLBENZENE | LT 1.5 | LT 15 | LT 1.5 | LT 150 | LT 1.5 | LT 3.0 | LT 15 | LT 1.5 | LT 3.0 | LT 1.5 | LT 15 |
| 2-CHLOROTOLUENE | LT 1.5 | LT 15 | LT 1.5 | LT 150 | LT 1.5 | LT 3.0 | LT 15 | LT 1.5 | LT 3.0 | LT 1.5 | LT 15 |
| 1,3,5-TRIMETHYLBENZENE | LT 1.5 | LT 15 | LT 1.5 | LT 150 | LT 1.5 | LT 3.0 | LT 15 | LT 1.5 | LT 3.0 | LT 1.5 | LT 15 |
| 4-CHLOROTOLUENE | LT 1.5 | LT 15 | LT 1.5 | LT 150 | LT 1.5 | LT 3.0 | LT 15 | LT 1.5 | LT 3.0 | LT 1.5 | LT 15 |
| TERT-BUTYLBENZENE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 | LT 2.0 | LT 1.0 | LT 10 |
| 1,2,4-TRIMETHYLBENZENE | LT 1.5 | LT 15 | LT 1.5 | LT 150 | LT 1.5 | LT 1.5 | LT 15 | LT 1.5 | LT 1.5 | LT 1.5 | LT 15 |
| SEC-BUTYLBENZENE | LT 1.5 | LT 15 | LT 1.5 | LT 150 | LT 1.5 | LT 1.5 | LT 15 | LT 1.5 | LT 1.5 | LT 1.5 | LT 15 |
| 1,4-DICHLOROBENZENE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 3.0 | LT 10 | LT 1.0 | LT 3.0 | LT 1.0 | LT 10 |
| P-ISOPROPYLTOLUENE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 3.0 | LT 10 | LT 1.0 | LT 3.0 | LT 1.0 | LT 10 |
| 1,3-DICHLOROBENZENE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 3.0 | LT 10 | LT 1.0 | LT 3.0 | LT 1.0 | LT 10 |
| 1,2-DICHLOROBENZENE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 3.0 | LT 10 | LT 1.0 | LT 3.0 | LT 1.0 | LT 10 |
| N-BUTYLBENZENE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 3.0 | LT 10 | LT 1.0 | LT 3.0 | LT 1.0 | LT 10 |
| 1,2-DIBROMO-3-CHLOROPROPANE | LT 1.0 | LT 10 | LT 1.0 | LT 100 | LT 1.0 | LT 3.0 | LT 10 | LT 1.0 | LT 3.0 | LT 1.0 | LT 10 |
| 1,2,4-TRICHLOROBENZENE | LT 3.0 | LT 30 | LT 3.0 | LT 300 | LT 3.0 | LT 6.0 | LT 30 | LT 3.0 | LT 6.0 | LT 3.0 | LT 30 |
| HEXACHLOROBUTADIENE | LT 2.0 | LT 20 | LT 2.0 | LT 200 | LT 2.0 | LT 4.0 | LT 20 | LT 2.0 | LT 4.0 | LT 2.0 | LT 20 |
| NAPHTHALENE | LT 3.5 | LT 35 | LT 3.5 | LT 350 | 4.0 | LT 7.0 | LT 35 | LT 3.5 | LT 7.0 | LT 3.5 | LT 35 |
| 1,2,3-TRICHLOROBENZENE | LT 3.0 | LT 30 | LT 3.0 | LT 300 | LT 3.0 | LT 6.0 | LT 30 | LT 3.0 | LT 6.0 | LT 3.0 | LT 30 |
| TOTAL | 10.9 | 439.8 | 7.5 | 0.0 | 9.1 | 46.9 | 160.2 | 6.7 | 35.9 | 6.8 | 174.0 |

## VOC RESULTS FROM TRIAL PITS

| DETERMINAND | SO63995 TP6 @ 1.2-1.4m ug/kg | SO63996 TP7 @ 0.45-0.7m ug/kg | SO63997 TP7 @ 1.6-2.2m ug/kg | SO63998 TP8 @ 0.3-0.4m ug/kg | SO63999 TP8 @ 1.6-2.0m ug/kg | SO64000 TP9 @ 0.8-1.1m ug/kg | SO64001 TP9 @ 2.6-2.7m ug/kg | SO64002 TP10 @ 0.6-0.7m ug/kg | SO64003 TP10 @ 1.6-2.0m ug/kg |
|---|---|---|---|---|---|---|---|---|---|
| DICHLORODIFLUOROMETHANE | LT 20 | LT 4.0 | LT 4.0 | LT 4.0 | LT 2.0 | LT 2.0 | LT 4.0 | LT 20 | LT 2.0 |
| CHLOROMETHANE | LT 15 | LT 3.0 | LT 3.0 | LT 3.0 | LT 1.5 | LT 1.5 | LT 3.0 | LT 15 | LT 1.5 |
| VINYL CHLORIDE | LT 15 | LT 3.0 | LT 3.0 | LT 3.0 | LT 1.5 | LT 1.5 | LT 3.0 | LT 15 | LT 1.5 |
| TRICHLOROFLUOROMETHANE | LT 15 | LT 3.0 | LT 3.0 | LT 3.0 | LT 1.5 | LT 1.5 | LT 3.0 | LT 15 | LT 1.5 |
| 1,1-DICHLOROETHENE | LT 15 | LT 3.0 | LT 3.0 | LT 3.0 | LT 1.5 | LT 1.5 | LT 3.0 | LT 15 | LT 1.5 |
| DICHLOROMETHANE | LT 250 | LT 50 | LT 50 | LT 50 | LT 25 | LT 25 | 64.2 | LT 250 | LT 25 |
| TRANS-1,2-DICHLOROETHENE | LT 15 | LT 3.0 | LT 3.0 | LT 3.0 | LT 1.5 | LT 1.5 | LT 3.0 | LT 15 | LT 1.5 |
| 1,1-DICHLOROETHANE | LT 10 | LT 2.0 | LT 2.0 | LT 2.0 | LT 1.0 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 |
| 2,2-DICHLOROPROPANE | LT 10 | LT 2.0 | LT 2.0 | LT 2.0 | LT 1.0 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 |
| CIS-1,2,DICHLOROETHENE | LT 10 | LT 2.0 | LT 2.0 | LT 2.0 | LT 1.0 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 |
| BROMOCHLOROMETHANE | LT 10 | LT 2.0 | LT 2.0 | LT 2.0 | LT 1.0 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 |
| TRICHLOROMETHANE | 31.6 | 2.0 | 2.0 | LT 2.0 | LT 1.0 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 |
| 1,1,1-TRICHLOROETHANE | 71.9 | 10.0 | 10.1 | 9.5 | 2.9 | 3.1 | 9.1 | 53.2 | 2.5 |
| 1,1-DICHLOROPROPENE | LT 10 | LT 2.0 | LT 2.0 | LT 2.0 | LT 1.0 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 |
| TETRACHLOROMETHANE | LT 10 | LT 2.0 | LT 2.0 | LT 2.0 | LT 1.0 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 |
| BENZENE | LT 10 | LT 2.0 | LT 2.0 | LT 2.0 | LT 1.0 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 |
| 1,2-DICHLOROETHANE | LT 10 | LT 2.0 | LT 2.0 | LT 2.0 | LT 1.0 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 |
| TRICHLOROETHENE | 16.8 | 2.8 | 3.7 | 6.9 | 1.2 | LT 1.0 | 2.8 | 13.7 | LT 1.0 |
| 1,2-DICHLOROPROPANE | LT 10 | LT 2.0 | LT 2.0 | LT 2.0 | LT 1.0 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 |
| DIBROMOMETHANE | LT 10 | LT 2.0 | LT 2.0 | LT 2.0 | LT 1.0 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 |
| BROMODICHLOROMETHANE | LT 10 | LT 2.0 | LT 2.0 | LT 2.0 | LT 1.0 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 |
| TRANS-1,3-DICHLOROPROPENE | LT 10 | LT 2.0 | LT 2.0 | LT 2.0 | LT 1.0 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 |
| TOLUENE | 122.0 | 11.3 | 15.1 | 6.4 | 5.3 | 2.7 | 8.6 | 35.2 | 3.3 |
| CIS-1,3-DICHLOROPROPENE | LT 10 | LT 2.0 | LT 2.0 | LT 2.0 | LT 1.0 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 |
| 1,1,2-TRICHLOROETHANE | LT 10 | LT 2.0 | LT 2.0 | LT 2.0 | LT 1.0 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 |
| TETRACHLOROETHENE | LT 10 | LT 2.0 | LT 2.0 | LT 2.0 | LT 1.0 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 |
| 1,3-DICHLOROPROPANE | LT 10 | LT 2.0 | LT 2.0 | LT 2.0 | LT 1.0 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 |
| DIBROMOCHLOROMETHANE | LT 10 | LT 2.0 | LT 2.0 | LT 2.0 | LT 1.0 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 |
| 1,2-DIBROMOETHANE | LT 10 | LT 2.0 | LT 2.0 | LT 2.0 | LT 1.0 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 |
| CHLOROBENZENE | LT 10 | LT 2.0 | LT 2.0 | LT 2.0 | LT1.0 | LT1.0 | LT 2.0 | LT 10 | LT1.0 |
| 1,1,1,2-TETRACHLOROETHANE | LT 15 | LT 3.0 | LT 3.0 | LT 3.0 | LT 1.5 | LT 1.5 | LT 3.0 | LT 15 | LT 1.5 |
| ETHYLBENZENE | LT 10 | LT 2.0 | LT 2.0 | LT 2.0 | LT 1.0 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 |
| M/P XYLENE | 25 | LT 4.0 | 4.8 | LT 4.0 | LT 2.0 | LT 2.0 | LT 4.0 | LT 20 | LT 2.0 |
| O-XYLENE | LT 10 | LT 2.0 | LT 2.0 | LT 2.0 | LT 1.0 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 |
| STYRENE | LT 10 | LT 2.0 | LT 2.0 | LT 2.0 | LT 1.0 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 |
| TRIBROMOMETHANE | LT 10 | LT 2.0 | LT 2.0 | LT 2.0 | LT 1.0 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 |
| ISOPROPYLBENZENE | LT 15 | LT 3.0 | LT 3.0 | LT 3.0 | LT 1.5 | LT 1.5 | 167 | LT 15 | LT 1.5 |
| BROMOBENZENE | LT 10 | LT 2.0 | LT 2.0 | LT 2.0 | LT 1.0 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 |
| 1,1,2,2-TETRACHLOROETHANE | LT 15 | LT 3.0 | LT 3.0 | LT 3.0 | LT 1.5 | LT 1.5 | LT 3.0 | LT 15 | LT 1.5 |
| 1,2,3-TRICHLOROPROPANE | LT 10 | LT 2.0 | LT 2.0 | LT 2.0 | LT 1.0 | LT 1.0 | LT 2.0 | LT 10 | LT 1.0 |
| N-PROPYLBENZENE | LT 15 | LT 3.0 | LT 3.0 | LT 3.0 | LT 1.5 | LT 1.5 | 69.8 | LT 15 | LT 1.5 |
| 2-CHLOROTOLUENE | LT 15 | LT 3.0 | LT 3.0 | LT 3.0 | LT 1.5 | LT 1.5 | LT 3.0 | LT 15 | LT 1.5 |
| 1,3,5-TRIMETHYLBENZENE | LT 15 | LT 3.0 | LT 3.0 | LT 3.0 | LT 1.5 | LT 1.5 | LT 3.0 | LT 15 | LT 1.5 |
| 4-CHLOROTOLUENE | LT 15 | LT 3.0 | LT 3.0 | LT 3.0 | LT 1.5 | LT 1.5 | LT 3.0 | LT 15 | LT 1.5 |
| TERT-BUTYLBENZENE | LT 10 | LT 2.0 | LT 2.0 | LT 2.0 | LT 1.0 | LT 1.0 | 24.2 | LT 10 | LT 1.0 |
| 1,2,4-TRIMETHYLBENZENE | LT 15 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 15 | LT 1.5 |
| SEC-BUTYLBENZENE | LT 15 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | 528 | LT 15 | LT 1.5 |
| 1,4-DICHLOROBENZENE | LT 10 | LT 3.0 | LT 3.0 | LT 3.0 | LT 1.0 | LT 1.0 | LT 3.0 | LT 10 | LT 1.0 |
| P-ISOPROPYLTOLUENE | LT 10 | LT 3.0 | LT 3.0 | LT 3.0 | LT 1.0 | LT 1.0 | LT 3.0 | LT 10 | LT 1.0 |
| 1,3-DICHLOROBENZENE | LT 10 | LT 3.0 | LT 3.0 | LT 3.0 | LT 1.0 | LT 1.0 | LT 3.0 | LT 10 | LT 1.0 |
| 1,2-DICHLOROBENZENE | LT 10 | LT 3.0 | LT 3.0 | LT 3.0 | LT 1.0 | LT 1.0 | LT 3.0 | LT 10 | LT 1.0 |
| N-BUTYLBENZENE | LT 10 | LT 3.0 | LT 3.0 | LT 3.0 | LT 1.0 | LT 1.0 | 139 | LT 10 | LT 1.0 |
| 1,2-DIBROMO-3-CHLOROPROPANE | LT 10 | LT 3.0 | LT 3.0 | LT 3.0 | LT 1.0 | LT 1.0 | LT 3.0 | LT 10 | LT 1.0 |
| 1,2,4-TRICHLOROBENZENE | LT 30 | LT 6.0 | LT 6.0 | LT 6.0 | LT 3.0 | LT 3.0 | LT 6.0 | LT 30 | LT 3.0 |
| HEXACHLOROBUTADIENE | LT 20 | LT 4.0 | LT 4.0 | LT 4.0 | LT 2.0 | LT 2.0 | LT 4.0 | LT 20 | LT 2.0 |
| NAPHTHALENE | LT 35 | 7.4 | LT 7.0 | LT 7.0 | LT 3.5 | LT 3.5 | LT 7.0 | LT 35 | LT 3.5 |
| 1,2,3-TRICHLOROBENZENE | LT 30 | LT 6.0 | LT 6.0 | LT 6.0 | LT 3.0 | LT 3.0 | LT 6.0 | LT 30 | LT 3.0 |
| TOTAL | 267.1 | 33.5 | 35.7 | 22.8 | 9.4 | 5.8 | 1012.7 | 102.1 | 5.8 |

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Gibb House
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Reading
RG6 1BL

Report Date 15/10/98

# Test Certificate
# SO63984



Freightliner Project - E210

| | | | Hyder Ref | SO63984 | SO63985 | SO63986 | SO63987 | SO63988 | SO63989 |
|---|---|---|---|---|---|---|---|---|---|
| | | | Client Ref | TP1 @ 0.6-1.0m | TP1 @ 1.9-2.3m | TP2 @ 0.6-0.7m | TP2 @ 1.2-1.6m | TP3 @ 0.3-0.5m | TP3 @ 0.5-0.65m |
| | | | Sample Date | 24-Sep-98 | 24-Sep-98 | 24-Sep-98 | 24-Sep-98 | 24-Sep-98 | 24-Sep-98 |
| | Units | Lab | Method | | | | | | |
| Arsenic | mg/kg | 1 | | <1 | 9 | 52 | 7 | 24 | 13 |
| Boron water sol | mg/kg | 1 | | 4.3 | 0.2 | 0.5 | <0.1 | 0.8 | 0.2 |
| Cadmium | mg/kg | 1 | | <1.0 | <1.0 | 4.5 | <1.0 | 1.2 | <1.0 |
| Chromium | mg/kg | 1 | | 44.0 | 3.0 | 21.0 | 5.0 | 10.0 | 24.0 |
| Chromium VI | mg/kg | 2 | | <1 | <1 | <1 | <1 | <1 | <1 |
| Copper | mg/kg | 1 | | 1.0 | 6.0 | 441.0 | 2.0 | 56.0 | |
| Dried Solids | % | 1 | | 87.8 | 82.4 | 85.3 | 82.2 | 80.4 | 85.4 |
| Lead | mg/kg | 1 | | <10.0 | <10.0 | 407.0 | <10.0 | 61.0 | 49.0 |
| Mercury | mg/kg | 1 | | <0.1 | <0.1 | 0.4 | <0.1 | 0.1 | <0.1 |
| Nickel | mg/kg | 1 | | <5.0 | <5.0 | 47.0 | <5.0 | 52.0 | 29.0 |
| TPH by GC-FID | mg/kg | 1 | | < 3.42 | < 3.64 | 4.59 (Petrol) | < 3.65 | < 3.73 | < 3.51 |
| Selenium | mg/kg | 1 | | 3 | <1 | 1 | <1 | <1 | <1 |
| Zinc | mg/kg | 1 | | <1.0 | 22.0 | 3550 | 18.0 | 166.0 | 78.0 |

Authorised by

Lab accreditation Nos 1(Bridgend)=1229 2(Runcorn)=0897
* Indicates determinand not covered by UKAS accreditation
# Indicates analysis by sub-contractor

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# Test Certificate
# SO63984



Report Date 15/10/98

Freightliner Project - E210

| | | | Hyder Ref | SO63990 | SO63991 | SO63992 | SO63993 | SO63994 | SO63995 |
|---|---|---|---|---|---|---|---|---|---|
| | | | Client Ref | TP4 @ 0.4-0.6m | TP4 @ 2.5-2.6m | TP5 @ 0.4-0.6m | TP5 @ 1.8-2.1m | TP6 @ 0.5-0.7m | TP6 @ 1.2-1.4m |
| | | | Sample Date | 24-Sep-98 | 24-Sep-98 | 24-Sep-98 | 24-Sep-98 | 24-Sep-98 | 24-Sep-98 |
| | Units | Lab | Method | | | | | | |
| Arsenic | mg/kg | 1 | | 91 | 4 | 33 | 6 | 29 | 8 |
| Boron water sol | mg/kg | 1 | | 0.4 | 1.5 | 0.2 | 0.1 | 0.6 | 0.2 |
| Cadmium | mg/kg | 1 | | 2.7 | <1.0 | 1.1 | <1.0 | <1.0 | <1.0 |
| Chromium | mg/kg | 1 | | 3.0 | 4.0 | 107.0 | 4.0 | 54.0 | 4.0 |
| Chromium VI | mg/kg | 2 | | <1 | <1 | <1 | <1 | <1 | <1 |
| Copper | mg/kg | 1 | | 63.0 | 5.0 | 171.0 | <1.0 | 134.0 | <1.0 |
| Dried Solids | % | 1 | | 85.8 | 70.4 | 87.3 | 81.1 | 84.8 | 82.9 |
| Lead | mg/kg | 1 | | 61.0 | <10.0 | 95.0 | <10.0 | 147.0 | <10.0 |
| Mercury | mg/kg | 1 | | 0.5 | <0.1 | <0.1 | <0.1 | 0.1 | <0.1 |
| Nickel | mg/kg | 1 | | 20.0 | <5.0 | 67.0 | <5.0 | 45.0 | <5.0 |
| TPH by GC-FID | mg/kg | 1 | | 13.1 (Petrol) | < 4.26 | < 3.44 | < 3.70 | < 3.54 | < 3.62 |
| Selenium | mg/kg | 1 | | 2 | <1 | <1 | <1 | <1 | <1 |
| Zinc | mg/kg | 1 | | 181.0 | 12.0 | 544.0 | 15.0 | 330.0 | 15.0 |

Authorised by

Lab accreditation Nos 1(Bridgend)=1229 2(Runcorn)=0897
* Indicates determinand not covered by UKAS accreditation
# Indicates analysis by sub-contractor

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RG6 1BL

# Test Certificate
# SO63984



Report Date 15/10/98

Freightliner Project - E210

| | Units | Lab | Hyder Ref | SO63996 | SO63997 | SO63998 | SO63999 | SO64000 | SO64001 |
|---|---|---|---|---|---|---|---|---|---|
| | | | Client Ref | TP7 @ 0.45-0.7m | TP7 @ 1.6-2.2m | TP8 @ 0.3-0.4m | TP8 @ 1.6-2.0m | TP9 @ 0.8-1.1m | TP9 @ 2.6-2.7m |
| | | | Sample Date | 24-Sep-98 | 24-Sep-98 | 24-Sep-98 | 24-Sep-98 | 24-Sep-98 | 24-Sep-98 |
| | | | Method | | | | | | |
| Arsenic | mg/kg | 1 | | 24 | 8 | 55 | 12 | 18 | 6 |
| Boron water sol | mg/kg | 1 | | 0.5 | 0.2 | 0.4 | <0.1 | 2.3 | 6.6 |
| Cadmium | mg/kg | 1 | | <1.0 | 1.5 | 3.5 | <1.0 | <1.0 | <1.0 |
| Chromium | mg/kg | 1 | | 10.0 | 4.0 | 19.0 | 3.0 | 25.0 | 3.0 |
| Chromium VI | mg/kg | 2 | | <1 | <1 | <1 | <1 | <1 | <1 |
| Copper | mg/kg | 1 | | 98.0 | 10.0 | 191.0 | 12.0 | 51.0 | 5.0 |
| Dried Solids | % | 1 | | 76.6 | 81.5 | 83.4 | 81.1 | 70.4 | 47.1 |
| Lead | mg/kg | 1 | | 60.0 | <9.0 | 242.0 | 12.0 | 48.0 | <10.0 |
| Mercury | mg/kg | 1 | | 0.2 | <0.1 | 0.2 | <0.1 | <0.1 | <0.1 |
| Nickel | mg/kg | 1 | | 52.0 | 5.0 | 74.0 | <5.0 | 32.0 | <5.0 |
| TPH by GC-FID | mg/kg | 1 | | < 3.92 | < 3.68 | < 3.60 | < 3.70 | < 4.26 | < 6.37 |
| Selenium | mg/kg | 1 | | 1 | <1 | <1 | <1 | 1 | <1 |
| Zinc | mg/kg | 1 | | 207.0 | 202.0 | 407.0 | 68.0 | 132.0 | 23.0 |

Authorised by

Lab accreditation Nos 1(Bridgend)=1229 2(Runcorn)=0897
* Indicates determinand not covered by UKAS accreditation
# Indicates analysis by sub-contractor

Gibb Ltd
Gibb House
London Road
Reading
RG6 1BL

# Test Certificate
# SO63984



Report Date 15/10/98

Freightliner Project - E210

| | | | Hyder Ref | SO64002 | SO64003 |
|---|---|---|---|---|---|
| | | | Client Ref | TP10 @ 0.6-0.7m | TP10 @ 1.6-2.0m |
| | | | Sample Date | 24-Sep-98 | 24-Sep-98 |
| | Units | Lab | Method | | |
| Arsenic | mg/kg | 1 | | 196 | 17 |
| Boron water sol | mg/kg | 1 | | 0.2 | <0.1 |
| Cadmium | mg/kg | 1 | | 3.8 | <1.0 |
| Chromium | mg/kg | 1 | | 23.0 | 4.0 |
| Chromium VI | mg/kg | 2 | | <1 | <1 |
| Copper | mg/kg | 1 | | 310.0 | 31.0 |
| Dried Solids | % | 1 | | 80.5 | 82.1 |
| Lead | mg/kg | 1 | | 109.0 | <10.0 |
| Mercury | mg/kg | 1 | | <0.1 | <0.1 |
| Nickel | mg/kg | 1 | | 76.0 | 7.0 |
| TPH by GC-FID | mg/kg | 1 | | < 3.73 | < 3.65 |
| Selenium | mg/kg | 1 | | <1 | <1 |
| Zinc | mg/kg | 1 | | 216.0 | 107.0 |

Authorised by

Lab accreditation Nos 1(Bridgend)=1229 2(Runcorn)=0897
* Indicates determinand not covered by UKAS accreditation
# Indicates analysis by sub-contractor

# PROVISIONAL RESULTS - GROUNDWATER

| Laboratory Ref | GW65570 | GW65571 | GW65572 | GW65573 | GW65566 | GW65568 | GW65569 |
|---|---|---|---|---|---|---|---|
| Client Ref | E1 | E2 | E3 | E4 | E5 | E6 | Trip Blank |
| Sample Date | 01/10/98 | 01/10/98 | 01/10/98 | 01/10/98 | 29/09/98 | 29/09/98 | 29/09/98 |
| Units | ug/l | ug/l | ug/l | ug/l | ug/l | ug/l | ug/l |
| DETERMINAND | | | | | | | |
| DICHLORODIFLUOROMETHANE | LT 2.0 | LT 2.0 | LT 2.0 | LT 2.0 | LT 2.0 | LT 2.0 | LT 2.0 |
| CHLOROMETHANE | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 |
| VINYL CHLORIDE | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 |
| TRICHLOROFLUOROMETHANE | 62.0 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 |
| 1,1-DICHLOROETHENE | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 |
| DICHLOROMETHANE | LT 25 | LT 25 | LT 25 | LT 25 | LT 25 | LT 25 | LT 25 |
| TRANS-1,2-DICHLOROETHENE | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 |
| 1,1-DICHLOROETHANE | 1.7 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| 2,2-DICHLOROPROPANE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| CIS-1,2,DICHLOROETHENE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| BROMOCHLOROMETHANE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| TRICHLOROMETHANE | LT 1.0 | LT 1.0 | 3.4 | LT 1.0 | 35.0 | 11.8 | LT 1.0 |
| 1,1,1-TRICHLOROETHANE | 3.2 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| 1,1-DICHLOROPROPENE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| TETRACHLOROMETHANE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| BENZENE | LT 1.0 | 1.1 | LT 1.0 | 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| 1,2-DICHLOROETHANE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| TRICHLOROETHENE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| 1,2-DICHLOROPROPANE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| DIBROMOMETHANE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| BROMODICHLOROMETHANE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | 10.4 | 3.9 | LT 1.0 |
| TRANS-1,3-DICHLOROPROPENE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| TOLUENE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| CIS-1,3-DICHLOROPROPENE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| 1,1,2-TRICHLOROETHANE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| TETRACHLOROETHENE | 1.2 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| 1,3-DICHLOROPROPANE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| DIBROMOCHLOROMETHANE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | 2.0 | 1.1 | LT 1.0 |
| 1,2-DIBROMOETHANE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| CHLOROBENZENE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| 1,1,1,2-TETRACHLOROETHANE | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 |
| ETHYLBENZENE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| M/P XYLENE | LT 2.0 | 7.7 | LT 2.0 | 4.5 | LT 2.0 | LT 2.0 | LT 2.0 |
| O-XYLENE | LT 1.0 | 2.5 | LT 1.0 | 2.3 | LT 1.0 | LT 1.0 | LT 1.0 |
| STYRENE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| TRIBROMOMETHANE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| ISOPROPYLBENZENE | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 |
| BROMOBENZENE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| 1,1,2,2-TETRACHLOROETHANE | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 |
| 1,2,3-TRICHLOROPROPANE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| N-PROPYLBENZENE | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 |
| 2-CHLOROTOLUENE | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 |
| 1,3,5-TRIMETHYLBENZENE | LT 1.5 | 33.9 | LT 1.5 | 31.7 | LT 1.5 | LT 1.5 | LT 1.5 |
| 4-CHLOROTOLUENE | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 |
| TERT-BUTYLBENZENE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| 1,2,4-TRIMETHYLBENZENE | LT 1.5 | 17.6 | LT 1.5 | 9.8 | LT 1.5 | LT 1.5 | LT 1.5 |
| SEC-BUTYLBENZENE | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 | LT 1.5 |
| 1,4-DICHLOROBENZENE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| P-ISOPROPYLTOLUENE | LT 1.0 | 6.4 | LT 1.0 | 6.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| 1,3-DICHLOROBENZENE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| 1,2-DICHLOROBENZENE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| N-BUTYLBENZENE | LT 1.0 | 6.6 | LT 1.0 | 6.1 | LT 1.0 | LT 1.0 | LT 1.0 |
| 1,2-DIBROMO-3-CHLOROPROPANE | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 | LT 1.0 |
| 1,2,4-TRICHLOROBENZENE | LT 3.0 | LT 3.0 | LT 3.0 | LT 3.0 | LT 3.0 | LT 3.0 | LT 3.0 |
| HEXACHLOROBUTADIENE | LT 2.0 | LT 2.0 | LT 2.0 | LT 2.0 | LT 2.0 | LT 2.0 | LT 2.0 |
| NAPHTHALENE | LT 3.5 | LT 3.5 | LT 3.5 | LT 3.5 | LT 3.5 | LT 3.5 | LT 3.5 |
| 1,2,3-TRICHLOROBENZENE | LT 3.0 | LT 3.0 | LT 3.0 | LT 3.0 | LT 3.0 | LT 3.0 | LT 3.0 |
| **TOTAL** | **68** | **76** | **3** | **61** | **47** | **17** | **0** |

# FREIGHTLINER SITE
## PROVISIONAL GROUNDWATER TESTING RESULTS

| | Laboratory Ref | GW65570 | GW65571 | GW65572 | GW65573 | GW65566 | GW65568 |
|---|---|---|---|---|---|---|---|
| | Client Ref | E1 | E2 | E3 | E4 | E5 | E6 |
| | Sample Date | 01-Oct-98 | 01-Oct-98 | 01-Oct-98 | 01-Oct-98 | 29-Sep-98 | 29-Sep-98 |
| Arsenic | (mg/l) | 0.009 | 0.051 | 0.028 | 0.043 | <0.005 | <0.005 |
| Boron | (mg/l) | 0.13 | 0.19 | 0.18 | 0.16 | 0.16 | 0.12 |
| Cadmium | (mg/l) | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Chromium | (mg/l) | < 0.03 | < 0.03 | 0.07 | < 0.03 | < 0.03 | < 0.03 |
| Chromium 6 | (mg/l) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Copper | (mg/l) | 0.02 | 0.04 | 0.32 | 0.03 | < 0.05 | 0.03 |
| Lead | (mg/l) | < 0.05 | 0.06 | 0.18 | < 0.05 | < 0.05 | < 0.05 |
| Mercury | (µg/l) | <0.02 | 0.14 | 0.04 | 0.03 | <0.02 | <0.02 |
| Nickel | (mg/l) | 0.03 | 0.06 | 0.1 | < 0.03 | < 0.03 | < 0.03 |
| Oil ID GCFID | (mg/l) | < 0.15 | < 0.15 | < 0.15 | < 0.15 | < 0.15 | < 0.15 |
| Selenium | (mg/l) | < 0.002 | < 0.002 | < 0.002 | < 0.002 | < 0.002 | < 0.002 |
| Zinc | (mg/l) | 0.08 | 0.26 | 0.61 | 0.05 | 0.03 | 0.03 |

# APPENDIX G

## Well Development Records

# GIBB ENVIRONMENTAL WELL DEVELOPMENT FIELD RECORD

| | |
|---|---|
| PROJECT NUMBER | E210 |
| PROJECT NAME | FREIGHTLINER, NEATH |
| FACILITY/LOCATION | FORMER FREIGHTLINER SITE |
| MEASURED BY | N V PARRY |
| DATE | 01-Oct-98 |
| WELL DESIGNATION | **BH E1** |

| Development DATA | | | | | |
|---|---|---|---|---|---|
| Well Development Date: | 01-Oct-98 | Start Time: | 07:50 | Finish Time: | 09:15 |
| Depth from TOC to Top of Sediment Before Developing: | | m | | After Development: | m |
| Total Well Depth (actual depth w/o sediment from TOC): | | 8.00 m | | | |
| Casing Stick-up (TOC to Ground Surface): | | 0 cm (or): | | Casing Recess (Ground Surface to TOC): | m |
| Screen Length: | | 4.50 m | | Depth to Top Screen Slot: | 1.50 m |
| Depth from TOC to Static Water before Developing: | | 1.25 m | | After Developing: | 1.25 m |
| Length of Water Column: | | 4.75 m | | Water Level is: | -0.25 m Above / Below Top Screen Slot |
| Well Diameter: | | 50 mm | | Borehole/Sandpack Diameter: | 150 mm |
| Volume of Water Loss During Drilling (if used): | | 0 litres | | | |
| Volume of Water in Well and Sandpack (before development): | | 24.25 litres | | assuming a sandpack porosity of 20% | |
| Volume of Water to Remove for Development: | | 121.2 litres | | i.e. 5 x well volume | |
| Depth from TOC to Static Water 24 hours after Development: | | m | | | |

Note development should continue until the following conditions are met:

1) Well water is reasonably clear

2) Removal of at least five well volumes (inlcuding saturated filter annulus plus water loss during drilling; or evacuation of all available water from well (unable to fill bailer after ten minutes, wait for recharge). Purging after development requires the removal of at least three well volumes.

| FIELD MEASUREMENTS | | | | | |
|---|---|---|---|---|---|
| Parameter | Equipment I.D | 1st Reading | 2nd Reading | 3rd Reading | 4th Reading |
| Temperature deg. C | - | 14.8 | 14.8 | 14.7 | 14.7 |
| pH | - | 7 | 7.2 | 7.1 | 7.1 |
| Specific Conductivity µS | - | 17 | 13 | 12 | 12 |
| No. of Litres Removed | - | 15 | 90 | 122 | 128 |
| Time | - | 08:08 | 08:55 | 09:05 | 09:10 |

TOTAL VOLUME OF WATER REMOV-135 Litres

Comments:

| GENERAL DATA | | | |
|---|---|---|---|
| Weather: | overcast, cool, dry | Air temp°C: | 14.5 |
| Type and Size of Well Developing Equip | Disposable bailer | | |
| Description of Surge Technique (if used): | | | |
| Physical Description of Water: | Dark brown, oily sheen | | |

# GIBB ENVIRONMENTAL WELL DEVELOPMENT FIELD RECORD

| | |
|---|---|
| PROJECT NUMBER | E210 |
| PROJECT NAME | FREIGHTLINER, NEATH |
| FACILITY/LOCATION | FORMER FREIGHTLINER SITE |
| MEASURED BY | N V PARRY |
| DATE | 01-Oct-98 |
| WELL DESIGNATION | **BH E3** |

| Development DATA | | | |
|---|---|---|---|
| Well Development Date: 01-Oct-98 | Start Time: 10:05 | Finish Time: | 10:55 |
| Depth from TOC to Top of Sediment Before Developing: | 6.00 m | After Development: | 6.20 m |
| Total Well Depth (actual depth w/o sediment from TOC): | 6.50 m | | |
| Casing Stick-up (TOC to Ground Surface): | 43 cm (or): | Casing Recess (Ground Surface to TOC): | m |
| Screen Length: | 3.00 m | Depth to Top Screen Slot: | 2.00 m |
| Depth from TOC to Static Water before Developing: | 2.18 m | After Developing: | 2.21 m |
| Length of Water Column: | 2.82 m | Water Level is: 0.18 m Above / Below Top Screen Slot | |
| Well Diameter: | 50 mm | Borehole/Sandpack Diameter: | 150 mm |
| Volume of Water Loss During Drilling (if used): | 0.00 litres | | |
| Volume of Water in Well and Sandpack (before development): | 14.40 litres | assuming a sandpack porosity of 20% | |
| Volume of Water to Remove for Development: | 71.98 litres | i.e. 5 x well volume | |
| Depth from TOC to Static Water 24 hours after Development: | m | | |

Note development should continue until the following conditions are met:

1) Well water is reasonably clear

2) Removal of at least five well volumes (inlcuding saturated filter annulus plus water loss during drilling; or evacuation of all available water from well (unable to fill bailer after ten minutes, wait for recharge). Purging after development requires the removal of at least three well volumes.

| FIELD MEASUREMENTS | | | | | |
|---|---|---|---|---|---|
| Parameter | Equipment I.D. | 1st Reading | 2nd Reading | 3rd Reading | 4th Reading |
| Temperature deg. C | - | 14.3 | 14.0 | 14.1 | 14 |
| pH | - | 6.9 | 7.0 | 6.9 | 6.9 |
| Specific Conductivity µS | - | 8 | 7 | 7 | 7 |
| No. of Litres Removed | - | 10 | 82 | 90 | 110 |
| Time | - | 10:12 | 10:30 | 10:32 | 10:35 |
| TOTAL VOLUME OF WATER REMOV 120 Litres | | | | | |
| Comments: | | | | | |

| GENERAL DATA | | | |
|---|---|---|---|
| Weather: | overcast, cool, dry | Air temp C: | 15.7 |
| Type and Size of Well Developing Equip | Disposable bailer | | |
| Description of Surge Technique (if used): | | | |
| Physical Description of Water: | Dark brown, becoming clear | | |

# GIBB ENVIRONMENTAL WELL DEVELOPMENT FIELD RECORD

| | |
|---|---|
| PROJECT NUMBER | E210 |
| PROJECT NAME | FREIGHTLINER, NEATH |
| FACILITY/LOCATION | FORMER FREIGHTLINER SITE |
| MEASURED BY | N V PARRY |
| DATE | 01-Oct-98 |
| WELL DESIGNATION | **BH E2** |

| Development DATA | | | | | |
|---|---|---|---|---|---|
| Well Development Date: | 01-Oct-98 | Start Time: | 09:25 | Finish Time: | |
| Depth from TOC to Top of Sediment Before Developing: | | m | | After Development: | 6.68 m |
| Total Well Depth (actual depth w/o sediment from TOC): | | 8.00 m | | | |
| Casing Stick-up (TOC to Ground Surface): | | 0 cm (or): | | Casing Recess (Ground Surface to TOC): | m |
| Screen Length: | | 4.00 m | | Depth to Top Screen Slot: | 1.50 m |
| Depth from TOC to Static Water before Developing: | | 1.13 m | | After Developing: | 2.21 m |
| Length of Water Column: | | 4.37 m | | Water Level is: | -0.37 m Above / Below Top Screen Slot |
| Well Diameter: | | 50 mm | | Borehole/Sandpack Diameter: | 150 mm |
| Volume of Water Loss During Drilling (if used): | | 0.00 litres | | | |
| Volume of Water in Well and Sandpack (before development): | | 22.31 litres | | assuming a sandpack porosity of 20% | |
| Volume of Water to Remove for Development: | | 111.55 litres | | i.e. 5 x well volume | |
| Depth from TOC to Static Water 24 hours after Development: | | m | | | |

Note development should continue until the following conditions are met:

1) Well water is reasonably clear

2) Removal of at least five well volumes (inlcuding saturated filter annulus plus water loss during drilling; or evacuation of all available water from well (unable to fill bailer after ten minutes, wait for recharge). Purging after development requires the removal of at least three well volumes.

| FIELD MEASUREMENTS | | | | | |
|---|---|---|---|---|---|
| Parameter | Equipment I.D. | 1st Reading | 2nd Reading | 3rd Reading | 4th Reading |
| Temperature deg. C | - | 13.6 | 13.0 | 13.1 | 13.1 |
| pH | - | 7 | 6.9 | 6.9 | 6.8 |
| Specific Conductivity µS | - | 10 | 12 | 11 | 12 |
| No. of Litres Removed | - | 10 | 120 | 130 | 145 |
| Time | - | 09:30 | 9:50 | 9:55 | 10:10 |
| TOTAL VOLUME OF WATER REMOV 135 Litres | | | | | |
| Comments: | | | | | |

| GENERAL DATA | | | |
|---|---|---|---|
| Weather: | overcast, cool, dry | Air temp C: | 17 |
| Type and Size of Well Developing Equip | Disposable bailer | | |
| Description of Surge Technique (if used): | | | |
| Physical Description of Water: | Dark brown, oily sheen, very strong organic (diesel?) smell | | |

# APPENDIX H

## Gas Monitoring Results

## Freightliner Terminal - Gas Monitoring Results - 16 October 1998

| BH No | Gas Concentration (%) | | | Groundwater Depth (m) | Cover Type |
|---|---|---|---|---|---|
| | $O_2$ | $CO_2$ | $CH_4$ | | |
| E1 | 2 | 2.6 | 82 | 1.3 | Flush |
| E2 | 20.2 | 0.2 | 0 | 1.12 | Flush |
| E3 | 5 | 1.7 | 24 | 1.66 (BGL) | Raised (0.2m) |

Atmospheric pressure: 1008; Temperature 15degrees C