



**South Hook LNG Terminal Co Ltd  
Milford Haven  
Application Site Report**

September 2008

---

# QM

| Issue/revision | Issue 1                                                                            | Revision 1                                                                          | Revision 2                                                                           | Revision 3 |
|----------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|------------|
| Remarks        | Draft                                                                              | Incorporating client comments                                                       | Final                                                                                |            |
| Date           | June 2008                                                                          | August 2008                                                                         | September 2008                                                                       |            |
| Prepared by    | Laura Grundy                                                                       | Laura Grundy                                                                        | Laura Grundy                                                                         |            |
| Signature      |   |   |   |            |
| Checked by     | Scott Beaton                                                                       | Scott Beaton                                                                        | Scott Beaton                                                                         |            |
| Signature      |   |   |   |            |
| Authorised by  | Neal Barker                                                                        | Neal Barker                                                                         | Neal Barker                                                                          |            |
| Signature      |  |  |  |            |
| Project number | 12091537/001                                                                       | 12091537/001                                                                        | 12091537/001                                                                         |            |
| File reference |                                                                                    |                                                                                     |                                                                                      |            |

WSP Environmental UK  
The Victoria  
150-182 The Quays  
Salford  
Manchester  
M50 3SP

Tel: +44 (0)161 886 2400  
Fax: +44 (0)16 1886 2402  
<http://www.wspgroup.com>

Reg. No: 1152332

---



---

# Contents

## **CONFIDENTIALITY STATEMENT**

|          |                                                           |           |
|----------|-----------------------------------------------------------|-----------|
| <b>1</b> | <b>Introduction</b>                                       | <b>1</b>  |
| <b>2</b> | <b>Objectives of Assessment</b>                           | <b>3</b>  |
| <b>3</b> | <b>Site Setting and Sources of Desk Study Information</b> | <b>4</b>  |
| <b>4</b> | <b>Site Reconnaissance</b>                                | <b>10</b> |
| <b>5</b> | <b>Assessment of Land Pollution Potential</b>             | <b>14</b> |
| <b>6</b> | <b>Conceptual Site Model</b>                              | <b>21</b> |
| <b>7</b> | <b>Conclusions</b>                                        | <b>25</b> |

## **FIGURES**

|           |                                  |
|-----------|----------------------------------|
| FIGURE 1: | Site Location Plan               |
| FIGURE 2: | Site Layout and Site Zone System |
| FIGURE 3: | IPPC Installation Boundary       |
| FIGURE 4: | Location of Above Ground Tanks   |

## **APPENDICES**

|             |                                                                             |
|-------------|-----------------------------------------------------------------------------|
| APPENDIX A: | Envirocheck Report                                                          |
| APPENDIX B: | Historical Maps                                                             |
| APPENDIX C: | Summary of Existing Site Investigation                                      |
| APPENDIX D: | Potentially Polluting Substances and Assessment of Land Pollution Potential |

---



---

# Confidentiality Statement

This report is addressed to and may be relied upon by the following parties:-

- *South Hook LNG Terminal Company Limited*
- *The Environment Agency (Wales)*

This assessment has been prepared for the sole use and reliance of the above named parties. This report shall not be relied upon or transferred to any other parties without the express written authorisation of WSP Environmental Limited. No responsibility will be accepted where this report is used, either in its entirety or in part, by any other party.



# 1 Introduction

## 1.1 AUTHORISATION

On the instruction of South Hook LNG Terminal Company Limited (hereafter known as SHLNG) an Application Site Report (ASR) has been compiled for the facility located at Milford Haven, (hereafter referred to as the site).

## 1.2 BACKGROUND INFORMATION

SHLNG is currently constructing a natural gas (LNG) receiving, storage and regasification terminal at South Hook, Milford Haven.

Under the provisions of the Pollution Prevention and Control Regulations 2000, the company is required to submit an application to the Environment Agency for a permit to operate the new process / installation. As part of the permit application, a site report is required to describe the 'initial conditions' of the site. This report is known as an 'Application Site Report' which is required for the purpose of the company's Environmental Permit application. This baseline site report has been compiled in accordance with the Environment Agency publication: *IPPC H7 Guidance on the Protection of Land under the PPC Regime: Application Site Report*.

## 1.3 SITE DESCRIPTION

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Site Address:                    | South Hook LNG Terminal Company Ltd<br>Dale Road<br>Herbrandston<br>Milford Haven<br>Pembrokeshire<br>SA73 3SL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| National Grid Reference:         | NGR: SM 875 064                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Size:                            | Approx. 210 hectares                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Description of Site:             | South Hook LNG Terminal Company Ltd (SHLNG) are currently constructing and propose to operate a liquid natural gas (LNG) receiving, storage and regasification terminal at South Hook, Milford Haven. The terminal will act as a base load facility, i.e. a facility that will operate throughout the year rather than on a seasonal basis, and although the unloading of LNG will be intermittent, the plant will operate continuously.                                                                                                                                                                                                     |
| Description of Surrounding Area: | <p>The area directly surrounding the site is predominantly rural with some major industrial developments in the Milford Haven area.</p> <p>The SHLNG site is located on the west coast of Wales, positioned on two flat topped hills, with a valley running north to south down the centre of the site towards Little Wick Bay. The Milford Haven estuary bounds the site to the southern and western extent. The site is bound to the east by a small valley feature running down to Gelliswick Bay that separates the site from the community of Hubberston. To the northwest a third small valley leading down to Muns Mouth in Sandy</p> |







## 3 Site Setting and Sources of Desk Study Information

### 3.1 INTRODUCTION

Information was accessed from both private and public sources and in particular was obtained from SHLNG and from a Landmark Envirocheck Report, May 2008 (**Appendix A**). Data obtained is referenced in Table 3.1.

**Table 3.1: Public Domain Information**

| <i>Document / Resource Title</i>       | <i>Information Obtained</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Historical Ordnance Survey Plans       | Information relating to: <ul style="list-style-type: none"><li>■ Historical land use of site</li><li>■ Historical land use of surrounding area</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Landmark Envirocheck Report, July 2007 | Environmental data relating to: <ul style="list-style-type: none"><li>■ Operational and non-operational landfills</li><li>■ Abstraction Licenses (groundwater and surface water)</li><li>■ Chemical releases</li><li>■ Discharge consents</li><li>■ IPPC Permits</li><li>■ Pollution Incidents</li><li>■ River Quality Surveys</li><li>■ Operational and non-operational scrap yards and waste transfer/treatment sites</li><li>■ Current industrial land uses</li><li>■ Water</li><li>■ Waste</li><li>■ Statutory records and authorisations</li><li>■ Borehole and trade directory entries</li></ul> |
| Coal Mining Report                     | ■ Not required                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| British Geological Survey Website      | ■ Mineral Extraction Data                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Environmental Agency Website           | ■ The site is affected by flood risk                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Various Graphical Resources            | Information including: <ul style="list-style-type: none"><li>■ BGS 1:50,000 Geological Map</li><li>■ 1:100,000 Groundwater Vulnerability Map</li><li>■ 1:21,000 Explorer Ordnance Survey Plan Sheet</li></ul>                                                                                                                                                                                                                                                                                                                                                                                          |



### 3.2 HISTORICAL LAND USE

A study has been undertaken of historical Ordnance Survey maps from 1868 to 2008. A selection of historical mapping has been presented in **Appendix B**.

The following represents a summary of the available map information:

**Table 3.2: Site History**

| <i>Site Features</i>                                                                                                                                                                     | <i>Dates</i>         |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| The site remained undeveloped and occupied by agricultural / park land.                                                                                                                  | Pre 1868 to pre 1953 |
| By 1964 the area was converted to a 'Works' dotted with industrial buildings which is most likely the beginning of an oil refinery.                                                      | Pre 1964 to pre 1967 |
| By 1968 the site was named as an oil refinery on the map with a jetty and pipelines extending from the refinery into the sea. A former railway also runs down the east side of the site. | Pre 1967 to pre 1990 |
| By 1990 the oil refinery had been vacated, the above ground facilities dismantled and vegetation allowed to grow across the site.                                                        | Pre 1990 to pre 2008 |

The uses of land in the immediate area have been considered. Based upon available map information the following historical land uses have been identified:

**Table 3.3: Surrounding Area History**

| <i>Surrounding Features</i> | <i>Dates</i>         | <i>Distance (m)</i>                          | <i>Direction</i> |
|-----------------------------|----------------------|----------------------------------------------|------------------|
| Old Quarry                  | Pre 1874 to Pre 1995 | 10m                                          | North            |
| Agricultural Land           | Pre 1868 to present  | From adjacent                                | Surrounding      |
| Non-coniferous Woodland     | Pre 1868 to present  | 10m                                          | East             |
| Town (Gelliswick)           | Pre 1875 to present  | From 60m                                     | South East       |
| Town (Milford Haven)        | Pre 1868 to present  | From adjacent                                | South East       |
| Town (Herbrandston)         | Pre 1868 to present  | From 400m                                    | North            |
| Golf Course                 | Pre 1967 to present  | Adjacent                                     | North East       |
| South Hook Fort (Disused)   | Pre 1968 to present  | Onsite, but outside the application boundary | South West       |
| Sewage Works                | Pre 1973 to present  | From 300m                                    | North            |

### 3.3 SITE ZONE REFERENCE SYSTEM

The site has been assessed within five zones, delineated on the basis of operations, processes and technically linked areas. The following reference system applies throughout the report. The location of each zone is presented in **Figure 2**.



**Table 3.4: Site Zone Reference System**

| <b>Zone Reference</b> | <b>Description of Area (incl. subdivision)</b> |
|-----------------------|------------------------------------------------|
| Zone 1                | LNG Transfer, Storage and Process Area         |
| Zone 2                | Storage of Ancillary Materials & Waste Oil     |
| Zone 3                | Transformers                                   |
| Zone 4                | Jetty                                          |
| Zone 5                | Other areas including vehicle access routes    |

### **3.4 ENVIRONMENTAL CONSENTS, LICENCES, AUTHORISATIONS, PERMITS AND DESIGNATIONS FOR THE SITE AND SURROUNDING AREA**

The following section contains regulatory information associated with the site and its sounding area within a 1km radius. Much of this information has been obtained from the Landmark Envirocheck Report.

#### **3.4.1 IPPC Permits**

The only IPPC Permits within 1km of the subject site is the IPPC permit for the site itself.

#### **3.4.2 LAPPC Authorisations**

There are no companies with LAPPC authorisations within 1km of the site.

#### **3.4.3 Radioactive Substances Authorisations**

There are no companies with radioactive substance authorisations within 1km of the site.

#### **3.4.4 Groundwater Abstractions**

There are no current EA licensed groundwater abstraction points within a 1km radius of the site.

Information published by the EA indicates that the site is not located within a designated Groundwater Source Protection Zone.

#### **3.4.5 Surface Water Abstractions**

There are no surface water abstractions on site however, there are nine EA licensed surface water abstraction points within a 2km radius of the site.

#### **3.4.6 Discharge Consents**

##### *EA information*

There are fourteen recorded discharge consents which are located within a 1km radius of the site.



#### 3.4.7 Operational and Non-Operational Landfill

Information provided in the Envirocheck Report (**Appendix A**) and published by the Environment Agency indicates that there are nine operational landfill sites within a 1km radius of the subject site. In addition there are three registered landfill sites that have been reported as closed and eleven historical facilities.

#### 3.4.8 Licensed Waste Treatment / Transfer Sites

There are no registered waste treatment or transfer sites listed within a 1km radius of the site.

#### 3.4.9 Sites of Special Scientific Interest (SSSIs) and Sensitive Habitats

The site is located within an area where sensitive habitats or species have been identified. The following SSSIs and sensitive habitats have been identified within a 1km of the site:

- Preseli – Environmentally Sensitive Area
- Pembrokeshire Coast National Park
- Milford Haven Waterway – SSSI
- Pembrokeshire Marine / Sir Benfro Forol – Special Area of Conservation (SAC)

The National Park boundary splits the South Hook LNG site from North to South. The Milford Haven Waterway (SSSI) abuts the site to the south and is also classed as the Pembrokeshire Marine SAC.

### 3.5 GEOLOGICAL, HYDROGEOLOGICAL AND HYDROLOGICAL DATA

Intrusive investigations were carried out prior to, during, and after site preparation. A significant amount of information on the underlying geology and hydrogeology of the site is available as a result of the extensive site investigation and remediation works undertaken.

#### 3.5.1 Regional and Site Geology

Information from the intrusive site investigation works undertaken on the site and Geological Mapping at 1:50 000 scale, Sheet 226 / 227 (Milford, Drift), show the following geological sequence beneath the site.

**Table 3.5: Summary of Geological Strata**

| <i><b>Geological Unit</b></i>                                                  | <i><b>Approximate Thickness (m)</b></i> | <i><b>Aquifer Status</b></i> |
|--------------------------------------------------------------------------------|-----------------------------------------|------------------------------|
| Made Ground (sand and gravel)                                                  | Variable                                | N/A                          |
| Clay, gravels and silts with peaty alluvium deposits found on the valley floor | Variable                                | N/A                          |
| Red Marls of the Old Red Sandstone                                             | to 912m                                 | Minor aquifer                |



### 3.5.2 Mineral Extraction

#### *Coal Mining*

The site is not located within an area affected by coal mining activities.

### 3.5.3 Hydrogeology and Hydrology

#### *Groundwater Vulnerability*

The Environment Agency Groundwater Vulnerability Map and Regional Appendices, which make up part of the published Policy and Practice for the Protection of Groundwater, divide the underlying strata in England and Wales into major, minor and non aquifers dependent upon their potential for potable water supply.

Based on the groundwater vulnerability map for the area (Sheet 34, Pembroke), the strata underlying the site is classified as a Minor Aquifer with variable permeability (See Table 3.5 for confirmation of geological strata).

It is considered that bedrock underlying the site provides limited groundwater storage due to its low intrinsic porosity and that groundwater flow is largely controlled by fissures, which are concentrated near to ground surface and along fracture zones. Groundwater is typically encountered locally as a perched water table at the interface between the weathered bedrock or engineered fill and the un-weathered bedrock. Boreholes drilled within the bedrock all encounter groundwater revealing a laterally continuous water table that is controlled predominantly by site topography.

Information from ground investigations carried out on site are presented in Section 3.7 below.

### 3.5.4 Surface Water (Hydrology)

The local surface water hydrology of the site was altered during the construction of the refinery by damming the valley running through the site down to Little Wick Bay to form the Skimming Pond, located in the valley bottom. Much of the site drainage was directed to flow down through the Skimming pond, prior to discharge to Milford Haven through an outfall located in Little Wick Bay just below the Mean Low Water Mark. This feature remains and new drainage infrastructure has been constructed to route surface water run-off through an attenuation pond up-stream of the Skimming Pond, and thence direct to effluent, with a minimum flow to the Skimming Pond to maintain the habitat.

#### *River Quality Survey*

Surface water features in the vicinity of the subject site are as follows:

**Table 3.6: Surface Water**

| <b><i>Surface Water Feature</i></b> | <b><i>GQA Classification</i></b> | <b><i>Distance from Site</i></b>                    | <b><i>Direction from Site</i></b> |
|-------------------------------------|----------------------------------|-----------------------------------------------------|-----------------------------------|
| Milford Haven                       | Not classified                   | Abuts the southern and western boundary of the site | South and West                    |
| Sandy Haven Pill                    | Not classified                   | 1.75km                                              | West                              |
| Hubberston Pill                     | Not classified                   | 2.25km                                              | East                              |



| <b>Surface Water Feature</b>                      | <b>GQA Classification</b> | <b>Distance from Site</b>           | <b>Direction from Site</b> |
|---------------------------------------------------|---------------------------|-------------------------------------|----------------------------|
| Reservoir                                         | Not classified            | 0.6km                               | North west                 |
| Area of standing water at Big Neeston             | Not classified            | 0.5km                               | North                      |
| Reservoirs                                        | Not classified            | 1.1km                               | North east                 |
| Reservoirs (disused)                              | Not classified            | 2.25km                              | North east                 |
| Various small areas of standing water and springs | Not classified            | Various to the north, east and west |                            |

### 3.5.5 Flood Risk

According to information published by the EA and the Envirocheck Report the site is located in an area at risk from flooding from rivers or sea without defences (zone 3).

## 3.6 SITE OPERATIONAL RECORDS, EMERGENCY RESPONSE RECORDS AND RECORDS OF ANY LAND POLLUTION INCIDENTS IN THE VICINITY OF THE SITE

The Envirocheck Report identifies eleven pollution incidents to controlled waters within 1km of the site. Only one incident has been identified on-site and this is when the site was the Esso refinery. This incident involved a spillage of petrol entering Milford Haven via surface run-off, in 1998; and was classified as minor. This record is open to question, as the site was unoccupied at the time, and had been so for several years.

The Envirocheck Report also identifies one substantiated pollution incident which occurred approximately 800m north east of the site. This incident involved the spillage of diesel to land in 2006. The incident was recorded as a significant incident in relation to land impact.

## 3.7 EXISTING SITE INVESTIGATION AND ASSESSMENT REPORTS

The following report has been reviewed and used in the development of a conceptual model of the site. A summary of this report and other site investigation works is provided in **Appendix C**.

*WSP Remediation: South Hook LNG – Soil and Groundwater Monitoring and Trend Analysis Report. March 2007.*



## 4 Site Reconnaissance

### 4.1 INTRODUCTION

It was deemed unnecessary to undertake a detailed site reconnaissance for the purposes of the ASR as at the time of writing this report the site was under construction. However, as the site will be newly developed it will be constructed in accordance with BAT standards and therefore will be adequate to prevent releases to land.

The following proposed site features were reviewed:

### 4.2 STORAGE TANKS AND ASSOCIATED PIPE WORK

A list of all the proposed above ground storage tanks is detailed below in Table 4.1.

Procedures for regular integrity testing of the tanks, bunded facilities and filling points will be implemented prior to start up, however as the tanks and bunds are new there should be no immediate concerns with regard to their integrity.

The location of the above ground tanks are shown in *Figure 4*.



**Table 4.1: Above Ground Tanks**

| <b>Tank No.</b>                                 | <b>Contents</b>       | <b>Volume</b>                   | <b>Ancillary Pipe work<br/>(incl. fill and draw<br/>lines/points)</b>                                                                                                                  | <b>Secondary / Tertiary<br/>Containment Feature</b>                                                                                  | <b>Observation (e.g. loss of<br/>integrity, spillage staining<br/>etc)</b> |
|-------------------------------------------------|-----------------------|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
|                                                 | Liquefied Natural Gas | 155,000m <sup>3</sup> x 5 tanks | Pipework is routed above a combination of concrete hardstanding, gravel and the jetty.                                                                                                 | Each tank will comprise an inner tank and an outer tank providing >100% back up in the event of leakage from the internal tank wall. | No observations can be made as the site has not been constructed.          |
|                                                 | Nitrogen              | 100 m <sup>3</sup> x 2 tanks    | Pipework is routed above gravel.                                                                                                                                                       | None – the nitrogen would evaporate at atmospheric conditions.                                                                       |                                                                            |
|                                                 | Sodium hydroxide      | 23m <sup>3</sup> x 2 tanks      | Fill point located inside the bund. Pipework for off-loading will be situated above concrete hardstanding with a spill tray beneath the vehicle connection point.                      | Single skinned tanks will be located in a dedicated concrete bund of >110% of tank capacity                                          |                                                                            |
| Maintenance / workshop vehicle re-fuelling tank | Diesel                | Max. 5m <sup>3</sup>            | Fill points will be located inside the bund. Pipework for loading and off-loading will be situated above concrete hardstanding with a spill tray beneath the vehicle connection point. | Single skinned tank will be located in a dedicated concrete bund of >110% of tank capacity inside a building.                        |                                                                            |



| <b>Tank No.</b>                                | <b>Contents</b> | <b>Volume</b>              | <b>Ancillary Pipe work<br/>(incl. fill and draw<br/>lines/points)</b>                                                                                                                                                                                               | <b>Secondary / Tertiary<br/>Containment Feature</b>                                                     | <b>Observation (e.g. loss of<br/>integrity, spillage staining<br/>etc)</b> |
|------------------------------------------------|-----------------|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| Diesel tanks<br>for fire water<br>pumps        | Diesel          | 5,500 litres x 2<br>tanks  | Tank overflow pipe<br>located within the<br>bund. Pipework for<br>off-loading will be<br>situated above<br>concrete<br>hardstanding with a<br>spill tray beneath the<br>vehicle connection<br>point.<br><br>Drain pipe through<br>the bund wall but<br>well sealed. | Single skinned metal tank<br>will be located in a<br>dedicated steel bund of<br>>110% of tank capacity. |                                                                            |
| Diesel tanks<br>for<br>emergency<br>generators | Diesel          | 13,500 litres x 2<br>tanks | Fill point located<br>inside the bund.<br>Pipework for off-<br>loading will be<br>situated above<br>concrete<br>hardstanding with a<br>spill tray beneath the<br>vehicle connection<br>point.                                                                       | Single skinned tank<br>located in a dedicated<br>concrete bund of >110% of<br>tank capacity.            |                                                                            |
| Diesel tanks<br>for jetty fire<br>water pumps  | Diesel          | 7,000 litres               | Fill point located<br>inside the bund.<br>Pipework for off-<br>loading will be<br>situated above<br>concrete<br>hardstanding with a<br>spill tray beneath the<br>vehicle connection<br>point.                                                                       | Single skinned tank<br>located in a dedicated steel<br>bund of >110% of tank<br>capacity.               |                                                                            |



#### **4.3 CONCRETE HARDSTANDING AND BUNDS**

The site will mainly be covered with concrete hardstanding, tarmac and gravel comprising site road and process areas.

#### **4.4 VEGETATION**

The majority of the site will comprise of hardstanding and buildings however, there will be grass embankments at various locations around the site. There will also be areas of vegetation for aesthetic purposes.

#### **4.5 SURFACE WATER FEATURES**

The nearest off site surface water feature is Milford Haven, which bounds the southern part of the site.

There are two surface water features on the site, the attenuation pond and the skim pond, which both act as emergency retention ponds for surface water discharge, and provide additional hold-up in the event of emergencies.

#### **4.6 NATURE OF THE STORAGE AND HANDLING OF MATERIALS**

Bulk raw materials will be stored in above-ground storage tanks within bunds. The maintenance / workshop vehicle re-fuelling tank will be situated within a bund inside a purpose built building.

Other raw materials will be stored in drums, IBCs or bags within a bunded area in a purpose built building.

Pipework containing potentially polluting substances will be routed above concrete hardstanding.

All hazardous liquid wastes, such as waste oil, will be stored in the centralised site waste management facility which is a bunded facility located inside a building.

#### **4.7 SURFACE WATER AND FOUL DRAINAGE**

Surface water from external hardstanding and roof runoff from the north, south and east of the site will enter the surface water drainage system. Surface water from the drainage gullies pass through one of two petrol interceptors, which discharge into Milford Haven via the attenuation pond. The attenuation pond can be isolated in the event of the surface water becoming contaminated to prevent the effluent entering Milford Haven. The interceptors are fitted with oil detectors and will be regularly visually inspected and maintained.

Surface water from the west of the site passes through the skim pond and underflow weir before discharge into Milford Haven.

There is no foul drainage system on site for process related waste water. Domestic effluent enters either a cesspool or is pumped to a sewage treatment works off-site.

## 5 Assessment of Land Pollution Potential

### 5.1 POLLUTING SUBSTANCES AND RELEVANT ACTIVITIES

A list of potentially polluting substances used, stored, or produced as waste (e.g. by-products from the manufacturing process) are contained in **Appendix D**. An assessment of their pollution potential has been made based on their properties, toxicity and volume stored.

Based on the assessment undertaken at the site, the following substances were identified as having the potential to cause land pollution are discussed in detail below.

**Table 5.1: Potentially Polluting Substances**

| <b>Substance</b>                          | <b>Activity</b>                                    | <b>Zone</b> |
|-------------------------------------------|----------------------------------------------------|-------------|
| Sodium hydroxide (liquid)                 | Delivery by road tanker to installation            | 2a and 5    |
|                                           | Road tanker off-loading                            | 2b          |
|                                           | Storage                                            | 2b          |
|                                           | Transfer to submerged combustion vaporiser for use | 1 and 2b    |
| Sodium hydroxide (solid) (back-up supply) | Delivery by road vehicle                           | 2a and 5    |
|                                           | Off-loading from road vehicle                      | 2a          |
|                                           | Storage                                            | 2a          |
|                                           | Transfer to point of use                           | 5           |
| Diesel (vehicle re-fuelling)              | Delivery by road tanker to installation            | 2a and 5    |
|                                           | Road tanker off-loading                            | 2a          |
|                                           | Storage                                            | 2a          |
|                                           | Dispensing fuel                                    | 2a          |
| Diesel (emergency services generators)    | Delivery by road tanker to installation            | 2b and 5    |
|                                           | Road tanker off-loading                            | 2b          |
|                                           | Storage                                            | 2b          |
|                                           | Transfer to generator                              | 2b          |
| Diesel (fire water pumps)                 | Delivery by road tanker to installation            | 2d and 5    |
|                                           | Road tanker off-loading                            | 2d          |
|                                           | Storage                                            | 2d          |
|                                           | Transfer to fire water pumps                       | 2d          |
| Diesel (Jetty fire water pumps)           | Delivery by road tanker to installation            | 4 and 5     |
|                                           | Road tanker off-loading                            | 4 and 5     |
|                                           | Storage                                            | 4           |
|                                           | Transfer to fire water pumps                       | 4           |
| Hydraulic oil                             | Drum delivery by road vehicle                      | 2a and 5    |
|                                           | Off-loading from road vehicle                      | 2a          |
|                                           | Storage                                            | 2a          |



| <b>Substance</b> | <b>Activity</b>                      | <b>Zone</b> |
|------------------|--------------------------------------|-------------|
|                  | Transfer to point of use             | 2a          |
|                  | Storage of waste oil                 | 2a          |
|                  | Transportation of waste oil off site | 2a and 5    |
| Lubricating oil  | Delivery by road vehicle             | 2a and 5    |
|                  | Off-loading from road vehicle        | 2a          |
|                  | Storage                              | 2a          |
|                  | Transfer to point of use             | 2a          |
|                  | Storage of waste oil                 | 2a          |
|                  | Transportation of waste oil off site | 2a and 5    |
| Transformer oil  | Storage in transformers              | 3a to 3h    |

## 5.2 PREVENTATIVE MEASURES

The pollution prevention measures (physical infrastructure and those relating to testing, inspection and maintenance) for each relevant activity associated with the potentially polluting substances have been identified and their extent and condition assessed. The results of this work are shown in **Appendix D**.

The information for this study was obtained during the site reconnaissance and from discussions with SHLNG staff.

For those potentially polluting substances and activities listed in Table 5.1, the nature of the pollution prevention measures have been assessed on the basis of primary, secondary or tertiary containment.

**Table 5.2: Pollution Prevention Measures for the Relevant Activities**

| <b>Substance</b>          | <b>Activity</b>                         | <b>Primary Containment</b>        | <b>Secondary Containment</b>                                                                                                    | <b>Nature of Tertiary Containment</b> |
|---------------------------|-----------------------------------------|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| Sodium hydroxide (liquid) | Delivery by road tanker to installation | Road tanker                       | Roadway comprising of tarmac hardstanding                                                                                       | Attenuation basin                     |
|                           | Road tanker off-loading                 | Road tanker and delivery pipework | Road tanker is situated in an area of kerbed concrete hardstanding during off-loading<br><br>Fill point located inside the bund | Attenuation basin                     |



| <b>Substance</b>         | <b>Activity</b>                                    | <b>Primary Containment</b> | <b>Secondary Containment</b>                                                                | <b>Nature of Tertiary Containment</b>                                                                                    |
|--------------------------|----------------------------------------------------|----------------------------|---------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
|                          | Storage                                            | Storage tank               | Tank is situated inside an impermeable concrete bund. Capacity is >110% of the tank volume. | Attenuation basin                                                                                                        |
|                          | Transfer to submerged combustion vaporiser for use | Pipework                   | Pipework is routed above concrete hardstanding                                              | Attenuation basin                                                                                                        |
| Sodium hydroxide (solid) | Delivery by road vehicle                           | Road vehicle               | Roadway comprising of tarmac hardstanding                                                   | None<br>(Note: in the event of the sodium hydroxide becoming a solution, it would be contained in the attenuation basin) |
|                          | Off-loading from road vehicle                      | Road vehicle<br>Bag        | Road vehicle is situated in an area of concrete hardstanding during off-loading             | None<br>(Note: in the event of the sodium hydroxide becoming a solution, it would be contained in the attenuation basin) |
|                          | Storage                                            | Bag                        | Stored inside a concrete kerbed building                                                    | None<br>(Note: in the event of the sodium hydroxide becoming a solution, it would be contained in the attenuation basin) |



| <b>Substance</b>                       | <b>Activity</b>                         | <b>Primary Containment</b>        | <b>Secondary Containment</b>                                                                                                    | <b>Nature of Tertiary Containment</b>                                                                                        |
|----------------------------------------|-----------------------------------------|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
|                                        | Transfer to point of use                | Bag                               | Transfer will take place above concrete hardstanding / tarmac roadways                                                          | None<br><br>(Note: in the event of the sodium hydroxide becoming a solution, it would be contained in the attenuation basin) |
| Diesel (vehicle re-fuelling)           | Delivery by road tanker to installation | Road tanker                       | Roadway comprising of tarmac hardstanding                                                                                       | Interceptor in the on-site drainage system                                                                                   |
|                                        | Road tanker off-loading                 | Road tanker and delivery pipework | Road tanker is situated in an area of kerbed concrete hardstanding during off-loading<br><br>Fill point located inside the bund | Interceptor in the on-site drainage system                                                                                   |
|                                        | Storage                                 | Storage tank                      | Tank is situated inside an impermeable concrete bund. Capacity is > 110% of the tank volume.                                    | Interceptor in the on-site drainage system                                                                                   |
|                                        | Dispensing fuel                         | Dispensing hose                   | Concrete kerbed area                                                                                                            | Interceptor in the on-site drainage system                                                                                   |
| Diesel (emergency services generators) | Delivery by road tanker to installation | Road tanker                       | Roadway comprising of tarmac hardstanding                                                                                       | Interceptor in the on-site drainage system                                                                                   |
|                                        | Road tanker off-loading                 | Road tanker and delivery pipework | Road tanker is situated in an area of kerbed concrete hardstanding during off-loading<br><br>Fill point located inside the bund | Interceptor in the on-site drainage system                                                                                   |



| <b>Substance</b>                | <b>Activity</b>                         | <b>Primary Containment</b>        | <b>Secondary Containment</b>                                                                                                         | <b>Nature of Tertiary Containment</b>      |
|---------------------------------|-----------------------------------------|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
|                                 | Storage                                 | Storage tank                      | Tank is situated inside an impermeable concrete bund. Capacity is >110% of the tank volume.                                          | Interceptor in the on-site drainage system |
|                                 | Transfer to generator                   | Pipework                          | Pipework is routed above concrete hardstanding                                                                                       | Interceptor in the on-site drainage system |
| Diesel (fire water pumps)       | Delivery by road tanker to installation | Road tanker                       | Roadway comprising of tarmac hardstanding                                                                                            | Interceptor in the on-site drainage system |
|                                 | Road tanker off-loading                 | Road tanker and delivery pipework | Road tanker is situated in an area of kerbed concrete hardstanding during off-loading<br><br>Fill point located inside a bunded area | Interceptor in the on-site drainage system |
|                                 | Storage                                 | Storage tank                      | Tank is situated inside an impermeable steel bund. Capacity is >110% of the tank volume.                                             | Interceptor in the on-site drainage system |
|                                 | Transfer to fire water pumps            | Pipework                          | Pipework is routed above concrete hardstanding                                                                                       | Interceptor in the on-site drainage system |
| Diesel (Jetty fire water pumps) | Delivery by road tanker to installation | Road tanker                       | Roadway comprising of tarmac hardstanding                                                                                            | Interceptor in the on-site drainage system |
|                                 | Road tanker off-loading                 | Road tanker and delivery pipework | Road tanker is situated in an area of kerbed concrete hardstanding during off-loading<br><br>Fill point located inside a bunded area | Interceptor in the on-site drainage system |



| <i><b>Substance</b></i> | <i><b>Activity</b></i>               | <i><b>Primary Containment</b></i> | <i><b>Secondary Containment</b></i>                                                      | <i><b>Nature of Tertiary Containment</b></i> |
|-------------------------|--------------------------------------|-----------------------------------|------------------------------------------------------------------------------------------|----------------------------------------------|
|                         | Storage                              | Storage tank                      | Tank is situated inside an impermeable steel bund. Capacity is >110% of the tank volume. | None                                         |
|                         | Transfer to fire water pumps         | Pipework                          | Pipework is routed above the jetty                                                       | None                                         |
| Hydraulic oil           | Delivery of drums by road vehicle    | Road vehicle                      | Roadway comprising of tarmac hardstanding                                                | Interceptor in the on-site drainage system   |
|                         | Off-loading from road vehicle        | Road vehicle<br>Drums             | Road vehicle is situated in an area of concrete hardstanding during off-loading          | Interceptor in the on-site drainage system   |
|                         | Storage                              | Drum                              | Stored inside a concrete kerbed building                                                 | Interceptor in the on-site drainage system   |
|                         | Transfer to point of use             | Drum                              | Transfer will take place above concrete hardstanding / tarmac roadways                   | Interceptor in the on-site drainage system   |
|                         | Storage of waste oil                 | Drum                              | Stored inside a concrete kerbed building                                                 | Interceptor in the on-site drainage system   |
|                         | Transportation of waste oil off site | Road vehicle<br>IBC               | Roadway comprising of tarmac hardstanding                                                | Interceptor in the on-site drainage system   |
| Lubricating oil         | Delivery by road vehicle             | Road vehicle                      | Roadway comprising of tarmac hardstanding                                                | Interceptor in the on-site drainage system   |
|                         | Off-loading from road vehicle        | Road vehicle<br>Drum              | Road vehicle is situated in an area of concrete hardstanding during off-loading          | Interceptor in the on-site drainage system   |



| <i><b>Substance</b></i>            | <i><b>Activity</b></i>               | <i><b>Primary Containment</b></i> | <i><b>Secondary Containment</b></i>                                    | <i><b>Nature of Tertiary Containment</b></i> |
|------------------------------------|--------------------------------------|-----------------------------------|------------------------------------------------------------------------|----------------------------------------------|
|                                    | Storage                              | Drum                              | Stored inside a concrete kerbed building                               | Interceptor in the on-site drainage system   |
|                                    | Transfer to point of use             | Drum                              | Transfer will take place above concrete hardstanding / tarmac roadways | Interceptor in the on-site drainage system   |
|                                    | Storage of waste oil                 | Drum                              | Stored inside a concrete kerbed building                               | Interceptor in the on-site drainage system   |
|                                    | Transportation of waste oil off site | Road vehicle IBC                  | Roadway comprising of tarmac hardstanding                              | Interceptor in the on-site drainage system   |
| Transformer oil                    | Storage in transformers              | Transformer                       | Located in a concrete bunded area                                      | Interceptor in the on-site drainage system   |
| Transformer oil (jetty substation) | Storage in transformers              | Transformer                       | Located in a concrete bunded area                                      | None                                         |

### **5.3 ASSESSMENT OF THE LIKELIHOOD OF LAND POLLUTION**

An assessment of the likelihood of land pollution from the installation is contained within ***Appendix D***.

The assessment has not identified any relevant activities where there is a reasonable possibility that there is, or will be current or future pollution of the land within the installation. This report has not identified any requirement for the collection of reference data.



## 6 Conceptual Site Model

### 6.1 INTERPRETATIVE NOTES ON CONCEPTUAL MODEL

The Conceptual Model is a representation of the potential sources of soil and groundwater contamination on the site together with mechanisms by which contamination can be released into the environment and mechanisms for migration of contamination together with potential environmental receptors that could be affected by contamination.

The Conceptual Model incorporates all the information obtained during the desk study and the site reconnaissance, and seeks to outline the potential interactions of historical land use, site operations, geology, hydrogeology and other natural attributes. The following supplementary notes interpret and describe the interactions between different aspects of the model.

Each note is referenced in the Presentation of the Conceptual Model (Section 6.10).

### 6.2 GEOLOGY AND HYDROGEOLOGY

The typical geological sequence beneath the site is as follows:

**Table 6.1: Geological Layers beneath the Site**

| <i>Geological Unit</i>                                                         | <i>Approximate Thickness(m)</i> | <i>Aquifer Status</i> |
|--------------------------------------------------------------------------------|---------------------------------|-----------------------|
| Made Ground (sand and gravel)                                                  | Variable                        | N/A                   |
| Clay, gravels and silts with peaty alluvium deposits found on the valley floor | Variable                        | N/A                   |
| Red Marls of the Old Red Sandstone                                             | to 912m                         | Minor aquifer         |

#### 6.2.1 Made Ground

Localised areas of made ground consisting of sand and gravel with varying coarseness. This made ground is as a result of construction and demolition works associated with the oil refinery and the LNG terminal construction works.

#### 6.2.2 Clay, Gravels and Silts

Bedrock is overlain by clay, gravels and silts with peaty alluvium deposits found on the valley floor.

#### 6.2.3 Red Marls of the Old Red Sandstone

The Red Marl comprises siltstones and fine sandstones, interbedded with fine and coarse sandstone horizons. Extensive regional folding has resulted in highly fractured and weathered bedrock of varying depths.



### **6.3 GROUNDWATER FLOW**

Groundwater flow represents a potential migration pathway of pollutants in the subsurface.

An extract from the WSP Remediation Report states that:

'It is considered that bedrock underlying the site provides limited groundwater storage due to its low intrinsic porosity and that groundwater flow is largely controlled by fissures, which are concentrated near to ground surface and along fracture zones. Groundwater is typically encountered locally as a perched water table at the interface between the weathered bedrock or engineered fill and the un-weathered bedrock. Boreholes drilled within the bedrock all encounter groundwater revealing a laterally continuous water table that is controlled predominantly by site topography. It was suggested by RPS that although relatively impermeable, the bedrock has an extensive and well-communicated fracture network typically associated with springs along the coast line.'

The presence of hardstanding with an engineered drainage system over the installation will reduce rainwater infiltration and limit the recharge of the deeper aquifer.

### **6.4 SURFACE WATER FEATURES**

The nearest surface water feature is Milford Haven, which bounds the southern and western part of the site.

There are two tidal inlets on either side of the site, Sandy Haven Pill approximately 1.75km to the west of the site and Hubberston Pill approximately 2.25km to the east of the site.

There are various small areas of standing water, springs and reservoirs surrounding the site within 2.25km to the north, east and west.

### **6.5 RESULTS OF PREVIOUS INVESTIGATIONS/ASSESSMENTS**

Site investigations have previously been undertaken, details of which are summarised in *Appendix C*.

### **6.6 OTHER RECEPTORS**

There are several sensitive habitats within 1km of the installation. These are:

- Preseli – Environmentally Sensitive Area
- Pembrokeshire Coast National Park
- Milford Haven Waterway – SSSI
- Pembrokeshire Marine / Sir Benfro Forol – Special Area of Conservation

The National Park boundary splits the South Hook LNG site from North to South. The Milford Haven Waterway (SSSI) abuts the site to the south and is also classed as the Pembrokeshire Marine SAC.



#### 6.6.1 Landscaped Areas

There are landscaped areas on site for aesthetic purposes and to minimise the potential for sediment runoff but these are not classified as sensitive areas. However, they do represent areas on site where contamination could rapidly enter the soil should a spillage occur.

### 6.7 LAND POLLUTION HISTORY

There is potential for historical land contamination as a result of the previous industrial history of the site. The site was previously an oil refinery.

### 6.8 SITE ZONING

For the purposes of this report, the site has been divided into five zones based upon the site setting and the possible (and actual) location of potentially polluting substances. These zones are shown on **Figure 2**.

**Table 6.2: Site Zone Reference System**

| <i>Zone Reference</i> | <i>Description of Area (incl. subdivision)</i> |
|-----------------------|------------------------------------------------|
| Zone 1                | LNG Transfer, Storage and Process Area         |
| Zone 2                | Storage of Ancillary Materials & Waste Oil     |
| Zone 3                | Transformers                                   |
| Zone 4                | Jetty                                          |
| Zone 5                | Other areas including vehicle access routes    |

### 6.9 SUMMARY OF CONCEPTUAL MODEL

#### 6.9.1 Introduction

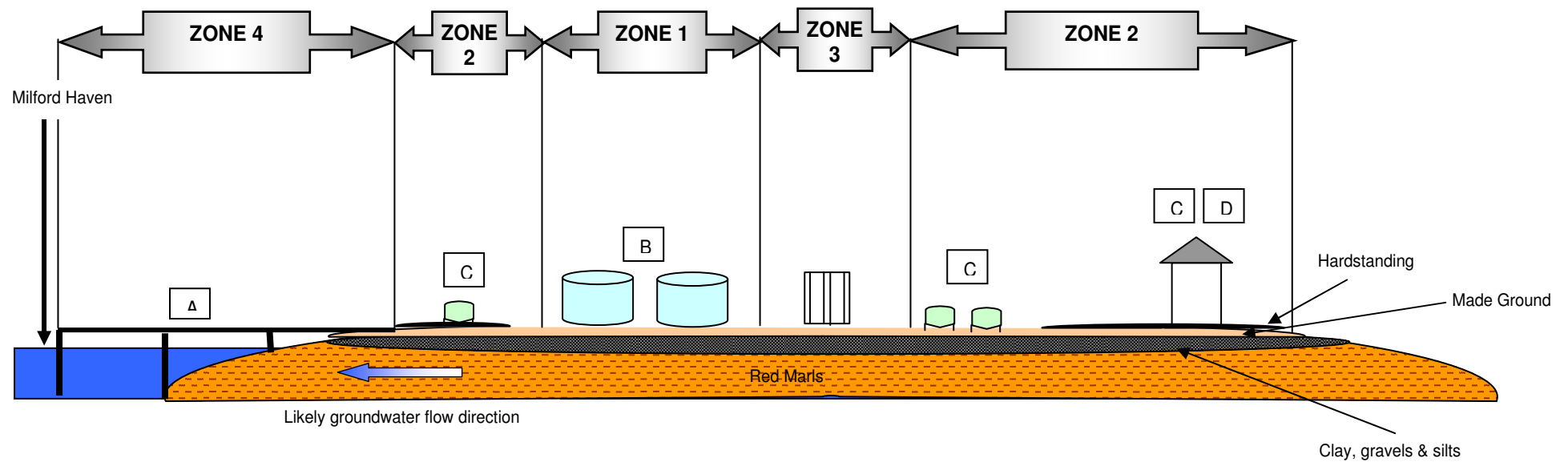
The findings of the desk study and site reconnaissance, as outlined above, have been used to develop the Conceptual Site Model (CSM) for the site. Uncertainties in the CSM are identified and their significance discussed.

The CSM is displayed schematically in Section 6.10.

In developing and presenting the CSM, the following assumptions were made:

- The main groundwater is at depth and flows towards Milford Haven to the south and west of the site.
- Groundwater is not present within any made ground or superficial geology except as perched water.

## 6.10 PRESENTATION OF CONCEPTUAL MODEL



### Summary of Reference Points

|                                              |                                                    |
|----------------------------------------------|----------------------------------------------------|
| A Off-loading and transfer of LNG to storage | C Delivery, storage and use of ancillary materials |
| B Storage and processing of LNG              | D Storage and transportation off-site of waste oil |



## 7 Conclusions

Although sources of contamination could be present at the site, the containment and management systems proposed should lead to little likelihood of land pollution. This assessment has been based on proposed site details and this position must be reviewed with the Regulator.



---

# Figures



---

## Appendix A    Envirocheck Report



---

## Appendix B Historical Plans



---

## Appendix C   Summary of Existing Site Investigation



---

# Appendix D Potentially Polluting Substances and Assessment of Land Pollution Potential