

# BAE SYSTEMS Environmental STAG II Environmental Section

Bishopton

Redrow Group Services Ltd

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# STAG II Environmental Section

## Bishopton

## Redrow Group Services Ltd

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| A0504-00-R1-1                     | A0504-00-R1-1                                  | February 2006                                  |



INVESTORS IN PEOPLE

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## EXECUTIVE SUMMARY

### Introduction and Objectives

Redrow Group Services Ltd, as part of the proposed re-development of the former Royal Ordnance Factory in Bishopton, have commissioned BAE Systems Environmental to carry out desk based researches on 4 areas of land. The locations of the sites are shown at Figure 1.

The report forms part of a STAG Part 2 appraisal and solely deals with the requirement in terms of environmental impact of road construction in these areas relating to the sub-objective 'water quality'. The objective of the project is to gain sufficient information to allow appraisal of three options for road construction in terms of their relative impacts on the water environment.

### Site Characteristics and Settings

Site A is located to the south of Dargavel Road near Craigmuir and is bounded by the M8 motorway to the east, Dargavel Road to the north and Greenock Road to the west. The site is currently fairly flat agricultural land and has no surface water or ecological designations in the immediate vicinity. No potential sources of contamination have been identified from historical maps. Ground conditions are indicated to consist of glaciomarine deposits of sand and gravel overlying Carboniferous cyclic sequences of sandstones, siltstones, mudstones and seatrocks. Bedrock is indicated to outcrop at or near the surface over much of the site.

Site B is located to the east of the M8 motorway near Linburn and is bounded by the M8 motorway to the north and west, Dargavel Road to the south and Old Greenock Road to the east. The site is currently fairly flat agricultural land and has no surface water or ecological designations in the immediate vicinity. No potential sources of contamination have been identified from historical maps. Ground conditions are indicated to consist of glaciomarine deposits of sand and gravel or glacial diamictons of boulders in a clay matrix overlying cyclic sequences of Carboniferous sandstones, siltstones, mudstones and seatrocks.

Site C is located to the west of the M8 motorway at the intersection of the M8 and A8 and is bounded by the M8 to the east, Greenock Road to the north-east and the Glasgow/Greenock railway line to the west. The site comprises agricultural land over a closed landfill, which operated between 1981 and 2003 and has surface water features in the form of reedbeds and drainage ditches. Surface water at the site flows into Lin Burn via a culvert under the M8 motorway. There are no ecological designations in the immediate vicinity of the site. Ground conditions have been previously examined prior to the commencement of land filling and were found to consist mainly of very soft to soft clay. Peat was encountered to the north-west of the site. Solid geology is indicated to comprise cyclic sequences of Carboniferous sandstones, siltstones, mudstones, coals and seatrocks.

Site D is located to the east of the M8 motorway at the intersection of the M8 and A8 and is bounded by the M8 to the west and Greenock Road to the north-east. The site is currently flat agricultural land and has surface water in the form of Lin Burn. There are no ecological designations in the immediate vicinity of the site, however, an area of water approximately 2km south-east of Lin Burn at site D has been designated a Site of

Special Scientific Interest. Ground conditions are indicated to consist of glaciomarine deposits of sand and gravel over cyclic sequences of Carboniferous sandstones, siltstones, mudstones, coals and seatrocks.

### **Current Surface Water Condition**

Surface water is present at Sites C and D and monitoring has been carried out at these sites by SEPA that has identified contaminants, in the form of ammonia and zinc, present at significant concentrations. Reedbeds currently exist at Site C in an attempt to facilitate bioremediation of surface water. Monitoring results from upstream and downstream waters indicate that water quality is not being improved by the existing reedbeds although the downstream point is at the confluence with another drainage ditch and so it is difficult to ascertain the actual benefits, if any, of the treatment.

Since groundwaters at all sites are indicated by SEPA to be equally vulnerable, the relative risks to groundwaters have been assessed based on the corresponding risks to surface waters at each location as these could ultimately impact on underlying groundwater. It should also be noted that all sites are indicated to be underlain by concealed aquifers or aquifers of limited potential and that no water abstractions have been recorded in the area. Site investigations involving exploratory holes at each location would be required in order to provide a more detailed and accurate assessment of groundwater vulnerability.

### **Preliminary Assessment of Impacts**

The relative impacts on surface and groundwaters of road construction at each of the sites has been assessed and each of the three possible combination of sites has been rated as 'high', 'medium' or 'low'.

Option 4, which comprises Sites C and D, has been rated as high risk due to potential adverse impacts of landfill leachate on surface waters present at the sites. However, this risk can be reduced significantly through careful consideration of engineering designs and methodologies for new works.

Option 5, which comprises Sites A and B, has been rated as low risk due to the absence of a contamination source and the absence of surface waters at both sites.

Option 4a, which comprises Sites A and D, has been rated as medium risk due to the presence of surface water in the immediate vicinity of Site D.

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## 1. INSTRUCTION

Redrow Group Services Ltd, as part of the proposed re-development of the former Royal Ordnance Factory in Bishopton, have commissioned BAE Systems Environmental to carry out desk based researches on 4 areas of land. The areas to be investigated are possible locations for a new motorway junction to allow direct access to the M8 motorway, to and from Glasgow.

### 1.1. Background and Objectives

The construction of the new junction is a key component in the delivery of a successful transport strategy to enable delivery of the proposed redevelopment scheme.

Following submission and acceptance by the Scottish Executive of the Strategic Transport Appraisal Guidance (STAG) Part 1 documentation that appraised 6 options for the delivery of a new motorway junction to serve the development, 2 options remained. It was agreed that these 2 options plus a hybrid option would be taken forward to the next stage of appraisal, STAG Part 2.

The objective of the project is to gain sufficient information to allow further appraisal of the remaining 3 options in terms of their relative impacts on the environment. This report solely deals with the requirement in terms of environmental impact of road construction in these areas relating to the sub-objective 'water quality'. Information has also been gathered in relation to the sub-objective of geological features. Other sub-objectives relating to Environment issues are being compiled by JMP Consulting, Glasgow.

### 1.2. Scope of Work

The works that are considered to be required in order to satisfy the STAG 2 guidance relating to the Environment aspects of the appraisal comprise a desk based review of existing information. Each option then needs to be reviewed in terms of the scale and nature of any impacts singularly and relative to each other.

The current report has included the following:

- Detailed review of all existing information such as historical, geological and hydrogeological maps
- Initial consultations with the Scottish Environment Protection Agency (SEPA) and Scottish Natural Heritage (SNH) for the purposes of gathering additional information relating to authorisations and consents, water quality and ecological designations.
- Site reconnaissance to establish environmental setting
- Assessment of potential impacts on the water environment for each option (others will also be highlighted e.g. ecological designations)
- Input of data into STAG summary tables
- Assessment of best option in terms of these aspects of the Environment sub-objective

The terms of reference used and limitations of the use of this report are described in Section 1.4.

### **1.3. Sources of Information**

The following general sources of information have been used in compiling this report: -

- Current and historical Ordnance Survey (OS) maps (from Envirocheck search).
- Geological, hydrogeological and hydrological data in the form of maps, plans and other documents from the British Geological Survey (BGS).
- Consultations with the Scottish Environment Protection Agency (SEPA) and Scottish Natural Heritage (SNH).

A full reference list is provided in Appendix 1.

### **1.4. Reporting Conditions**

It is emphasised that a desk based review can only indicate the potential for environmental impacts from the proposed development. Where such an impact is envisaged, an intrusive ground investigation is usually required to further quantify the nature and extent of the impact.

The report refers to the conditions present at the Site at the time of the study. BAE Systems Environmental can accept no liability for any future changes of Site conditions. It should be noted that BAE Systems Environmental has relied on the accuracy of the information contained in the documents consulted and is in no circumstances responsible for the accuracy of such information or data supplied.

This report has been specifically prepared for the purposes stated in section 1.1 and therefore should not be used for any other purpose without prior consultation with BAE Systems Environmental.

## 2. SITE DETAILS AND DESCRIPTION

### 2.1. Site Description

There are 4 sites that have been identified as possible locations for the proposed M8 junction slip roads. Walkover surveys were conducted from the boundary of each site on 16<sup>th</sup> November 2005. The sites are described below and their locations shown on Figure 1. Photographs taken during the walkover surveys are shown at Appendix 2.

- Site A – located to the south of Dargavel Road near Craigmuir, the site is currently agricultural land comprising fairly flat grassland, which rises on a gentle incline towards the north-east. The site is bounded by the M8 motorway to the east, Dargavel Road to the north and Greenock Road to the west. Access is currently restricted by hedgerows and a fence of barbed wire stretched between wooden posts. Two residences are located nearby; Lochranza Cottage at approximately 24450,66988 and Craigmuir farmhouse at approximately 24472,66978. No surface water features could be seen from the site boundary and none are shown on the OS map of the area. This site would serve as an off ramp westbound.
- Site B – located to the east of the M8 motorway near Linburn, the site is currently agricultural land comprising fairly flat grassland used for grazing sheep. The site is bounded by the M8 motorway to the north and west, Old Greenock road to the east and Dargavel Road to the south. Access is currently restricted by a fence of barbed wire stretched between wooden posts. An electricity pylon is located to the north of the site at approximately 24497,67033. No surface water features could be seen from the site boundary and none are shown on the OS map of the area. This site would serve as an on ramp east bound.
- Site C – located to the west of the M8 motorway at the intersection of the M8 and A8, the site is currently agricultural land over a closed landfill. The landfill forms a fairly steep-sided hill, which rises up towards the west to a height of approximately 14m above ground level. The site is bounded by the Glasgow/Greenock railway line to the west, the M8 motorway to the east and Greenock Road to the north-east. Managed reed beds are located on site along the boundary with the M8 and comprise shallow flooded areas approximately 15m wide containing reeds to facilitate bioremediation of surface water on the site. Surface water is also present in a number of drainage ditches surrounding the landfill. The site can be accessed via a road at the north-east, which leads off Greenock Road and was historically used for access to the landfill. A plan of the landfill is attached at Appendix 5. This site would serve as an off ramp westbound.
- Site D – located to the east of the M8 motorway at the intersection of the M8 and A8, the site is currently agricultural land comprising fairly flat grassland. The site is bounded by the M8 motorway to the west and Greenock Road to the north-east. The site can be accessed from Greenock Road, where there is a break in the hedgerows and trees that otherwise enclose the area. A small patch of waterlogged ground covering approximately 4m<sup>2</sup> was visible near the entrance. Surface water is also present in the form of Lin Burn to the south of the site. This site would serve as an on ramp east bound.

## 2.2. Motorway Junction Options

The three options namely '4', '4a' and '5' to be appraised for STAG Part 2 are described as follows:

- Option 4 comprises a new off slip from the M8 at Site C with a new on slip through Site D.
- Option 5 comprises the alteration of the existing off slip at Site A with a new on slip at Site B.
- Option 4a is a hybrid of both of these options comprising the alteration of the existing off slip at Site A with a new on slip at Site D.

### **3. ENVIRONMENTAL SETTING**

The information in the following sections has been interpreted from published data. Extracts of the Geological, Hydrogeological and Groundwater Vulnerability maps are presented in Figures 2 and 3 and Appendix 3 respectively. Figure 4 shows the approximate locations of selected BGS boreholes.

#### **3.1. Published Geology**

##### **3.1.1. Sites A and B**

Published geological maps indicate the sites are underlain by Late Devensian Glaciomarine Deposits of deltaic and beach sand and gravel. To the north west and south east glacial diamictons are indicated, which comprise till of lodgement or deformation type, boulders and stones in a hard to stiff sandy silty clay matrix. Bedrock is shown to outcrop at or near the surface over much of Site A and towards the south of Site B.

The solid geology is indicated to consist of the Lawmuir Formation of the Lower Carboniferous Period, which generally comprises sandstones, especially in lower part, with siltstones, mudstones, marine and non-marine limestones, coals and seatearths. Quartz dolerite dykes of Upper Carboniferous age are also indicated to be in the vicinity trending south-west to north-east.

##### **3.1.2. Sites C and D**

Site C is indicated to be underlain by Made Ground comprising man-made materials on original ground surface. Site D is indicated to be underlain by Late Devensian Glaciomarine Deposits comprising intertidal and subtidal clay and silt.

The solid geology across the sites is indicated to consist of two formations of Carboniferous age. To the north-east is the Limestone Coal Formation of the Upper Carboniferous Period, which generally comprises cyclic sequences of sandstones, siltstones, mudstones, coals, blackband and clayband ironstones and seatrocks. To the south-west is the Lower Limestone Formation of the Lower Carboniferous Period, which generally comprises mudstones with sandstones, siltstones, marine limestones, thin coals and clayband ironstones.

#### **3.2. Borehole Data**

BGS borehole data from 1966 for NS 4476470073 (No.158), located to the north east of Site A, indicates 1 ft (0.3m) of sand and gravel over at least 14 ft (4.3m) of doleritic basalt dyke, which is very weathered and broken to approximately 5 ft (1.5m). It should be noted, however, that the dyke is likely to be a localised linear feature and that conditions immediately to the north and south of the dyke are likely to be those described above in section 3.1.1.

Borehole data from 1966 for NS 4487969420 (No.156), located on the eastern side of Site C, indicates 43 ft (13.1 m) of soft to very soft, silty to very silty clay over at least 5 ft (1.5m) of boulder clay.

The lithologies encountered in both boreholes are consistent with the published geology.

Copies of the available borehole logs are provided in Appendix 8.

### **3.3. Hydrogeology**

The deposits underlying all 4 sites can be classified as a concealed aquifer of limited or local potential comprising Quaternary coastal and river alluvium. It is considered that ground conditions beneath the sites are moderately permeable.

### **3.4. Hydrology**

The nearest classified watercourse to all of the sites is Dargavel burn, a tributary of the River Gryfe, which is located approximately 1 km to the south-west of Site C. This has been classified by SEPA, based on samples from 2004, as 'A2', which is described as 'good'.

Sites A and B have no surface water features in the immediate vicinity. Sites C and D are located close to and drain into Lin Burn, which is also a tributary of the River Gryfe, further downstream from Dargavel Burn. The River Gryfe is a tributary of Black Cart Water, which flows into the River Clyde.

#### ***3.4.1. Water Monitoring at Southbar Landfill***

Surface water is present at Southbar landfill in the form of drainage ditches and reed beds. The landfill is surrounded by a 1m deep ditch that channels surface water into reedbeds, which are located along the eastern edge of the landfill adjacent to the M8 motorway. Water is then channelled through a culvert under the M8 motorway and into Lin Burn.

Currently, there is no discharge consent for water draining from the landfill. Surface water monitoring has been carried out by SEPA between August 2000 and May 2005 and the locations of sampling points are shown in Figure 5. It should be noted that the most recent round of sampling carried out by SEPA, in May 2005, did not include point 1. The results have been summarised below:

##### ***3.4.1.1. Ammonia***

Levels of ammonia elevated above the EQS of 0.015 mg/l have been recorded at all sampling points, the maximum concentration was 19.950 mg/l at point 6 on 26<sup>th</sup> June 2003. Since then ammonia levels at point 6 have fluctuated, but show an overall decrease, reaching 0.234 mg/l in samples taken in 2005. The average concentration of ammonia in the area, calculated from the most recent available data for all sampling points is 1.481 mg/l.

##### ***3.4.1.2. Chloride***

Slightly elevated levels of chloride have been recorded in the past at sampling locations 1, 5 and 6. However, recent samples have shown chloride levels that are well below the EQS of 250 mg/l at all sampling locations.

##### ***3.4.1.3. Copper***

Levels of copper elevated above the EQS of 1 µg/l have been recorded at sampling locations 4, 5 and 6, the maximum concentration being 10.83 µg/l in August 2000.

Samples taken in May 2005 from locations 5 and 6 found levels of 2.46 µg/l and 3.01 µg/l respectively.

#### **3.4.1.4. Iron**

Levels of iron elevated above the EQS of 1 mg/l have been recorded, in the past, at all sampling locations. However, the most recent samples from May 2005 for points 2, 3 and 6 contained levels of iron below the EQS. Samples from points 4 and 5 had levels of 2.18 mg/l and 1.66 mg/l respectively.

#### **3.4.1.5. Potassium**

Samples taken in May 2005 from points 2, 3, 4, 5 and 6 were analysed for potassium and levels were found that exceeded the DWS of 12 mg/l at 2 No. locations. These were 19.2 mg/l and 19.4 mg/l at points 2 and 3 respectively.

#### **3.4.1.6. Zinc**

Levels of zinc elevated above the EQS of 8 µg/l have been recorded at all sampling points, the maximum concentration being 1840.6 µg/l at point 4 on 3<sup>rd</sup> August 2000. Since then zinc levels at point 4 have fluctuated, with a concentration of 623 µg/l recorded, most recently, on 1<sup>st</sup> December 2003. Samples taken in May 2005 at points 5 and 6 found levels of 293 µg/l and 9.75 µg/l respectively.

### **3.4.2. Evaluation of Environmental Impact of Removing Reedbeds**

Since construction at Site C would require disturbing or removing the existing reedbeds it is important to consider the possible environmental impact that this may have. The two main contaminants found by SEPA in samples from Southbar landfill at levels significantly exceeding their Environmental Quality Standards are ammonia and zinc. In order to evaluate whether the existing reedbeds are attenuating these two contaminants, their concentrations in surface waters on either side of the reedbeds have been examined. Monitoring point 2 is located upstream of the reedbeds and point 5 is located downstream. It should be noted, however, that point 5 is a point of confluence for three separate water sources, which will all contribute to the quality of water at this location. Water not only flows towards point 5 from the reedbeds to the north, but also in drainage channels from the landfill to the south, adjacent to the M8, and from the landfill to the south west. Monitoring points 4, 3 and 1, which are located along the channel to the south-west of point 5 have consistently found elevated concentrations of both ammonia and zinc. This indicates that this channel is likely to be contributing towards the concentration of both contaminants in samples taken at point 5. Nevertheless point 5 is located immediately downstream of the reedbeds and is likely to give the most reliable representation of the quality of water exiting the reedbeds.

Samples have been collected from points 2 and 5 on the same date on 10 No. occasions between 9<sup>th</sup> October 2001 and 4<sup>th</sup> May 2005. The results are shown in Tables 1 and 2 below:

| Date of Sampling | Units | Ammonia Concentration at Point 2 | Ammonia Concentration at Point 5 |
|------------------|-------|----------------------------------|----------------------------------|
| 9/10/2001        | mg/l  | 2.13                             | 2.32                             |
| 11/1/2002        | mg/l  | 2.63                             | 4.63                             |
| 25/7/2002        | mg/l  | 6.96                             | 10.10                            |
| 22/11/2002       | mg/l  | 1.37                             | 1.41                             |
| 13/2/2003        | mg/l  | 1.69                             | 6.31                             |
| 18/3/2003        | mg/l  | 4.15                             | 10.35                            |
| 26/6/2003        | mg/l  | 6.23                             | 17.10                            |
| 23/7/2003        | mg/l  | 6.14                             | 16.9                             |
| 1/12/2003        | mg/l  | 1.31                             | 1.17                             |
| 4/5/2005         | mg/l  | 2.21                             | 1.46                             |

**Table 1 – Ammonia Concentrations at SEPA Sampling Points 2 and 5**

Levels of ammonia in surface waters have been higher at point 5 on eight out of ten occasions.

| Date of Sampling | Units | Zinc Concentration at Point 2 | Zinc Concentration at Point 5 |
|------------------|-------|-------------------------------|-------------------------------|
| 9/10/2001        | mg/l  | 46.83                         | 83.58                         |
| 11/1/2002        | mg/l  | 38.48                         | 702.90                        |
| 25/7/2002        | mg/l  | 14.35                         | 38.12                         |
| 22/11/2002       | mg/l  | 24.49                         | 30.84                         |
| 13/2/2003        | mg/l  | 23.28                         | 22.75                         |
| 18/3/2003        | mg/l  | 12.69                         | 21.29                         |
| 26/6/2003        | mg/l  | 5.91                          | 16.74                         |
| 23/7/2003        | mg/l  | 8.40                          | 17.61                         |
| 1/12/2003        | mg/l  | 28.14                         | 102.70                        |

**Table 2 – Zinc Concentrations at SEPA Sampling Points 2 and 5**

Levels of zinc in surface waters have been higher at point 5 on eight out of nine occasions.

Since downstream concentrations of both ammonia and zinc at point 5 have been generally higher than upstream concentrations at point 2 it would appear that the reedbeds are not attenuating these contaminants and their removal would not have an adverse impact on water quality. However, this conclusion is reached tentatively due to the impact of converging water sources at this location.

### **3.5. Ecological Designations**

All sites are located on land classified as an area of unadopted green belt. Consultation with SNH identified one Site of Special Scientific Interest/Special Protection Area approximately 2 km to the south east of Site D at Black Cart Water. This area has been designated due to its overwintering population of whooper swans, which also depend on surrounding land for feeding and occasional roost sites. The whooper swans have, in the past, particularly favoured the River Gryfe at Selvieland and surrounding agricultural land. Activities likely to impact on the birds are disturbance and loss of feeding and roosting sites. An extract of the Sensitive Land Uses Map is shown at Appendix 3.

### **3.6. Mineral Extraction**

There are no economically important mineral resources in the immediate vicinity of any of the four sites. Peat extraction is reported to have been carried out at Site C in the past and anecdotal evidence suggests that some peat remained prior to commencement of tipping at the landfill. It is not considered that extraction of this peat would be economically viable due to its location.

## 4. HISTORICAL DEVELOPMENT

### 4.1. General

The following section refers to the historical development of the sites and their surroundings in as far as its potential to have impacted the sites or to have affected the site settings. This account has been summarised from historical maps shown at Appendix 4 and Local Authority archived files from SEPA relating to the landfill site at Southbar (Site C).

### 4.2. Sites Historical Development

Historical maps of the sites show very little industrial development in the immediate vicinity, with the exception of the construction of the M8 motorway between 1970 and 1976 and also the development of a landfill on Site C between 1978 and 1999. The following tables summarise the information contained in historical maps dating from mid 1800s to 1999.

| Year      | Land Use  |
|-----------|---|
| 1858-1970 | <ul style="list-style-type: none"> <li>• Agricultural land of Craigmuir Farm</li> <li>• Dargavel Road at north of the site</li> <li>• Greenock Road to the west</li> <li>• Linburn Plantation to the east</li> <li>• Well indicated at 24473,66992 from 1858-1863</li> <li>• Drainage ditches indicated on site from 1858-1958</li> </ul> |
| 1978-1999 | <ul style="list-style-type: none"> <li>• Land use as above</li> <li>• M8 motorway along the eastern boundary with Linburn Plantation</li> </ul>   |

**Table 3 – Site A Historical Development**

| Year      | Land Use  |
|-----------|---|
| 1864-1970 | <ul style="list-style-type: none"> <li>• Agricultural land</li> <li>• Dargavel Road at south</li> <li>• Old Greenock Road at east</li> <li>• Well indicated at 24503,67025 in 1863</li> </ul> |
| 1978-1999 | <ul style="list-style-type: none"> <li>• Land use as above</li> <li>• M8 motorway to the west and north</li> </ul>  |

**Table 4 –Site B Historical Development**

| Year      | Land Use  |
|-----------|---|
| 1864-1970 | <ul style="list-style-type: none"> <li>• Agricultural land</li> <li>• Greenock Road at north east</li> <li>• Railway line at south west</li> <li>• Railway siding shown at the south-west of the site from 1919-1922</li> </ul> |
| 1976      | <ul style="list-style-type: none"> <li>• Land use as above</li> <li>• M8 motorway at east</li> </ul>  |
| 1981      | <ul style="list-style-type: none"> <li>• Commencement of land-filling (phases 1 to 4)</li> </ul>  |
| 1989      | <ul style="list-style-type: none"> <li>• Commencement of phase 5</li> </ul>   |
| 1990      | <ul style="list-style-type: none"> <li>• Commencement of phases 6 and 7</li> </ul>  |
| 1999      | <ul style="list-style-type: none"> <li>• As above</li> </ul>  |
| 2003      | <ul style="list-style-type: none"> <li>• Landfill site restored to agricultural land</li> </ul>   |

**Table 5 - Site C Historical Development**

It should be noted that the presence of the Royal Ordnance Factory is not indicated on early maps due to national security. It has been located to the west of Site C, at the other side of the Glasgow/Greenock railway line since 1916. The 1999 OS map notes issues at Site C near monitoring point 4.

| Year      | Land Use  |
|-----------|---|
| 1864-1970 | <ul style="list-style-type: none"> <li>• Agricultural land</li> <li>• Greenock Road at north east</li> <li>• Railway line at south west</li> </ul>  |
| 1976-1999 | <ul style="list-style-type: none"> <li>• Land use as above</li> <li>• M8 motorway at west</li> <li>• Slip road from A8 to M8 indicated on 1976 map at the north of Site D. Made ground is likely to be present at this location.</li> </ul> |

**Table 6 - Site D Historical Development**

#### 4.3. History of Southbar Landfill (Site C)

Southbar landfill is approximately centered at grid reference NS 4467069320 and is now closed and restored although there is still a current waste management license operated by WH Malcolm. Prior to WH Malcolm's occupation, the site is understood to have been used as a council tip for mixed wastes with anecdotal information suggesting the tipping of mainly ash based materials. Anecdotal information received verbally from SEPA suggests that the ash materials were excavated at the time of the extension to the M8 Motorway and used in the construction of the road. Anecdotal information also suggests that boreholes constructed along the southern boundary encountered ashy materials.

The landfill operated under licence since February 1981. In total, there have been 7 phases of tipping resulting in over 500,000 tonnes of waste deposited at the site. Published data from SEPA shows the most recent authorised waste types as:

- Asphalt, bitumen and coated roadstone
- Bonded asbestos
- Brick and concrete rubble
- Ceramics and glass
- Paper and cardboard
- Plasterboard
- Plastic
- Sawdust
- Scrap metal
- Shredded tyres
- Soil
- Wood

Anecdotal information from the operator suggests that the waste types that are most likely to be present in the area of interest would be soils and demolition wastes. It is unlikely that asbestos containing materials would be present in this area.

Tipping phases 1 to 4 (in the area previously used for tipping) operated until March 1999, receiving approximately 1500 tonnes per day of non-hazardous industrial waste. During this time peat extraction was reported to have been carried out, with stripped areas being infilled with waste. However, alternative anecdotal information suggests that not all of the peat was removed before filling.

A falling head permeability test was carried out on 17<sup>th</sup> April 1989, which indicated very soft orange/grey slightly silty clay with a dry density of 1600 kg/m<sup>3</sup>, moisture content of 24.6% and permeability at 20°C of 1 x 10<sup>-9</sup> m/s. These results indicate a practically impervious and impermeable substrate. Application was made on 1<sup>st</sup> February 1989 for a revision of licence to include 100 tonnes per day of pulverised and/or composted waste. It is unclear whether this application was granted.

A waste disposal licence was granted on 21<sup>st</sup> June 1989 for phase 5 with the following stipulations:

- No putricible material was permitted
- Sides had to be lined with a minimum of 1m of clay
- Underlying clay at base had to be graded and compacted to reach a permeability of 1 x 10<sup>-9</sup>
- Gas wells had to be installed to the depth of waste on a 100m grid and also outwith the fill area
- Waste had to be 90% 'muck and rubble' and 10% other specified solids

Leachate described as 'hydrogen sulphide' was noted from phase 5 on 22<sup>nd</sup> January 1990. Foul smelling leachate was noted in the ditch on 9<sup>th</sup> May 1991 and 5<sup>th</sup> June 1992. Phase 5 was closed in July 2002.

On 13<sup>th</sup> September 1990 an application was lodged for phases 6 and 7 and additional tipping in phases 1, 2, 3 and 5. The application included a request for the tipped area to increase in height from 6m to 14m. The area it was planned to extend into was described as 5.73ha of scrub woodland, 4.95ha of agricultural field and 1.89ha of another agricultural field. In October 1990, prior to phases 6 and 7 and as a result of the request for licence, 5 boreholes were drilled for the purpose of recovery of soil samples. Borehole locations are shown at Appendix 5. Borehole 5, which was located closest to the area of proposed road construction, encountered no made ground and found soft clay and silt to a depth of 19.3m underlain by a silty sand to at least 19.9m. The groundwater level was 3.35m b.g.l. and no standard penetration test could be carried out due to falling under the weight of the hammer. The ground investigation concluded that the remainder of the area was underlain by low strength materials with alluvial soils thinning to the north. It was recommended that a 60m wide bund should be put along the boundary.

The landfill closed and was restored to productive agricultural use in 2003.

## 5. ADDITIONAL ENVIRONMENTAL INFORMATION

- Information has been collected from archived SEPA files relating to Southbar landfill and has been summarised in the preceding text.
- Envirocheck reports have been obtained centered on two points, which encompass all four sites. The reports are attached at Appendix 6.
- Information was sought from SNH regarding ecological designations at each of the four sites, their reply is summarised in section 3.5.
- Data was obtained for two BGS boreholes in close proximity to the sites and is summarised in section 3.2.

## 6. PRELIMINARY ASSESSMENT OF IMPACTS

### 6.1. Introduction

Data sourced from SEPA, SNH, BGS and others has been obtained in relation to the sites and their environmental setting. BAE Systems Environmental has reviewed the information in terms of the suitability of sites and the likely impacts of construction works and our conclusions are below.

### 6.2. Impacts on the Water Environment

The risks to surface water and groundwater for each of the possible slip road combinations have been assessed and given a relative rating of 'low', 'medium' or 'high' as shown below.

#### 6.2.1. Risks to Surface Waters

- Option 5 - low
- Option 4a - medium
- Option 4 - high

Since there are no surface waters in the immediate vicinity of Sites A and B (option 5), construction of slip roads at these locations is considered to represent the lowest risk.

Surface water exists at Sites C and D (option 4) in the form of drainage ditches, reedbeds and Lin Burn. While removal of the reedbeds would possibly not pose a serious risk to surface water quality, construction at Site C could also result in disturbing part of the restored landfill. This may result in the release of leachate, which could have an adverse impact on surface water quality. Made ground is thought likely to be present at the north of Site D where a motorway slip road was located previously. Construction at Site D could disturb the made ground, releasing contaminants. Due to the combination of all of these factors, this option is considered to represent the highest risk. Part of this risk, however, will be mitigated by intrusive investigation to delineate the landfill boundary. This will inform engineering designs allowing methodologies to be devised, which would prevent intrusion of the landfill.

Option 4a comprises Site A and Site D, where construction activities would not disturb the landfill, but could potentially disturb made ground at Site D. The potential release of contaminants at Site D could impact on Lin Burn, therefore, this option has been given an intermediate rating.

#### 6.2.2. Risks to Groundwaters

- Option 5 - low
- Option 4a - medium
- Option 4 - high

Groundwaters at all sites are indicated by SEPA to be equally vulnerable. The risks to groundwaters are directly related to the potential for sources of contamination to be present. Since construction at Sites C and D (option 4) has the greatest potential to

release contaminants, this option is considered to represent the highest risk. Option 5 has the lowest potential to release contaminants and is rated as the lowest risk.

It should also be noted that all sites are indicated to be underlain by concealed aquifers or aquifers of limited potential and that no water abstractions have been recorded in the area. Site investigations involving exploratory holes at each location would be required in order to provide a more detailed and accurate assessment of groundwater vulnerability.

### **6.3. Impacts on Ecology and Geological Resources**

SNH has indicated that an area within 2km of Sites C and D has been designated as a Site of Special Scientific Interest (SSSI) due to its winter population of whooper swans. Activities likely to distress the swans and impact on the SSSI are disturbance and loss of their feeding and roosting sites. Since any construction activities at Sites C and D will be localised it is unlikely that they would have any impact on the SSSI.

No regionally important geological or mineralogical resources have been identified at any of the four sites.

### **6.4. STAG Worksheets**

#### **6.4.1. Water Quality**

STAG worksheets (W1) relating to water quality, drainage and flooding at the strategic and project levels have been completed and are shown at Appendix 7. The worksheet is utilised as a tool to assist in appraisal of likely impacts of road construction in areas where surface water, groundwater, land drainage or flood defences exist. Note that this report is only focused on surface and groundwater quality.

Likely impacts on surface and ground waters have been appraised and the impact significance assessed. Option 4 has been assessed as having a slight adverse impact on both surface and ground waters. Of the three possible options that were examined, this represents the greatest negative impact. Option 5 would have no effect on surface water as there are no surface waters in the immediate vicinity and likely impacts on ground water are thought to be negligible. This option would appear to have very little impact on water quality and is, therefore, considered the most favourable. Option 4a is considered to represent slight adverse impacts on both surface and groundwater quality at Site D and is rated as intermediate.

The assessments given in the STAG worksheets agree with the conclusions drawn by the preliminary assessment of impacts in section 6.2, both showing option 5 as the preferred option in terms of minimising impacts on the water environment.

It should be noted, however, that if option 4 or 4a were chosen and construction took place at Site C, the existing measures to treat leachate would likely be improved, resulting in a beneficial impact on water quality.

#### **6.4.2. Geological Features**

Since no geological sites or mineral reserves have been identified at any of the four sites, it was considered unnecessary to complete worksheet G1 in relation to these features.