



Forth Energy

Grangemouth Renewable Energy Plant

Figure 1.1

Site Location

Legend

- Application boundary
- Cooling water infrastructure



0 250 500 1,000 1,500

Metres

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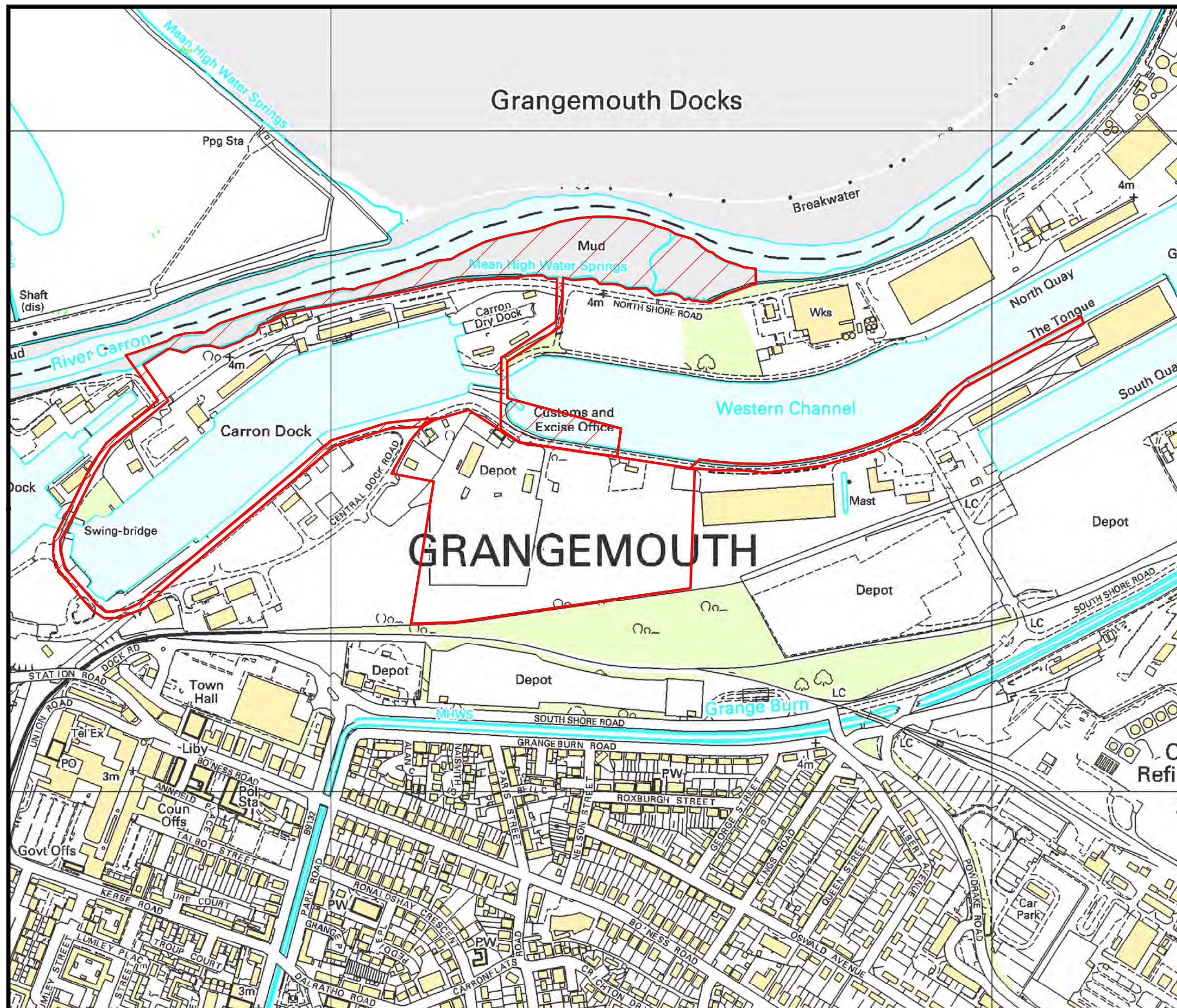
SKM ENVIROS

Forth Energy



Grangemouth Renewable Energy Plant

Figure 1.2

Application Boundary



Legend

-  Application boundary
-  Cooling water infrastructure

0 50 100 200 300

Metres

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SINCLAIR KNIGHT MERZ
SKM ENVIROS

Forth Energy

Volume 1

Non Technical Summary

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1 Introduction

- 1.1.1** Forth Energy is seeking consent from the Scottish Ministers under Section 36 of the Electricity Act 1989 to construct and operate the proposed Grangemouth Renewable Energy Plant with a net electrical output of 100 Megawatts (MWe), on a site at the Port of Grangemouth. At the same time, 'deemed planning permission' under Section 57(2) of the Town and Country Planning (Scotland) Act 1997 (as amended) is also sought from the Scottish Ministers alongside the Section 36 Consent. The combination of these two consenting procedures will mean that Scottish Ministers will grant consent to generate, and also planning permission to use the land for the purposes of electricity generation.
- 1.1.2** The fuel will be sustainably sourced biomass, which is a recognised source of renewable energy¹ and will be used as a fuel to generate renewable electricity and heat. The biomass is burnt in a boiler which produces high pressure steam. This steam is passed through a steam turbine to produce electricity. In addition, steam can be taken from the process and used by customers who require heat for either processes or space heating and hot water. These will contribute to the national reduction of emissions of carbon dioxide (CO₂) and contribute to the attainment of national policy objectives which are aimed at the decarbonisation of electricity and heat generation.
- 1.1.3** This document comprises the Non Technical Summary (NTS) of the Environmental Statement (ES) prepared for the project.
- 1.2 Forth Energy – The Applicant**
- 1.2.1** Forth Energy is a joint venture between Scottish and Southern Energy (SSE) and Forth Ports and has the potential to be Scotland's biggest developer of dedicated renewable power generation facilities. The joint venture is currently progressing renewable energy projects at Forth Ports' sites in Scotland. SSE is the UK's largest renewable energy generator. Forth Ports owns and operates seven commercial ports and manages 280 square miles of navigable waters in Scotland.
- 1.2.2** Forth Energy believes that the Grangemouth Renewable Energy Plant will be a valuable step in tackling the global challenges of climate change and the national challenges of increasing the amount of energy to be generated from renewable sources. In addition the project contributes to addressing the potential generation capacity shortfall and security of energy supply issues.
- 1.2.3** This project will also assist SSE in meeting its supplier obligations under the Renewables Obligation², ensuring that the company plays a vital part in delivering solutions to the issues and challenges that face society today.
- 1.3 The Need for this Project**
- 1.3.1** There is a strong policy drive at a European, UK and Scottish level to continue to develop renewable energy. International, UK-wide, and national commitments have been made to address the effects of climate change and to achieve greater security in the domestic supply of energy.
- 1.3.2** In summary, these European, UK Government and Scottish Government policies establish a strategic need for additional renewable energy generation capacity to be developed to assist in tackling climate change. Furthermore, the UK needs to address the potential future electricity generation gap, where electricity demand could outstrip supply due to the closure of older generating stations on the system, as well as ensuring that

¹ The 'UK Renewable Energy Strategy' (UKRES), Department of Energy and Climate Change (DECC) (July 2009).

² Renewables Obligation Order 2009

the country maintains its security and diversity of energy supply. The Renewable Energy Plant is considered to be a valuable addition to the UK's energy generation portfolio and will assist in securing the UK's energy supply.

- 1.3.3** The proposed Grangemouth Renewable Energy Plant would have significant advantages compared to other renewable technologies such as wind power, hydroelectric, solar and photovoltaics, which, whilst being valuable sources of renewable energy, are intermittent in nature.
- 1.3.4** The degree of intermittency is commonly referred to as the 'load factor'³. The Grangemouth Renewable Energy Plant's design load factor is 85%, meaning that the power generation capacity will be available 85% of the time, which will assist the National Grid in balancing short term electricity supply with demand and maintaining the integrity of the national electricity transmission system.
- 1.3.5** Forth Energy believes a broad range of technologies need to be deployed to address the challenges that are faced in relation to renewable energy and climate change. The proposed development will make a direct contribution to achieving renewable energy generation and renewable heat deployment targets thereby implementing Government policy at the UK and Scottish levels, which encourages more electricity generation and heat usage from renewable sources.
- 1.3.6** As part of this necessary generation mix, Forth Energy is proposing to construct and operate the Renewable Energy Plant at the Port of Grangemouth. The total renewable electrical output for the site will be up to 100 megawatts (MW) of electricity, expressed as MWe. Gross electricity production will be approximately 118 MWe, with a net export capacity of 100 MWe, the balance of power being used to operate the plant. The plant will also be capable of exporting up to 200 MWth (Megawatts thermal) of renewable heat to nearby users. In terms of electricity generation, the Renewable Energy Plant has a strategic fit with the requirements of the Falkirk Council area, in that it will be large enough to supply nearly all of the area's (industrial, commercial and domestic) electricity requirements (i.e. c. 92%⁴).
- 1.3.7** In terms of annual carbon emission savings, expressed in terms of avoided greenhouse gas emissions, the average annual savings for the Renewable Energy Plant would be 0.16 Mega Tonnes⁵ of CO₂e. In terms of life time carbon emission savings, taking into account the reduction in carbon in the UK electricity transmission grid, the savings over the life time of the Grangemouth plant are estimated to be approximately 3.2 Mega Tonnes of CO₂e over the lifetime of the plant (assuming the plant is operational for at least 20 years).
- 1.3.8** The electricity and heat produced by the Grangemouth Renewable Energy Plant would therefore contribute positively to the policy objectives outlined above, by producing renewable energy and heat over its lifetime and thereby reducing greenhouse gas emissions from UK power generation.

1.4 Environmental Statement

- 1.4.1** This Environmental Statement (ES) accompanies an application for consent (under Section 36 of the Electricity Act 1989) for the proposed Renewable Energy Plant. The application is submitted to the Scottish Government Energy Consents Unit (SGECU) which processes the application on behalf of the Scottish Ministers. The Grangemouth Renewable Energy Plant ES is the formal written statement of the findings of the development's environmental impact assessment (EIA), and addresses the predicted positive and

³ The Load Factor is calculated by dividing the amount of electricity that a plant produces over a year by the amount of electricity it could have produced if it had run at full power over that same period.

⁴ The Digest of UK Energy Statistics states that the current load across Falkirk district on an annual basis is 806 GWh, (this is net of the Grangemouth refinery complex's internal energy requirements), the proposed plant will provide 745 GWh, with an assumed availability of 85%.

⁵ This is based on a grid factor of 0.570 kgCO₂e/kWh, approximate 85% plant availability, 100MWe net output

negative impacts on the environment during the construction, operation and decommissioning stages of the proposed Renewable Energy Plant and proposes mitigation measures where necessary to limit significant environmental effects. The EIA has been undertaken in accordance with the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000⁶ and subsequent amendments (the EIA Regulations).

1.4.2 The ES is intended to allow the reader to understand the nature of the proposed development and to evaluate the likely significant environmental effects. It therefore acts to aid the decision-making process and to present information in a readily accessible form.

1.4.3 The Grangemouth Renewable Energy Plant ES comprises five separate volumes:

- Volume 1: Non Technical Summary (this document);
- Volume 2: ES Main Text;
- Volume 3: Appendices;
- Volume 4: Transport Assessment; and
- Volume 5: Figures.

1.4.4 The following documents have also been prepared to accompany the Section 36 Application:

- Planning Statement;
- Design Statement;
- Sustainability Statement;
- Combined Heat and Power Feasibility Study;
- Fire Prevention Method Statement; and
- Statement of Participation.

1.4.5 Details on how to view or purchase copies of the ES are provided within Section 7 of this NTS. Through the publication of the ES, stakeholders are encouraged to contribute to the consenting and development process by active participation in the application consultation process. Further information on stakeholder consultation is provided in Section 5.

1.5 Non-technical Summary

1.5.1 This Non Technical Summary or NTS presents, in non-technical language, the findings of the EIA. The publication and circulation of this NTS is intended to assist stakeholders in understanding the predicted positive and negative impacts of the proposed development in relation to its surrounding environment.

⁶ Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000

2 Description of Proposed Development

2.1 Introduction

- 2.1.1** Forth Energy is currently considering a variety of renewable energy projects at Forth Ports' sites in Scotland and is developing these where viable and sustainable projects are identified. In addition to the four proposed Renewable Energy Plants, Forth Energy is currently progressing wind turbine projects at Dundee and Grangemouth. To complement the variable nature of renewable generation, such as wind, Forth Energy recognised the need to develop base load renewable power generation, with biomass being the most appropriate renewable fuelled base-load option. The need for such baseload power also arises from the current and planned closures of this large number of existing power plants in the UK and the Scottish Government's resistance to the development of new nuclear power generation.
- 2.1.2** Forth Energy is ideally situated to develop biomass power generation due to the land ownership portfolio of Forth Ports. Ports are the obvious locations for siting Biomass Renewable Energy Plants as the substantial quantities of fuel required by the plants can be transported by ship, which is the most carbon efficient form of transportation for bulk cargo. The facilities owned by Forth Ports have existing infrastructure for handling large quantities of biomass. The Ports are considered industrial locations, with adjacent urban hinterlands that have potentially strong electricity and heat demands.
- 2.1.3** The general location of the proposed development within the Port of Grangemouth is shown in Figure 1, with the location of the Section 36 Application boundary shown in more detail in Figure 2. The site has been selected as a location for biomass development due to the presence of the nearby operational quay capable of taking suitably sized ships from national or international sources and the infrastructure to receive and discharge large quantities of biomass. In addition, the site is located within a designated general economic development area, with close road links for deliveries of biomass fuel sourced from UK suppliers and for ash removal. The availability of a sufficiently large area of land, and the availability of an electrical connection were also factors in the site's selection. The industrial area and proximity of other mixed use consumers is considered likely to include potential customers with a demand for steam and/or heat from the electricity generation process of the Renewable Energy Plant.
- 2.1.4** The plant will export up to 100 MWe of renewable electricity and up to 200 MWth of renewable heat to local users from the use of up to 1.5 million tonnes per year of biomass fuel (dependent upon energy content, termed the 'calorific value').
- 2.1.5** The plant is intended to operate on a full time basis, 24 hours a day, except during maintenance downtime. The application boundary shown in Figure 2 includes:
- the main plant area;
 - an area of search for the installation of the cooling water intake (within the Western Channel);
 - two alternative infrastructure corridors for the installation of cooling water discharge pipes, ;
 - an area of search for the installation of the cooling water outfall (in the vicinity of the River Carron); and
 - an infrastructure corridor for the fuel transfer conveyor (along the Central Dock Road).
- 2.1.6** Fuel will be transferred to the power plant areas via an enclosed conveyer belt system. There are two potential layout options, as shown in Figures 3.1 and 3.2. Figure 3.1 shows a layout including a circular open-air fuel storage facility, which would be utilised if the fuel used in the Renewable Energy Plant comprises predominantly woodchip. Figure 3.2 shows a layout where the main fuel store comprises silos which would be necessary if the fuel used is predominantly wood pellets.

- 2.1.7** The construction period for the proposed development will be approximately 36 months. It is expected that the construction workforce will peak at approximately 500 although average numbers will be in the order of 300 over the three year construction period. An operational workforce of about 40 is anticipated. In addition, the project will also support 10 existing and 21 new port operations staff who will undertake the fuel handling.
- 2.1.8** The potential for the plant to increase its efficiency through the supply of steam and/ or hot water to nearby facilities has been investigated. Discussions are ongoing with a number of potential heat users and it is Forth Energy's intention that the plant will be designed and built to enable renewable heat/steam to be supplied to local users where commercially feasible. The proposed plant will be 'heat ready' as it will include appropriate off-takes to enable steam or hot water to be supplied to local customers.
- 2.1.9** The onshore element of the proposed development site will comprise:
- the main plant and fuel storage area;
 - an area of search for the installation of the cooling water intake;
 - two alternative infrastructure corridors for the installation of cooling water discharge pipes;
 - an area of search for the installation of the cooling water outfall; and
 - an infrastructure corridor for the fuel transfer conveyor.
- 2.1.10** The site will incorporate fuel storage, a power plant area, an electrical switchyard and a covered conveyer system for transferring fuel. The design of the Renewable Energy Plant includes a 110 m high stack, a boiler hall 65 m tall, a turbine hall 30 m tall, main fuel and mixed fuel stores, (33 m and 20 m tall respectively), ash silos 12 m tall and two auxiliary boilers with a single 45 m stack, containing two flues. The layout of the development has been derived from the appropriate siting and orientation of the plant and its components, taking account of the principles of good design, ensuring operational safety and having regard to a number of environmental and technical considerations.
- 2.1.11** Sections 2.2 to 2.8 describe each of the main components of the proposed plant. Further details are provided in the ES.

2.2 Fuel Type and Source

- 2.2.1** It is intended that the plant will operate with a range of biomass fuels. All biomass fuels will comply with the requirements and definitions of biomass as defined in the Renewables Obligation Order⁷. The fuel mix for the Renewable Energy Plant will primarily comprise wood chip or wood pellets with the remainder from other biomass fuels as outlined in Table 2.1 below. All biomass fuels will be sustainably sourced, as set out in the Sustainability Statement that accompanies this application.

Table 2.1: Fuel mix

Wood (70-90%)	Other Fuels (10-30%)
Wood Chip or pellets: Virgin Timber - including short rotation forestry (e.g. eucalyptus) Forest residues	Purpose Grown Energy Crops: Short rotation coppice (e.g. willow) Grasses (e.g. miscanthus) Agricultural residues (e.g. rape seed meal) Recovered Biomass Materials: Timber (including treated timber) Paper Cardboard

⁷ Renewable Obligation Order 2009.

2.2.2 Fuel will arrive at the Renewable Energy Plant in numerous physical forms, however the majority of biomass will comprise wood chip or wood pellets (virgin timber and forest residues).

2.3 Fuel Storage and Handling

2.3.1 Fuel will mainly be delivered to the plant via ship (at least 90% of the fuel used), discharged at the existing quay and transferred to the fuel storage area, via a covered conveyer system. The delivery of fuel will result in circa 120 vessels per annum i.e. one to two vessels per week. The plant will also be capable of accepting up to 10% of its fuel by road (equivalent to 24 lorry loads per day). Fuels will be stored in dedicated fuel storage areas such as a circular open-air facility (for wood chips); silos (for wood pellets) and an enclosed fuel storage shed for material delivered by road. Ships will be unloaded at The Tongue (an operational area within the Port of Grangemouth) using cranes with grabs onto a conveyer to the main fuel store via a series of hoppers.

2.3.2 The Renewable Energy Plant will require up to 1.5 million tonnes of biomass per year (dependent upon the calorific value of the fuel). The main fuel store will accommodate up to 38,000 tonnes of biomass. This is sufficient fuel for 9 days continuous operation of the plant.

2.4 Power Generation

2.4.1 The proposed combustion technology will use either a Fluidised Bed (FB) or Pulverised Fuel (PF) boiler, which are proven designs used in similar plants currently in operation throughout Europe. They are considered to be the most efficient technologies in the context of the range of available fuels that are proposed for use.

2.4.2 The boiler will supply steam to a single steam turbine and generating unit, producing a total of approximately 118 MWe of renewable electricity. It is currently estimated that 18 MWe will be required to supply on-site equipment, resulting in an export capacity of 100 MWe.

2.4.3 Forth Energy aims to optimise the environmental and economic benefit from the Grangemouth Renewable Energy Plant. The overall energy efficiency of the plant will be improved by incorporating Combined Heat and Power (CHP) technology (i.e. the export of renewable heat to nearby users), including process use and space heating into the design. The opportunities for CHP in the vicinity of the proposed site have been investigated by Forth Energy as described in the CHP Feasibility Study which accompanies the Section 36 Application.

2.4.4 There are two possible means of extracting the heat from the plant: these are either via flue gas condensation or using steam bled from the main turbine, subject to the quantity and temperature of heat required.

2.4.5 Initial discussions have been held with process industry heat customers and the proximity of the Grangemouth Refinery provides a considerable opportunity for Forth Energy to supply an element of its process heat needs. A total potential of 200 MW of process heat supply has been identified between the Refinery and a number of other process heat users. Initial discussions have been held with the management at the Ineos Refinery whose production facilities are located immediately adjacent to the Port.

2.4.6 Discussions with Falkirk Council have identified potential for the development of a District Heating network to service Grangemouth town centre. The quantity of medium grade heat available from the flue gases suggests that there is the potential to supply a District Heating network with a capacity of up to 19 MW.

2.4.7 The CHP Feasibility Study demonstrates that there is significant potential for a realistic volume of heat to be supplied from the Grangemouth Renewable Energy Plant. As with all project opportunities of this nature, it will only be possible to undertake detailed feasibility studies and for commercial discussions around contractual terms and conditions to take place, following the granting of consent. Customers will need the confidence that the development of the Grangemouth Renewable Energy Plant will proceed before they can commit to a contractual relationship with the plant operator.

- 2.4.8** To ensure that medium grade heat can be supplied continuously, even when the plant is undergoing maintenance, two small, light fuel oil-fired auxiliary boilers (2 x 10 MWth) and a heat accumulator will also be installed to meet the heat demand when main boiler is not operational.

2.5 The Cooling System and Aqueous Discharges

- 2.5.1** A hybrid cooling system with a small visible plume will be used, abstracting water from the impounded dock (i.e. the Western Channel) to condense both the turbine exhaust steam and provide cooling water for other parts of the plant. This cooling water will be intermittently discharged to the River Carron to control the level of soluble solids within the system.
- 2.5.2** There will be two rows of six cooling tower cells (each 80 m by 20 m by 23 m in height - see Figures 3.1 and 3.2). The cooling tower will be free of visible plumes when ambient temperatures are above 5°C and the relative humidity is less than 95 %. At this location this would result in the frequency of occurrence of a visible plume of less than 2.5 % per year of daylight hours, based on five years' (2005-2009) relative humidity and temperature data available from the meteorological station at Edinburgh Gogarbank, approximately 24 km to the south west of the site.
- 2.5.3** Cooling water will be abstracted via an intake structure located in the western end of the impounded dock, within an area bounded by dolphins which prevent ship navigation in this area. Cooling water pumps will be installed within a pump-house, which will be located in the boiler hall. The cooling water outfall infrastructure will be located within the 'area of search for cooling water infrastructure' on the River Carron (see Figure 4), in a location that will not impact on navigation and be acceptable to the Navigation Authority; British Waterways.
- 2.5.1** Process effluents from the Renewable Energy Plant will comprise cooling water, boiler blow-down, water treatment plant effluent, flue gas condensate and other minor discharges. The remaining process effluents will be discharged to the Forth Estuary via the River Carron, and the discharge will comply with the limits agreed with SEPA as part of the project's Pollution Prevention and Control (PPC) Permit⁸. It is proposed that the flue gas condensate will be treated on site and discharged to the local sewerage system. Domestic sewage may also be discharged directly to sewer with the flue gas condensate or be treated in a package treatment plant (such as a biocube) prior to discharge to the River Carron.
- 2.5.2** Surface water will be discharged to the dock. Surface water drainage from the Renewable Energy Plant (from areas with a potential for oily contamination, such as in the vicinity of the combustion plant) will pass through an oil interceptor prior to discharge.

2.6 Flue Gas Treatment

- 2.6.1** The combustion temperature and residence time of the fuel in the boiler will be controlled to ensure high efficiency combustion and low carbon monoxide formation, whilst also limiting the formation of nitrogen oxides (NOx). Emissions of NOx will be reduced further by two recognised methods known as Flue Gas Recirculation and Selective Non Catalytic Reduction (SNCR), if required. The flue gases will exit the boiler and pass through fabric bag filters to control and reduce particulate emissions.
- 2.6.2** The flue gas abatement equipment will be designed to ensure that the emission limits set by the Scottish Environment Protect Agency (SEPA) will be met for all fuels and fuel mixes used in the plant. The flue gases will discharge to the atmosphere via the 110 m high stack.

2.7 Electricity Export

- 2.7.1** A new substation will be built onsite to transform and transmit the electrical output from the plant to the local 132 kV network via a 132 kV underground electrical connection onto the main national transmission network

⁸ Pollution Prevention and Control (Scotland) Regulations 2000.

at Bainsford substation. The connection between the Renewable Energy Plant and the point of connection will be undertaken by the host network operator Scottish Power Transmission Limited (SPTL) under their permitted development rights. The routing and design of the connection will therefore be undertaken by SPTL. The cable installation is expected to be laid using the traditional open-cut method with cables buried directly in the ground.

2.8 Carbon Capture

2.8.1 The Renewable Energy Plant is a low carbon technology and it is not therefore proposed to design or build the plant to be Carbon-Capture Ready. The plant is also below the 300 MWe European Union threshold⁹ for the consideration of Carbon Capture Readiness.

2.9 Cumulative Impact

2.9.1 In line with the EIA Regulations and good practice, the EIA takes into account other existing and planned development in the area of the proposed site and considers the cumulative impacts associated with these developments. The following proposed projects may have cumulative impacts with the proposed Renewable Energy Plant:

- Grangemouth Biodiesel Plant (consented);
- Longannet Biomass Plant (consented);
- Rosyth Renewable Energy Plant (EIA stage); and
- Leith Renewable Energy Plant (EIA stage).

2.9.2 The environmental assessments, summarised in Section 6, include a consideration of the potential for cumulative impacts with the above projects, where relevant.

⁹

Towards Carbon Capture and Storage: Government's Response to Consultation <http://www.berr.gov.uk/files/file51115.pdf>

3 The Site

3.1 Description of the Application Site

- 3.1.1** The application site is located on generally level land within the Port of Grangemouth and covers an area of 18.05 hectares (ha).
- 3.1.2** The main plant area is bounded by Central Dock Road and the Western Channel to the north; Central Dock Road to the west; a railway line to the south; and industrial works to the east. The site is accessed from the North Shore Road, which forms an arm of the A904 Earls Road / Station Road roundabout providing access to the Port from the M9 (Figure 1).
- 3.1.3** The main plant area is currently used for secondary port activities, to support general cargo activities all of which can be supported in other areas of the site. The Port of Grangemouth is the largest container port in Scotland and operates with full marine services and cargo handling activities 24 hours per day, seven days a week. The port is capable of taking suitably sized ships from national or international origins as well as having the infrastructure to receive and discharge large quantities of biomass. Part of the main plant area is currently occupied by a haulage business (Duncan Adams). The activities associated with this facility will be relocated within the secure port estate and the site cleared prior to construction commencing.
- 3.1.4** The Carron Dock and Western Channel lie to the north of Central Dock Road. The River Carron runs 100 – 150 m parallel to the docks to the north and the Grange Burn and is located 200 m to the south of the closest site boundary. While the closest shoreline of the Forth Estuary is 100 m to the north of the site (i.e. the southern bank of the River Carron at this location), the River Carron and docks join the estuary approximately 2.3 km to the north east.

3.2 Application Site Surroundings

- 3.2.1** The area surrounding the proposed site is flat, with the Forth Estuary to the north, the town of Grangemouth to the south, industrial complexes on Earls Road to the west, and the Grangemouth Refinery and petrochemical complexes to the east. To the south, Grangemouth is bordered by the M9 motorway.
- 3.2.2** The site is located within an industrial port with oil and gas importation, exportation and storage infrastructure and facilities located around the Eastern Channel of the Port. There are container storage and handling areas positioned around the Grange Dock and a fish meal plant adjacent to the Western Channel. The warehousing, industrial building and plant within the docks are typically 20 m or more in height. Longannet Power Station is located directly across the Forth Estuary, to the north of the port and comprises an 80 m high boiler house and associated stack 183 m in height. In general, the character of the port and the estuary at this location is broadly industrial.
- 3.2.3** The nearest residences to the proposed development are located 200 m to the south of the site boundary. Tree lines along the boundary of the port and the Grange Burn provide these residences with protection against direct views of the port. The north side of the River Carron comprises agricultural fields, some isolated houses and the small community of Skinflats.
- 3.2.4** In the vicinity of the application site there are a number of recreational facilities including Falkirk Football Club's stadium located approximately 3 km to the southwest, Grangemouth Sports Complex and Grangemouth Sports Stadium located approximately 2 km to the southwest, and Grangemouth Golf Course located approximately 3 km to the south southeast.
- 3.2.5** The application site is adjacent to the Firth of Forth Special Protection Area (SPA) and Site of Special Scientific Interest (SSSI). Important mudflats at Kinniel are located to the immediate east of the port and Skinflats to the west. These areas are designated as they support large numbers of nationally and internationally important bird species.

- 3.2.6** There are a number of Sites of Special Scientific Interest (SSSI) within 10 km of the application site, the closest of which include Avon Gorge SSSI (3.4 km to the southeast); Carron Dams SSSI (5.7 km to the west); and Bo'mains Meadow SSSI (6 km to the southeast).
- 3.2.7** Edinburgh International Airport is located some 24 km southeast of the site and Glasgow International Airport is located just over 47 km to the south west. Falkirk Council is the relevant local authority for the site, with Fife Council's administrative area on the northern bank of the Forth Estuary.

4 Stakeholder Consultations

- 4.1.1** In progressing the Renewable Energy Plant through the EIA and Section 36 consent application stage, Forth Energy and the EIA team have undertaken consultations with the Scottish Government's Energy Consent Unit (SGECU), Falkirk Council, SEPA and Scottish Natural Heritage (SNH) (the latter three are termed the 'statutory' consultees for the Section 36 application process) and a large number of other stakeholders.
- 4.1.2** These consultations have included the formal submission of a Request for a Scoping Opinion under the EIA Regulations, and supplemental consultations with non-statutory stakeholders to obtain a wide spectrum of views.
- 4.1.3** In addition, the public consultation programme comprised: a meeting held with Grangemouth Community Council in February 2010; an initial public exhibition on the 18th, 19th and 20th of February at La Porte Precinct, Grangemouth; and a second public exhibition at the same location on the 25th and 26th of June.
- 4.1.4** At each exhibition a series of display boards were used to provide information on the nature and purpose of the project. Representative of Forth Energy were on hand for the duration of the exhibitions to answer questions on the proposals. Initial engagement with community councils and members of the public was undertaken early in the development of the project in order to obtain the local community's initial opinions and hear concerns, in order to inform the EIA and project design. Forth Energy returned to the local community to provide responses to the questions raised by members of the public at the earlier engagement events, as well as providing additional information about the proposals. Details of each public exhibition were publicised in an advertorial and a public notice in the local newspaper, the Falkirk Herald, and also through the distribution of posters, leaflet delivery to local households and newsletter distribution in the general area. This consultation is detailed in the Statement of Participation which accompanies the Section 36 Application.
- 4.1.5** The relevant views of stakeholders have been incorporated into the ES, and Forth Energy would like to thank all stakeholders who have taken part in the consultations to-date.
- 4.1.6** Forth Energy will publicise the submission of the Section 36 Consent Application by placing a notice in the local press (Falkirk Herald), at least one national newspaper on two occasions and over two successive weeks and also within the Edinburgh Gazette, thereby ensuring members of the public and other stakeholders are aware of the development and are informed as to where they may obtain information on its environmental effects.
- 4.1.7** Throughout the Section 36 determination period, Forth Energy will continue to consult with stakeholders to address any queries which they have, and to assist in the on-going detailed design of the project. Forth Energy has established a dedicated project website (www.forthenergy.co.uk) which will act as an information resource to the public, outlining the progress of the development and arrangements for future engagement events.

5 Site Selection

- 5.1.1** Ports with operational berths are ideal locations for the installation of biomass-fired Renewable Energy Plants as they have existing infrastructure for handling large quantities of biomass. The fuel can be delivered by ship, which is the most carbon efficient form of freight transportation. They are also industrial locations, with urban hinterlands, with a strong demand for electricity and potentially heat. Such locations also provide access to cooling water for the plant.
- 5.1.2** Forth Ports owns the following six ports in Scotland:
- Grangemouth (Firth of Forth);
 - Leith (Firth of Forth);
 - Burntisland (Firth of Forth);
 - Rosyth (Firth of Forth); and
 - Methil (Firth of Forth);
 - Dundee (Firth of Tay).
- 5.1.3** A high level assessment was undertaken initially, to assess the six Scottish ports for their suitability for the construction and operation of a Renewable Energy Plant. The following technical requirements were considered at this early screening stage:
- **Presence of appropriate marine access and a suitable quay** that is capable of accommodating sufficiently large vessels from national or international sources;
 - **Land availability** – sufficient area of land must be available within Forth Ports' landholding, close to the quay so that fuel can be efficiently transferred;
 - **Electrical connection** – a 132, 275 or 400 kV electrical network must be available in close proximity to connect the Renewable Energy Plant to the electricity transmission system economically; and
 - **Opportunities for Combined Heat and Power (CHP)** – proximity to existing or potential future heat users or the availability of land for co-locating a possible heat user.
- 5.1.4** The Ports of Grangemouth, Leith, Dundee and Rosyth were each identified as meeting the above technical requirements and therefore being potentially suitable as the location of a large-scale Renewable Energy Plant.
- 5.1.5** Five potentially suitable sites were identified at the Port of Grangemouth:
- The selected 5.9 ha Distribution Centre site;
 - An area covering 2.6 ha referred to as 'Areas Q & S' currently used for storage of wind turbine components;
 - A 3.5 ha site at Junction Dock which would require infilling prior to use;
 - A disused 27.75 ha site known as the 'Deep Water Berth Terminal Area'; and
 - A disused 10.25 ha site referred to as 'Areas P & Q'.
- 5.1.6** The five sites were assessed against the above technical requirements and also the following additional criteria to assist in selecting the preferred location and to identify any unacceptable environmental impacts:
- **Cooling water supply** – proximity to a water body with sufficient water available for water cooling of the power plant condenser to achieve a high plant efficiency. All sites at Grangemouth are adjacent to the Firth of Forth, an ideal source of cooling water;
 - **Road access** – adequate access to the site from the national road system must be available to facilitate access during construction, for the transportation by road of limited percentages of fuel and for operational staff. The selected site has good access via the M9;

- **Sensitive land use receptors** – proximity to residential and other sensitive land uses, with respect to air quality, noise and visual amenity. The selected site is closer to sensitive receptors than the alternative sites at Grangemouth however potential environmental impacts can be controlled so that no significant impact occurs at the housing in proximity to the site;
- **Archaeology** – the presence of or proximity to cultural heritage features, in particular nationally designated sites such as Scheduled Monuments and Listed Buildings. There are no known features of historic interest registered within any of the five sites considered in detail;
- **Air Quality** – a review of local air quality and the potential of the area to accommodate an additional source of atmospheric emissions. Forth Energy was advised that with an appropriately designed stack height and emissions abatement, the proposed Renewable Energy Plant could be located at any of the sites with no significant impact on the air quality in the vicinity;
- **Ecology** – proximity to national, international and locally designated sites and potential presence of protected species on site. The selected site was considered to be the most favourable with respect to ecology, as this site is furthest from the Firth of Forth Special Protection Area (SPA). This site is also buffered from the SPA by development to the east and the docks to the west. This site was considered least likely to have an impact upon the SPA. The findings of the EIA have confirmed that with appropriate mitigation, the proposed Renewable Energy Plant could be constructed and operated at this site such that it has no significant impact on any of the designated sites in the area;
- **Settings and views** – proximity to National Scenic Areas, Regional Scenic Areas, Candidate Special Landscape Areas, Areas of Great Landscape Value, Registered Historic Gardens and Designed Landscapes and Conservation Areas. The general setting of the area is industrial, however the setting and views of the five potential sites were not considered to be a significant differentiator in the site selection process; and
- **Climate change** – any risks posed to the site as identified by recent future climate scenarios produced by the UK Climate Impacts Programme. The most recent future climate scenarios¹⁰ indicate that the selected site is currently at a lower risk of flooding than the other options as it is located in flood zone one.

5.1.7 The site selection studies indicated that the Distribution Centre site would be the most suitable for the location of the proposed Renewable Energy Plant. Following a review of the site selection criteria and the identified significant differentiators, it was judged that the main considerations at Grangemouth were the selected site's proximity to potential heat users and the ecology and transport issues presented by the other potential sites. Thus the Distribution Centre site was considered to be the most favourable site.

5.1.8 The vicinity of the preferred site has also been identified by Forth Ports for future development to attract further port trade to this area, including the development of additional warehousing, container storage and additional businesses to improve the services available at the port and to enhance Grangemouth's role as the premier port in Scotland. The development of a Renewable Energy Plant on the Distribution Centre site would facilitate the distribution of heat, electricity and cooling (where required) to this area.

¹⁰ <http://ukclimateprojections.defra.gov.uk/>

6 Summary of Environmental Effects

6.1 Air Quality and Climate Change

6.1.1 The Environmental Statement assesses the potential impacts on air quality during the construction, operational and decommissioning phases of the proposed Renewable Energy Plant. The assessment has considered the following:

- Investigation of baseline conditions;
- the potential impact of dust during the construction, operational and eventual decommissioning of the Renewable Energy Plant;
- the potential impact on human health due to emissions from road vehicles travelling to and from the Renewable Energy Plant during the construction and operational phases;
- the emission and dispersion of a range of substances from the combustion of biomass during the operation of the plant and the likely effects on human health;
- the potential effects of acid and nitrogen deposition at designated habitat sites during the operation of the plant; and
- the frequency of visible moisture plumes from the main stack.

6.1.2 In addition to the dissemination of the Scoping Statement, discussions have been held with Falkirk Council and the Scottish Environment Protection Agency with regard to the scope and methodology of the assessment, and the nature and extent of baseline information available for use within the assessment.

6.1.3 A review of existing ambient air quality in the area has been undertaken to understand the baseline conditions, including the location and nature of existing sources of emissions in the locality of the proposed development site. These existing conditions were determined by review of the extensive data already available for the area. It has not been necessary to carry out any new ambient air quality monitoring as sufficient data is already available to undertake a robust assessment.

6.1.4 Dust emissions during construction, operation and decommissioning will be controlled through the implementation of a range of mitigation measures including those incorporated into the plant design and including monitoring when necessary. This will ensure any impacts are minimised and no significant impacts are predicted.

6.1.5 The evaluation of traffic emissions using dispersion modelling concluded that the impact of the proposed Renewable Energy Plant is forecast to be insignificant during construction (around 600 daily traffic movements (this is the estimated total proposed movements for two way traffic)) and operation (around 114 daily traffic movements including fuel deliveries and staff vehicles).

6.1.6 The potential effects of emissions of the proposed Renewable Energy Plant during the operational phase were assessed using computer based atmospheric dispersion modelling techniques where appropriate, and other applicable approaches. The study used worst case assumptions and took existing pollution levels into account. In view of the process and emission controls integral to the design and operation of the facility, it was forecast that all relevant air quality standards and guidelines will be achieved. The most appropriate stack height was determined to be 110 m above ground level.

6.1.7 As well as considering air quality standards and guidelines, the health risks associated with the residual emissions from the proposed facility were evaluated and found to be small in comparison to available Government benchmarks for insignificant level of risk. On this basis, it is concluded that there will be no significant adverse effects on human health as a result of emissions from the proposed development.

6.1.8 The dispersion modelling deposition assessment shows that the proposed facility could have a relatively small effect on the designated nature conservation sites in the vicinity of the proposals. Levels of acid deposition at the Bo'ness area of the Firth of Forth SPA exceeded 1% of the relevant critical load, which triggers the need for an Appropriate Assessment of this site. Levels of acid and nitrogen deposition also exceeded 1% of the relevant critical loads at Slamannan Plateau SPA. When including the Rosyth and Leith Renewable Energy Plants, modelled levels of cumulative acid deposition at Blawthorn Moss SAC and Black Loch Moss SAC exceeded 1% of the relevant critical load. The process contribution at these sites is a small fraction of existing background levels of deposition, and it is considered any effects from the proposed Renewable Energy Plant are unlikely to be significant.

6.1.9 The frequency of visible moisture plumes from the main stack has been assessed.

6.1.10 The residual impact on air quality due to the construction, operation and decommissioning of the Renewable Energy Plant has therefore been assessed as not significant for the various pollutants and aspects considered. The predicted environmental concentration (i.e. the process contribution plus background levels) are within the relevant air quality objectives and environmental assessment levels for each pollutant considered.

6.2 Landscape and Visual

6.2.1 The Environmental Statement assesses the potential impacts on Landscape and Visual receptors of the construction, and operational phases of the proposed Renewable Energy Plant. The assessment has included consultation with Scottish Natural Heritage (SNH), desk studies and site surveys, to establish the current landscape and visual baseline of the application site and surrounding areas. In addition a Zone of Visual Influence (ZVI) has been produced to determine the extent of visual influence of the taller elements of the proposed Renewable Energy Plant. This work has assisted in the selection of appropriate and representative viewpoints for assessment.

6.2.2 Landscape impacts have been considered against a baseline study which looked at the receiving landscape in terms of existing landscape designations, existing landscape character assessment, settlement and an urban analysis of areas which currently fall outside SNH character areas. Nineteen visual receptors have been chosen to represent views and visual amenity within the study area from a variety of different locations and distances from the application site.

6.2.3 Cumulative impacts have been assessed for proposed projects within a 30 km study area where the potential of significant additional landscape and visual impacts when combined with the proposed Renewable Energy Plant may occur. The projects considered include: the proposed Biomass plant at Longannet and the Forth Energy proposed Renewable Energy Plants at Rosyth and Leith.

6.2.4 The proposals have been assessed on the basis of a basic engineering form and it is this which has been used to generate the visual wireframes and photomontages within the ES. An architectural strategy has been considered as a secondary phase of mitigation which has been developed during the ES and will be completed following a successful Section 36 application. This architectural strategy has been developed by Gordon Murray Architects and forms part of the Design Statement that accompanies the ES. The potential outcomes following the application of this architectural strategy on the assessed basic engineering form are discussed for both the landscape and visual impacts identified.

6.2.5 No significant landscape effects were recorded for the application site itself and no significant effects were noted on the character elements of the Port and Town of Grangemouth. Landscape effects beyond the immediate urban expanse of Grangemouth were found to be minor and not significant.

6.2.6 Of the nineteen visual receptors analysed four are considered to have significant impacts, with one of these visual impacts only becoming significant when the plume from the proposed Renewable Energy Plant is visible. Generally the largest visual impacts are from those receptors within 2 km of the application site and within this area many views are restricted, or else set against an already heavily industrialised scene. Beyond

2 km the scale of the visual impacts reduces and only visual impacts from Kincardine Bridge are assessed as being significant. Some cumulative impacts have been identified but none of these have been assessed as significant.

6.2.7 The assessment has shown that the proposed Renewable Energy Plant will result in no significant landscape impacts on the townscape character of Grangemouth and its Port, or for the wider landscapes north and south of the Forth Estuary. It has also been demonstrated that only a small number of visual receptors will be significantly affected by the proposals and these visual impacts will be seen within the context of a landscape which is often defined by existing large and expansive buildings and structures.

6.2.8 Secondary mitigation in the form of architectural styling to the proposed Renewable Energy Plant has the potential to further enhance the appearance of the proposed plant.

6.3 Noise

6.3.1 The Environmental Statement assesses the potential noise and vibration impacts of the construction, operational and decommissioning phases of the proposed Renewable Energy Plant. The assessment has included ambient (the existing level) noise measurement at the nearest residential receptors and computerised noise modelling of the proposed Renewable Energy Plant in order to quantify the potential noise impacts associated with the proposed development.

6.3.2 As part of the noise assessment, there have been consultations with the Environmental Health Team at Falkirk Council to agree the locations for ambient noise measurement and with the Scottish Environment Protection Agency (SEPA) to consider noise mitigation measures.

6.3.3 Ambient noise measurements were carried out at four locations representing the nearest residential community. All measurements made were attended, with observations also being made of weather conditions prevailing at the time, and also of the nature of the noise.

6.3.4 The ambient noise climate in the vicinity of the proposed development is typical of an industrial area with nearby major roads. Noise levels are influenced by noise from the nearby M9 motorway and from local industrial sources including the Ineos oil refinery.

6.3.5 Potential noise levels have been calculated at the nearest residential dwellings during the construction and decommissioning phases of the Renewable Energy Plant. These are based upon the noise levels for typical construction and demolition activities contained within Annex B of British Standard 5228-1:2009 *Code of Practice for noise and vibration control on construction and open sites – Part 1: Noise*, and assessed against the appropriate criteria for determining significance of noise impact from the same British Standard.

6.3.6 The highest calculated construction noise levels at the nearest sensitive receptors in Grangeburn Road to the south of the proposed development are associated with the ground excavation, earthworks and piling phase of construction. The level however is within the criterion of 66 dB(A) during the daytime adopted from the British Standard as noted above. All existing British Standards and guidance notes specify sound levels in decibels (dB). The decibel scale is logarithmic rather than linear; hence a 3dB increase in the sound level represents a doubling of the sound energy present. Judgement of the loudness of a sound is subjective but, as a general guide, nothing less than a change of 10dB corresponds to a doubling of loudness.

6.3.7 The human ear responds differently to sound of different frequencies. The ear “hears” high frequency sound of a given level more loudly than low frequency sound of the same level. The A-weighted sound level, dB(A) takes this response into consideration and is used for measurement of environmental noise. It can be used to indicate the subjective human response to noise.

6.3.8 All other calculated construction noise levels are lower. Construction noise will therefore not result in any significant impact at the nearest receptors during daytime activity.

- 6.3.9** Potential vibration generated during the construction and decommissioning phases is unlikely to be significant, although monitoring of piling vibration levels in Grangeburn Road is recommended.
- 6.3.10** Potential noise levels at the nearest dwellings during operation of the proposed Renewable Energy Plant have been calculated using a computerised noise model of the plant. The potential noise impact has been determined by comparing the calculated plant noise levels with the measured background noise levels at the nearest dwellings in line with the guidance in British Standard 4142:1997 *“Method for rating industrial noise affecting mixed residential and industrial areas”*. Consideration has also been given to the impact of the predicted change in ambient noise level in accordance with guidance in *‘Guidelines for Noise Impact Assessment’* (Draft): 2007 produced by the Institute of Environmental Management and Assessment / Institute of Acoustics.
- 6.3.11** The assessment has shown that with the proposed mitigation measures, the Renewable Energy Plant will result in no significant noise impact at any of the identified sensitive residential receptors. The predicted Renewable Energy Plant noise levels at all receptors are below the benchmark criteria outside bedrooms at night given in SEPA’s *Horizontal Guidance for Noise (H3) Part 1*.
- 6.3.12** The highest calculated noise level for demolition activities during the decommissioning phase of the project are similar to those generated during the construction phase, and are also within the 65 dB(A) criterion during daytime adopted from British Standard 5228-1: 2009. The information relating to proposed construction phasing and equipment lists will become available at the detailed design stage. Further noise calculations will then be undertaken to determine the specific requirements for noise mitigation measures. Typical noise mitigation measures will include ensuring that works will be completed in accordance with the guidance for noise control set out in British Standard 5228-1: 2009 ensuring modern plant is used and that there is regular and effective maintenance of plant and machinery on the site e.g. lubrication of bearings, maintaining the integrity of silencers, and engine covers. Similar measures will be considered for the decommissioning phase.
- 6.3.13** There are a number of measures that have been incorporated into the current design in order to minimise the noise impact of the operational phase of the proposed Renewable Energy Plant, including locating the main plant area (power island) at the point on the site furthest from residential uses; and locating the fuel storage buildings between the main plant area and the nearest receptors to provide additional screening to further reduce any potential noise impact.
- 6.3.14** Further, more detailed computerised noise modelling of the site will be carried out during the detailed design stage utilising noise source data for specific items of plant, in order to ensure that noise impact is adequately controlled.
- 6.3.15** The specific requirement for noise control measures for individual items of plant and equipment can only be determined at the detailed design stage. However these will typically include, but not be limited to, careful specification of building construction for the main plant buildings; appropriate attenuation of building ventilation systems; fitting steam vents with appropriate silencers; and providing externally located equipment (e.g. conveyors and fans) with appropriate acoustic enclosures.
- 6.3.16** Noise from the construction, operation and decommissioning of the proposed Renewable Energy Plant will be considered further at the detailed design stage and appropriate measures incorporated into the design and layout of the site to ensure that noise emissions from the site are minimised. No significant residual effects are anticipated.

6.4 Terrestrial Ecology

- 6.4.1** The Environmental Statement assesses the potential impacts on terrestrial ecology receptors of the construction, operational and decommissioning phases of the proposed Renewable Energy Plant. The assessment has included consultation with Scottish Natural Heritage (SNH), a desk study and field surveys,

comprising a habitat survey, a bat roost assessment and bat activity surveys as well as an otter survey, in order to establish the current ecological baseline of the application site and surrounding areas. In addition, the bat surveys and breeding and wintering bird surveys carried out for the proposed Port of Grangemouth Wind Turbine Development have also been considered.

- 6.4.2** Four international nature conservation sites and twenty-four national conservation sites are present within 15 km of the application boundary and a single non-statutory nature conservation site is present within 2 km of the application boundary. Of these, the Firth of Forth site, which carries the international designations of Special Protection Area (SPA) and Ramsar Wetland for its wintering birds and birds of passage interest (see Chapter 12 of the ES), is located adjacent to the application site boundary, whereas Slamannan Plateau SPA, which is designated for its migratory Taiga Bean Goose interest, is located 11.2 km southwest of the site. Finally, Blawthorn Moss Special Area of Conservation (SAC) and Black Loch Moss SAC, both of which are designated areas of active and degraded raised bog, are located 14.6 km south-southwest and 15 km southeast of the site, respectively.
- 6.4.3** Only one notable bird species was recorded breeding within the application site (a single pair of Oystercatcher, an Annex 1 species). A common tern colony is present within the Western Channel 50 m to the north of the main plant area. One option for the cooling water discharge is routed north from the main site, into mudflats south of the breakwater, where it is within 250 m of areas used by significant numbers of qualifying waterfowl of the Firth of Forth SPA / Ramsar Wetland, including: shelduck (up to 500); red knot (up to 830); redshank (up to 450); dunlin (up to 650); and curlew (up to 50). There are no records of protected or notable species of plants, invertebrates, amphibians or reptiles within the ecology study area and no records of badgers, water voles, or hedgehogs. Otter has been recorded in the Port of Grangemouth in the past, but no otters or evidence of otters was recorded in the 2010 survey. Surveys recorded low activity of foraging bats within the general area of the site, where no bat roosts were found, and it is concluded that the exposed location of the Port makes the site unsuitable to roosting and commuting bats. The main plant site is located within the industrial Port of Grangemouth within which there are no habitats of nature conservation interest. However, running water and mudflat habitat is present within a 200 m buffer.
- 6.4.4** Ecological receptors of sufficient value to be brought forward to the assessment stage include the following: nature conservation sites designated for biological features; running water habitats, mudflats; breeding birds; the common tern colony; and, taking a precautionary approach, bats and otters.
- 6.4.5** The assessment has shown that the proposed Renewable Energy Plant is unlikely to result in significant impacts on the majority of the identified sensitive terrestrial ecology receptors during the construction, operation and decommissioning phases, respectively. A significant residual impact on the Firth of Forth Site of Special Scientific Interest (SSSI) is possible at Preston Island due to acid deposition resulting from airborne emissions, although the actual extent of any effect is uncertain owing to limited information on the responses of vegetation to increases in deposition on sites, such as the Firth of Forth, where the critical load is already greatly exceeded. In the absence of mitigation, significant impacts on mudflat habitat, otters, breeding birds as well as qualifying interests in the Firth of Forth SPA could also occur, but with the implementation of mitigation measures outlined in Chapter 12, no residual impacts are expected.
- 6.4.6** In line with good practice, mitigation measures will be carried out to ensure that even non-significant impacts are minimised.
- 6.5 Aquatic Ecology**
- 6.5.1** The potential impacts of the proposed Grangemouth Renewable Energy Plant on aquatic ecology mainly relate to the abstraction (take up) and discharge of cooling water. It is proposed to use hybrid cooling towers (a combination of water and air cooling), which will greatly reduce water extraction and discharge when compared with the direct-cooled (water only) alternative. It is proposed to abstract cooling tower water from the Western Channel (1,400 m³/hr), which is filled with water derived from the Forth Estuary, and to discharge

cooling tower water to the lower tidal reach of the River Carron. There is a zone along a 700 m section of the River Carron over which the discharge may be located. To ensure good dispersal of the blow-down water, it is proposed to only discharge on a falling tide, i.e. two periods of 4 hours per day at a rate of 3,360 m³/hr. The cooling towers will therefore have a built-in sump to hold water without any discharge during tidal periods of rising or still water. The discharge will be at maximum of 12°C above the ambient temperature of the receiving water and have a salinity of approximately 45 parts per thousand.

- 6.5.2** The Firth of Forth is protected by several designations: it is part of the River Teith Special Area of Conservation (SAC) under the Habitats Directive, and is a Special Protection Area (SPA), a Ramsar site, and part of the Firth of Forth Sites of Special Scientific Interest (SSSI). The SAC qualifying features for the River Teith are the river lamprey, sea lamprey, Atlantic salmon and sea trout. The application site is between two of the most sensitive ecological sites within the Firth of Forth SPA, these being the Kinneil and Skinflats mudflats. There are extensive eel or sea grass beds found in and around the Firth of Forth. Eelgrass beds have enhanced nature conservation status and are covered by a UK Habitat Action Plan for seagrass beds. The extensive mud and sand flats support a range of benthic communities, which in turn are a feeding resource for birds and fish.
- 6.5.3** The River Carron enters the Forth Estuary to the west of the application site. This section of the river is tidal and highly modified by man. The upper part of the bank has been raised and hardened as a flood defence, and the lower banks comprise fine mud.
- 6.5.4** The Forth Estuary supports a diverse fish community including resident, marine migrant, nursery-using and over-wintering species, as well as those undertaking migrations through the estuary between the sea and the freshwater upstream. It acts as a migration route for river lamprey, sea lamprey, Atlantic salmon¹¹ and sea trout between coastal waters and their river spawning areas. In addition, the smelt (*Osmerus eperlanus*), an estuarine species of conservation concern, lives within this region, and the Forth Estuary population has recently been recovering.
- 6.5.5** Construction activities in the vicinity of the Forth Estuary and River Carron will comprise the installation of the cooling water intake and outfall structures. Potential impacts with respect to aquatic ecology relate to possible piling work, oil spills from mobile equipment and generation of runoff containing high suspended solids. With good management and mitigation, the effects of these will be negligible.
- 6.5.6** The withdrawal of water from the Forth Estuary could result in the impingement (animals caught on the screens) and entrainment (animals passing through the cooling system) of fish and crustaceans and therefore the abstraction infrastructure will be constructed according to guidance issued by the Scottish Environment Protection Agency which is complemented by that of the Environment Agency (of England and Wales).
- 6.5.7** None of the rare or migratory fish that are of conservation concern in the Forth Estuary (sea and river lamprey, salmon, sea trout, smelt and allis and twaite shad) are liable to be entrained. All these species breed in freshwater and do not migrate down the Forth Estuary to the sea until after they are too large to pass through a 3 mm slot width wedge-wire screen. The position of the intake within the dock and the use of a low intake velocity are also factors that will reduce entrainment. Given the use of such protective measures, fish impingement mortality would be negligible. The intake will therefore offer no threat to adult fish and cause no impact to the fisheries present in the Forth Estuary.
- 6.5.8** It is proposed to place the discharge of the cooling tower water into the River Carron estuary adjacent to the proposed site. As all locations within the area of search for the discharge will result in similar dispersal of the plume, their near field effect is predicted to be similar. The River Carron in this region is a highly modified

¹¹ The Atlantic Salmon is listed on the IUCN Red List of threatened species and protected under the Salmon and Freshwater Fisheries Act 1975 supplemented by the Salmon Act 1986 and the species is listed under the EC Habitats Directive Annex 11a.

channel. It is tidal, so the water can be expected to flow both up and down stream. The channel is at least 100 m wide at low water, and has a depth at high water of greater than 4.5 m.

- 6.5.9** The extent of the distribution of the heated cooling water discharge within the Carron (i.e. the thermal plume) was estimated using a computer model (CORMIX). Three scenarios were modelled which covered worst case environmental and discharge conditions. In all cases the temperature of the thermal effluent was less than 1 degree above ambient within 200 m of the outfall and the discharge never exceeded 10% of the width of the channel. The small volume of the discharge in relation to the flow of the River Carron and the use of diffusers allow rapid dilution of a discharge.
- 6.5.10** The discharged cooling water will also hold low levels of chlorine (< 0.1 mg/l), which will be used within the Renewable Energy Plant as a biocide to control bacterial slimes and other forms of biofouling. The use of diffusers will ensure that this residual chlorine rapidly mixes and reacts with the receiving water, removing any residual toxicity to fish and other marine life of the Forth Estuary.
- 6.5.11** In conclusion, taking conservative predictions of the proposed Renewable Energy Plant impact, the small scale of the water extraction, and the position of the intakes and discharge proposed, are predicted to result in no significant impacts on aquatic life.

6.6 Hydrology, Hydrogeology, Geology and Soils

- 6.6.1** The development is located in a low lying location within the Port of Grangemouth, adjacent to the Western Channel. The main operational areas of the site (i.e. the operational plant area and the fuel storage area) are situated on previously developed land, with the areas identified for cooling water infrastructure within the impounded dock (i.e. the Western Channel) and the River Carron, north of the plant development.
- 6.6.2** The nearest surface water features to the site are the Carron Dock and the Western Channel, which abut the northern boundary of the main plant area. The closest significant watercourses to the site other than the Forth Estuary are the River Carron to the north of the main plant area and Grange Burn to the south. The River Carron flows in a west to north east direction approximately 100 m to 150 m to the north of the main plant area. The upstream catchment of Grange Burn includes Westquarter Burn to the south west of the site, with flows passing from west to east in Grange Burn through a maintained channel within the Port of Grangemouth. The majority of surface water runoff from within the site currently passes to ground through infiltration with runoff during extreme events (e.g. storms, extreme rainfall etc) having the potential to follow natural gradients towards the Carron Dock and Western Channel along the northern boundary of the main plant area.
- 6.6.3** In accordance with Scottish Planning Policy and recognising the possible future impacts of climate change, a flood risk assessment has determined the need to raise sensitive equipment above a design datum of 5.50 m AOD (Above Ordnance Datum, which is a recognised measurement of height of land above sea level) and provide safe areas of refuge above this datum for personnel within the site. The design includes an allowance to account for the likely impact of climate change on water levels in the Forth Estuary. Incorporated into this will be a drainage system across the main plant area of the site which will manage drainage discharges to the Carron Dock and Western Channel subject to consenting.
- 6.6.4** The site is underlain by localised Made Ground Deposits from the reclamation from the Forth Estuary tidal flats. These are underlain by marine drift deposits which comprise mainly silt and clay of former intertidal flats (Carse Clay). It is expected that shallow groundwater may be present within these deposits. The bedrock geology comprises the Carboniferous Passage Formation and Coal Measures consisting of sandstones, mudstones, siltstone, seat earth and coal. Made Ground and drift deposit soils beneath the site and potentially contaminative historical land uses on the site have been identified. The presence or absence of any significant contamination and hence the quality of underlying soils will be confirmed by a suitably targeted ground investigation which will be undertaken at the detail design stage of the Renewable Energy Plant.

- 6.6.5** Appropriate working methods based on good practice will be incorporated into an Environmental Management Plan (EMP). This will ensure that there will be no residual effects to surface water through sediment input or site activities, as controls will be put in place during construction, based on good practice measures promoted by SEPA. No significant residual effects are predicted with regards to site activities due to the protection measures proposed to control sediment and oil contamination in runoff. However, as with any development project the potential will remain for accidental spillages of oil or fuel, although with protection measures in place through the EMP, any resultant effects on the water environment are not considered to be significant.
- 6.6.6** The abstraction of water from the impounded dock (i.e. Western Channel) and discharge to the River Carron for the cooling process will be regulated by a CAR¹² licence and also via a PPC Permit (Pollution Prevention Control Permit). Regulation of these processes will ensure that the existing hydrological environment within the dock and river are maintained with no significant negative effects.
- 6.6.7** No significant environmental effects have been identified in terms of impacts to the hydrological or hydrogeological environment. Overall this development will not result in any predicted negative residual effects of significance on the water or soil environments.
- 6.7 Cultural Heritage**
- 6.7.1** The cultural heritage chapter considers the potential impacts of the proposed Grangemouth Renewable Energy Plant upon cultural heritage features, defined here as relict features predating the First Edition Ordnance Survey map (surveyed 1860 in this area), selected later features of historic interest, such as wartime and industrial features, and all designated assets such as listed buildings and scheduled monuments. Potential impacts upon the physical fabric and setting of features are also considered.
- 6.7.2** A desk-based study, walkover survey and site visits have been carried out in order to identify assets that may be impacted upon by the proposed Renewable Energy Plant and establish their current condition. This work also provided information upon which to base the assessment of archaeological potential.
- 6.7.3** Within the proposed application boundary there are three non-designated cultural heritage features. There is limited potential for previously unrecorded archaeological features, maritime archaeological features or palaeoenvironmental deposits to be present within the application site. There are ten listed buildings but no scheduled monuments within 1 km of the proposed development.
- 6.7.4** There will be no direct impacts on known cultural heritage features as a result of the construction of the proposed Renewable Energy Plant and the indicative grid connection. The construction of the proposed cooling water infrastructure may result in the removal of derelict dock infrastructure, such as railway / crane rails and cobbles. There is also limited potential for the cooling water infrastructure to impact on previously unrecorded maritime archaeological assets. Such impacts will be mitigated through implementation of a programme of archaeological works that will allow for the preservation by record of any features affected. Residual construction impacts will be, at most, of negligible significance.
- 6.7.5** The predicted operational impacts are confined to impacts on the dockside structures and the Antonine Wall. Operational impacts on both the Antonine Wall and Grangemouth Docks have been assessed as being of negligible significance. As this is not significant in terms of the EIA Regulations no mitigation is proposed and the residual effects on these features will remain of negligible significance.
- 6.7.6** There will be no decommissioning impacts on cultural heritage features.
- 6.7.7** No significant cumulative impacts on cultural heritage features were identified as a result of the construction, operational and decommissioning phases of the proposed Renewable Energy Plant with any of the

¹² Water Environment (Controlled Activities) (Scotland) Regulations 2005

developments considered. It is concluded that the proposed development will have no impacts of greater than minor significance. Such impacts are not significant in terms of the EIA Regulations.

6.8 Socioeconomics

- 6.8.1** The socio-economic chapter focuses on the social and economic effects that are likely to occur as a result of the construction, operation and decommissioning of the proposed development. The study area covers the immediate area of Grangemouth and the wider area in general, in order to assess the likely effects that may arise within the local community.
- 6.8.2** The assessment was based on the analysis of available desk-based information, results of stakeholder feedback and a thorough qualitative assessment of a range of social and economic indicators.
- 6.8.3** It is expected that the construction workforce will peak at approximately 500 although average numbers will be in the order of 300 over the three year construction period. An operational workforce of about 40 is anticipated. In addition, the project will create jobs for approximately 21 new port operation staff with respect to fuel handling.
- 6.8.4** The assessment concludes that the development of the proposed Grangemouth Renewable Energy Plant would bring a number of positive benefits to the local economy, assessed as being of moderate (and hence significant) positive impact. These positive benefits would accrue from the construction, operation and maintenance, supply chain, and decommissioning of the Grangemouth Renewable Energy Plant over the total project period and would comprise the equivalent of 206 full time jobs directly, 157 full time jobs indirectly (i.e. 337 jobs in total, when the number of these jobs being taken from outside the area is considered), and therefore £26.45 million of Gross Value Added (i.e. output and profits of those people and contractors employed) per annum into the local economy of Grangemouth and Falkirk.
- 6.8.5** In addition at a Scotland level the Grangemouth Renewable Energy Plant would create a number of positive benefits assessed here as being of minor positive impact. These would comprise 206 jobs directly, 219.3 jobs indirectly, 425.3 jobs in total, and £30.1 million of Gross Value Added per annum.
- 6.8.6** Further, the project would provide an injection into the local economy of £18 million operating and maintenance expenditure over each year of operational life of the Renewable Energy Plant, and hence total expenditure amounting to £450 million (at current prices) over the expected minimum 25 year operational life of the Renewable Energy Plant. The resulting expenditure and direct and indirect employment generation (as set out above) would have a positive impact upon the local economy, assessed as being a moderate positive effect on the local economy.
- 6.8.7** The project would also create wider qualitative socio-economic benefits including a wide range of potential job and skills opportunities for both the local business community and for members of the local labour force. Other positive impacts would include overall renewables industry supply chain benefits, biomass / wood-fuel resource supply chain benefits, and enhancement in sustainable biomass / woodfuel supply in Scotland. In addition, opportunities for renewable heat use would be created for a wide range of neighbouring activities in community, commercial, business, retail, leisure, and residential uses, together with the potential economic benefits which would derive from the operation and maintenance of the new heat networks.
- 6.8.8** Any potential adverse effects from the construction, operation, and decommissioning of the project would be addressed through the proposed mitigation measures including procurement and skills, and training initiatives providing supply chain spin-offs for local businesses and also acting as a useful educational resource, assisting in raising awareness of climate change and clean energy solutions amongst the local and wider community.

6.9 Aviation and Telecommunication Systems

6.9.1 In the course of the assessment of the impacts of the project on aviation and telecommunication systems, the project team has consulted with a number of stakeholders, including the Ministry of Defence, BAA Safeguarding (Edinburgh Airport), the Civil Aviation Authority (CAA), National Air Traffic Services, Ofcom, British Telecom and many others. These consultations resulted in no objections being raised by any of the stakeholders consulted.

6.9.2 Modelling was undertaken to estimate the number of properties whose terrestrial TV reception may be affected by the proposed development. Television signals need a clear path between the transmitter tower and the TV aerial on the property and therefore if a tall structure is built between these two it can affect the quality of the TV reception at the property. The modelling found that the TV reception at up to 50 properties could be affected due to the buildings of the Renewable Energy Plant. Forth Energy commits to mitigate any such deterioration identified with respect to TV reception. There will therefore be no significant impacts on aviation and telecommunication systems.

6.10 Traffic and transport

6.10.1 The proposed transport routes, access arrangements, estimated traffic volumes and potential environmental effects of traffic during construction, operation and decommissioning of the proposed Renewable Energy Plant are addressed within the ES. In addition a detailed Transport Statement (TS) has been prepared (Volume 4).

6.10.2 Discussions have been held with Falkirk Council Transport Division and Transport Scotland regarding the assessment methodology, significance criteria and baseline conditions.

6.10.3 The proposed civil and mechanical construction traffic and operational biomass / maintenance delivery routes have been discussed and agreed with the consultees. Laden construction vehicles and biomass deliveries would approach the site from the east via Junction 5 of the Motorway and travel via the A9 and A904 to access the Port of Grangemouth via North Shore Road and the A904 Earls Road / Station Road roundabout. Vehicles will then travel onto Central Dock Road to access the site. Traffic approaching from the west would utilise Junction 6 of the M9 Motorway and join the A904 Earls Road via the A905 Glensburgh Road.

6.10.4 Empty vehicles would exit the site travelling back along North Shore Road and exit the Port of Grangemouth through the A904 Earls Road / Station Road roundabout and onto Junction 6 of the M9 Motorway. Vehicles travelling westbound can join the M9 Motorway at this junction whereas vehicles travelling eastbound will continue onto Falkirk Road and travel via the A9 Laurieston Bypass to Junction 5 of the M9 Motorway. These HGV routes follow established routes which are considered to be appropriate for HGV movements.

6.10.5 It is expected that the majority of abnormal loads during construction will be delivered by sea and therefore there will be no effect on the local road network. Even if abnormal loads need to be delivered by road it is expected that with deliveries restricted to night time, and with police escorts, the effects on road users would be minimal and not significant.

6.10.6 During the peak of the construction phase (2014 with 500 construction staff), there are predicted to be pedestrian severance (i.e. difficulty of road crossing) issues on some roads based on the criteria in guidance produced by the Institute of Environmental Assessment (The Environmental Assessment of Road Traffic). However, there are barriers to pedestrian activity along the specified access routes.

6.10.7 The AM and PM peak hours for construction traffic are outside the peak hours for network traffic, as the combination of construction traffic and background traffic is less than the background traffic during the network peak hours, there will be no noticeable effects on pedestrian severance over that currently experienced.

6.10.8 All other impacts during construction, including accidents and road safety, driver delay, and pedestrian amenity, fear and intimidation are also predicted to be insignificant.

- 6.10.9** The majority of fuel will be delivered by ship to the Renewable Energy Plant however; it is the intention to deliver up to 212,000 tonnes of locally sourced fuel by road. It is also possible that even some of this could be delivered by ship. The TS provides details of the HGV movements this volume of material will generate, and the numbers will equate to no more than 2 HGV movements each way every hour. The TS concluded that there is capacity on the local road network to take this increase plus other maintenance vehicles and deliveries.
- 6.10.10** There will be 40 staff working at the plant once operational. A shift working system will be in operation. The TS assessed the impact of these workers arriving to site by road and concluded that there would be no significant impact on the road network.
- 6.10.11** Due to the low levels of vehicle movements during the operational phase of the plant the ES does not predict any significant effects on accidents and road safety, driver delay, pedestrian severance and pedestrian amenity, fear and intimidation.
- 6.10.12** No cumulative environmental effects of the proposals are predicted.
- 6.10.13** All effects associated with decommissioning traffic are also considered to be insignificant.

7 Viewing and Purchase of Environmental Statement

7.1 Viewing of Environmental Statement

- 7.1.1** The Grangemouth Renewable Energy Plant Environmental Statement may be viewed at the following locations during the statutory consultation period, during the opening hours of business of the host establishments.

Falkirk Council
Development Services
Municipal Buildings
West Bridge Street
Falkirk
FK1 5RS

Grangemouth Library
Bo'ness Road
Grangemouth
FK3 8AG

Falkirk Library
Hope Street
Falkirk
FK1 5AU

7.2 Downloading of the Environmental Statement

- 7.2.1** Copies of the Section 36 Application package, including this Environmental Statement, are available on the Forth Energy website, www.forthenergy.co.uk. Electronic copies on CD are available free of charge from:

Debbie Barclay
Forth Energy
1 Prince of Wales Dock
Leith
EH6 7DX

7.3 Purchase of Environmental Statement

- 7.3.1** Paper copies of the Environmental Statement are available from the address above for a charge of £400.00 inclusive of VAT and UK delivery
- 7.3.2** Cheques should be made payable to Forth Ports PLC. Cash should not be forwarded by mail.

Abbreviations

The following is a list of abbreviations adopted in the Non Technical Summary.

%	Per cent
°C	Degrees Celsius
AOD	Above Ordnance Datum
BS	British Standard
CAA	Civil Aviation Authority
CAR	Controlled Activities Regulations
CHP	Combined Heat and Power
CO ₂	Carbon dioxide
CO _{2e}	Carbon dioxide equivalent
Db(A)	Decibels, A-weighted
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ES	Environmental Statement
FB	Fluidised bed
GCR	Geological Conservation Review
ha	Hectare(s)
HGV	Heavy goods vehicle
km	Kilometre(s)
kV	Kilovolts
kWh	Kilowatt hour
m	Metre(s)
m ³ /s	Cubic metres per second
m ³ /hr	Cubic metres per hour
mg/l	Milligrams per litre
mm	Millimetres(s)
MWe	Megawatt (electrical energy)
MWth	Megawatt (thermal energy)
NNR	National Nature Reserve
NO _x	Oxides of nitrogen
NTS	Non-technical Summary
PPC	Pollution Prevention and Control
RAF	Royal Air Force
RRS	Royal Research Ship
SAC	Special Area of Conservation
SEPA	Scottish Environment Protection Agency
SGECU	Scottish Government Energy Consents Unit
SHETL	Scottish Hydro Electric Transmission Limited
SNCR	Selective Non-catalytic Reduction
SNH	Scottish Natural Heritage

SPA	Special Protection Area
SPTL	Scottish Power Transmission Limited
SSE	Scottish and Southern Energy
SSSI	Site of Special Scientific Interest
TS	Transport Statement
TV	Television
UK	United Kingdom
ZVI	Zone of Visual Influence

Appendix A Figures



Forth Energy

Grangemouth Renewable Energy Plant

Figure 1
Site Location

Legend

- Application Boundary
- Cooling water infrastructure

Metres
0 550 1,100 2,200

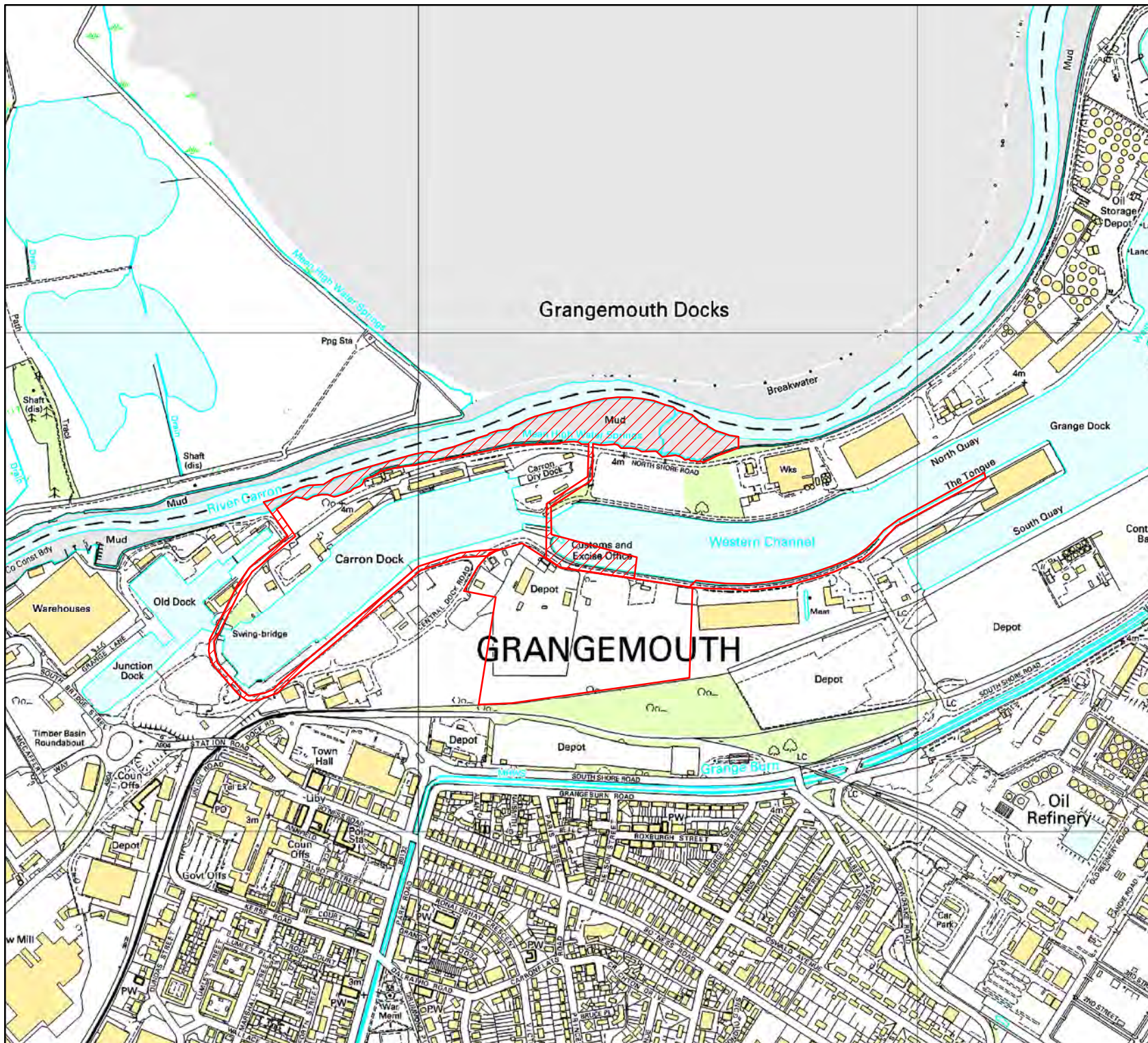
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SINCLAIR KNIGHT MERZ
SKM ENVIROS

Grangemouth Renewable Energy Plant

Figure 2

Application Boundary



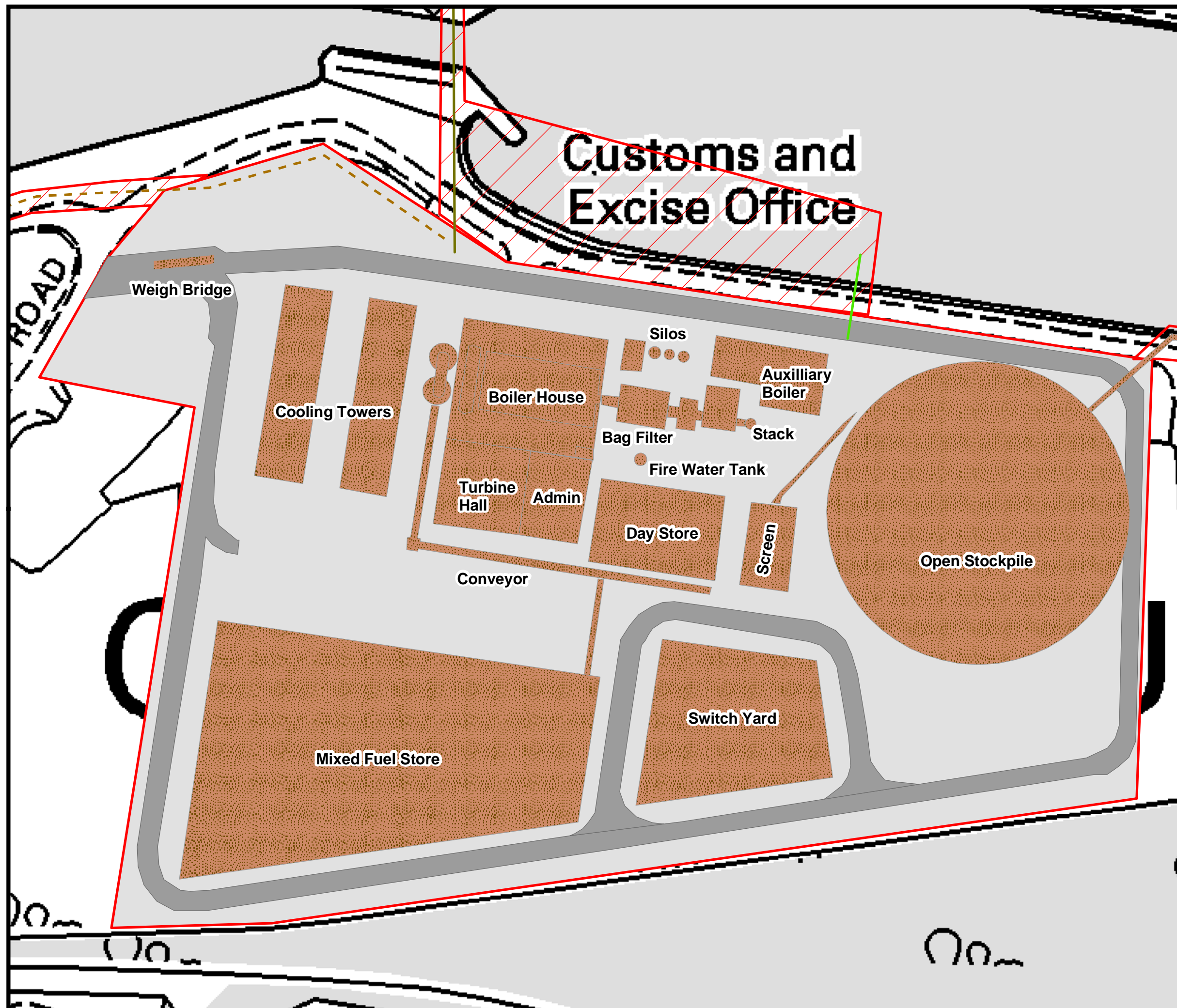
Legend

- Application Boundary
- Cooling water infrastructure

Metres
0 105 210 420

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SKM ENVIROS



Legend

- Application boundary
- Cooling water infrastructure
- Access Road
- Proposed Layout
- Cooling water abstraction pipe route
- Cooling water discharge pipe route 1
- Cooling water discharge pipe route 2

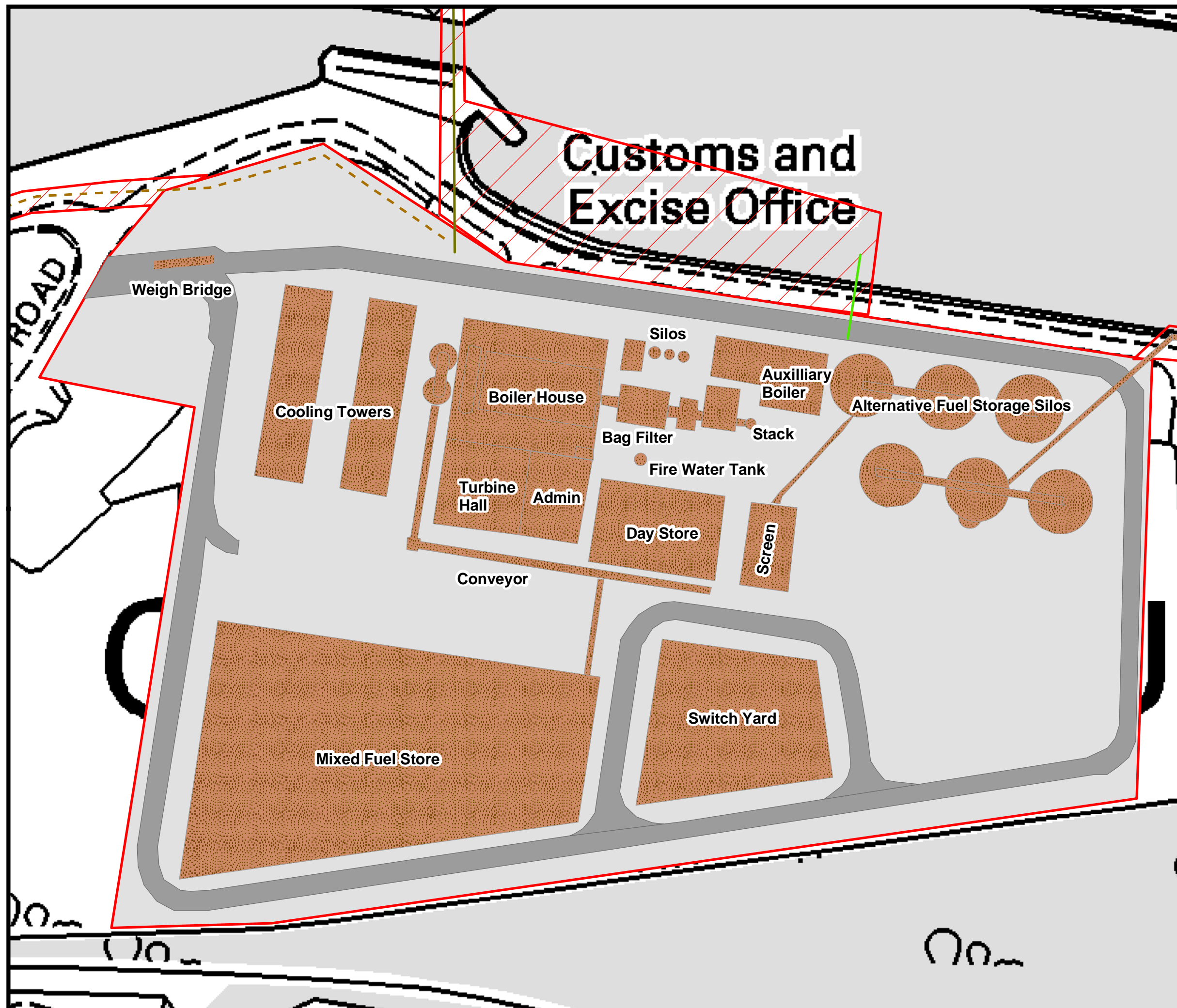


0 25 50

Metres

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Legend

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0 25 50

Metres

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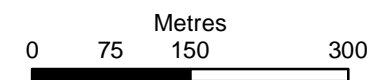
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Grangemouth Renewable Energy Plant

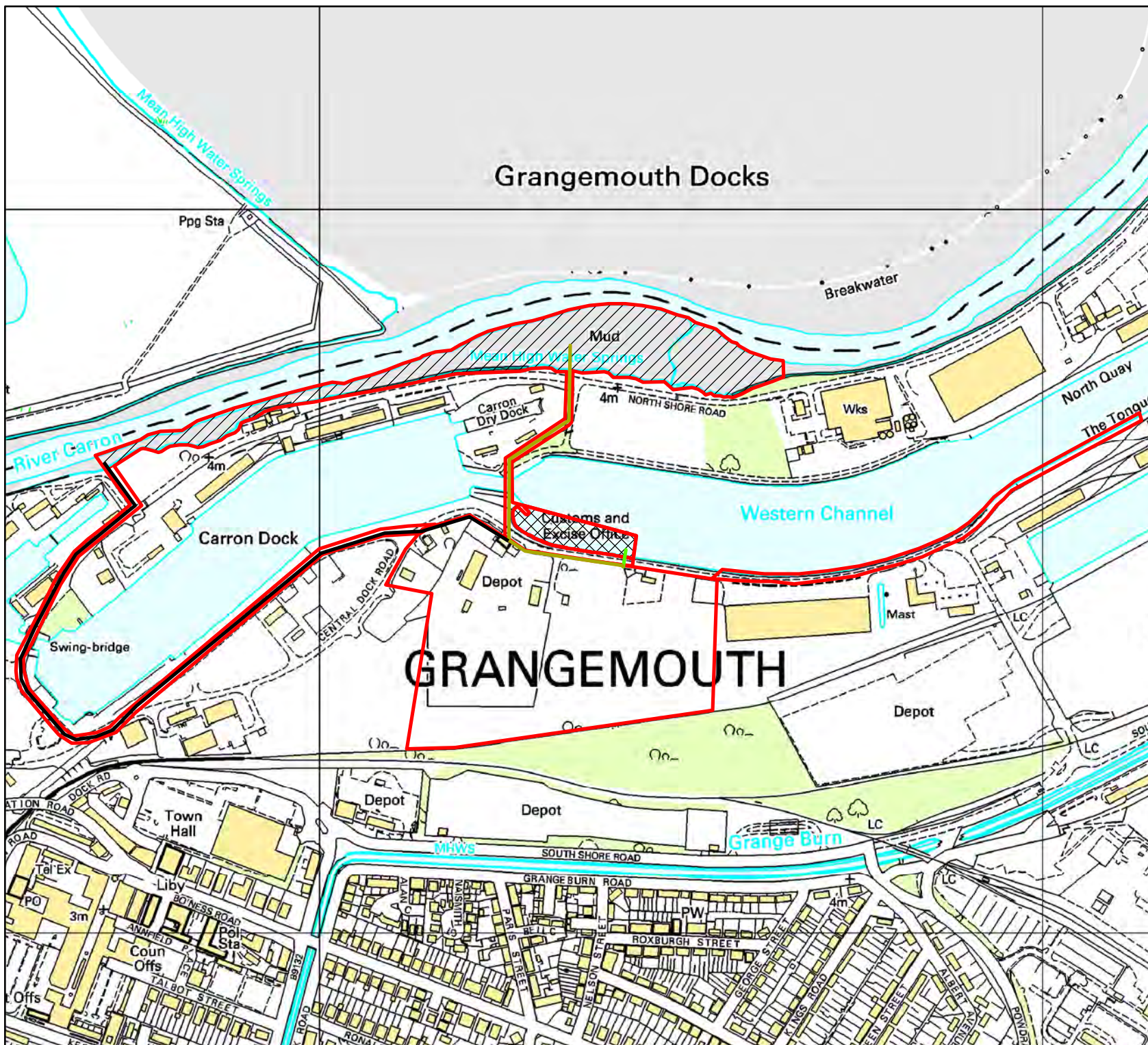
Figure 4
Cooling water
pipeline routes

Legend

- Discharge Option 2
- Discharge Option 1
- Abstraction
- Area of search for outfall
- Area of search for intake
- Application Boundary



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