

## 15 DRAINAGE AND FLOOD RISK

### 15.1 Introduction

15.1.1 This Chapter of the Environmental Statement provides a Flood Risk Assessment (FRA) relating to a planning application for the Barr Killoch Energy Recovery Park, Ochiltree, East Ayrshire. This FRA considers the potential flood risk to the proposed development and the potential risk of the proposed development to contribute to offsite flood risk. A qualitative impact assessment has been undertaken using a combination of professional judgement, legislation and other statutory policy and guidance.

### 15.2 National Planning Policy

15.2.1 The Scottish Planning Policy (SPP), published on the 23<sup>rd</sup> June 2014, sets out the national planning policies which reflect Scottish Ministers' priorities for the operation of the planning system and for the development and use of land.

15.2.2 Paragraph 255 under the 'Managing Flood Risk and Drainage' policy requires that the planning system promotes a precautionary approach to flood risk from all sources, taking into account the predicted effects of climate change. Flood avoidance, flood reduction and the use of Sustainable Drainage Systems (SuDS) should also be promoted. Paragraph 256 under the same policy also states that developments, which would probably be affected by flooding or would cause an increase in the probability of flooding elsewhere should be prevented. Table 15.1 defines the flood risk classification of the SPP.

<b>Type of Flooding</b>	<b>Flood Risk Classification</b>	<b>Description</b>
Rivers and Coastal Flooding	Little or No Risk	Annual probability of coastal or watercourse flooding is less than 0.1% (1:1000 years). No constraints due to coastal or watercourse flooding.
	Low to Medium Risk	Annual probability of coastal or watercourse flooding is between 0.1% and 0.5% (1:1000 to 1:200 years). Suitable for most development. A flood risk assessment may be required at the upper end of the probability range (i.e. close to 0.5%), and for essential infrastructure and the most vulnerable uses. Water resistant materials and construction may be required. Generally not suitable for civil infrastructure. Where civil infrastructure must be located in these areas or is being substantially extended, it

<b>Table 15.1 Flood Risk Classification</b>		
<b>Type of Flooding</b>	<b>Flood Risk Classification</b>	<b>Description</b>
		should be designed to be capable of remaining operational and accessible during extreme flood events.
	Medium to High Risk	<p>Annual probability of coastal or watercourse flooding is greater than 0.5% (1:200 years).</p> <p>May be suitable for:</p> <ul style="list-style-type: none"> <li>• residential, institutional, commercial and industrial development within built-up areas provided flood protection measures to the appropriate standard already exist and are maintained, are under construction, or are a planned measure in a current flood risk management plan;</li> <li>• essential infrastructure within built-up areas, designed and constructed to remain operational during floods and not impede water flow;</li> <li>• some recreational, sport, amenity and nature conservation uses, provided appropriate evacuation procedures are in place; and</li> <li>• job-related accommodation, e.g. for caretakers or operational staff.</li> </ul> <p>Generally not suitable for:</p> <ul style="list-style-type: none"> <li>• civil infrastructure and the most vulnerable uses;</li> <li>• additional development in undeveloped and sparsely developed areas, unless a location is essential for operational reasons, e.g. for navigation and water-based recreation, agriculture, transport or utilities infrastructure (which should be designed and constructed to be operational during floods and not impede water flow), and an alternative, lower risk location is not available; and</li> <li>• new caravan and camping sites.</li> </ul> <p>Where built development is permitted, measures to protect against or manage flood risk will be required and any loss of flood storage capacity mitigated to achieve a neutral or better outcome.</p> <p>Water-resistant materials and construction should be used where appropriate. Elevated buildings on structures such as stilts are unlikely to be acceptable.</p>
Surface Water Flooding	N/A	<p>Infrastructure and buildings should generally be designed to be free from surface water flooding in rainfall events where the annual probability of occurrence is greater than 0.5% (1:200 years).</p> <p>Surface water drainage measures should have a neutral or better effect on the risk of flooding both on and off the site, taking account of rain falling on the site and run-off from adjacent areas.</p>

15.2.3 The Flood Risk Management (Scotland) Act 2009 (FRM 2009) was enacted on 16<sup>th</sup> June 2009 repealing the Flood Prevention (Scotland) Act 1961. The FRM 2009 includes measures for a framework for coordination and cooperation between organisations involved in flood management and details additional responsibilities for the Scottish Environment Protection Agency (SEPA), Scottish Water and Local Authorities in relation to flood management. The FRM 2009 also required SEPA to provide an assessment of flood risk and measures to assist in the preparation of flood risk management plans. SEPA has done this in the form of interactive maps available on their website.

15.2.4 SEPA’s Flood Risk Assessment (FRA) Checklist has been completed and is included in Appendix 15.1.

**15.3 Site Description and Location**

***Site Location***

15.3.1 The proposed development is located in East Ayrshire approximately 2.5km to the southwest of the settlement of Ochiltree. The site is the head office of Barr Environmental Limited which currently incorporates a number of office and storage buildings, asphalt plant and ancillary infrastructure, an area used for training purposes and general lay-down area for equipment. The site is predominantly surrounded by agricultural land used for grazing with the Hargreaves industrial site used for the processing and storage of coal adjacent to the north of the site. The site lies at between approximately 150m Above Ordinance Datum (AOD) and 160m AOD. The Further details of the site location are provided in Table 15.2.

<b>Table 15.2 Proposed Site Location Summary</b>	
Site Name	Barr Killoch Energy Recovery Park
Site Address	Ochiltree, East Ayrshire
National Grid Reference of site	NS 48001 20376
Site Area	3.6ha (area of proposal)
Existing Land Use	Industrial Estate - mix of existing buildings, infrastructure relating to the asphalt plant and bare ground used as a laydown area for equipment and storage of materials. In addition there is a visitor/employee car park and a weighbridge which will be retained as part of the development.
Proposed Land Use	Energy Recovery Park – Materials Recovery Facility (MRF), Refuse Derived Fuel (RDF) production and Energy from Waste Plant (EfW).
Local Planning Authority	East Ayrshire Council

<b>Table 15.2</b>	
<b>Proposed Site Location Summary</b>	
Scottish Environment Protection Agency Region	South West

### ***Existing Drainage Regime***

- 15.3.2 Initial drainage surveys and investigation have been undertaken to identify the existing foul and surface water drainage on and across the site and these are shown on Barr Industrial's topographical survey dated March 2012, reference KIL/SP/0312, and on Balance Services Ltd drainage survey dated March 2015. The survey and investigation are limited but provide a reasonable level of confidence on the current drainage regime on and across the site. Further investigation is recommended at the next stage to confirm full drainage provisions across the site.
- 15.3.3 The existing development area of the site is a mix of undrained and drained surfaces. The majority of the western half of the site, used as a processing and stock bay area, appears to have no formal drainage and therefore appears to drain typically to ground. The central and eastern area of the site has foul and surface water drainage systems shown but the extent of these have not been fully confirmed. It is however evident that the main access road into the development area and the existing car/service parking areas to the central and south eastern end are drained through a gully and pipe drainage network.
- 15.3.4 The drainage information confirms that a 600mm surface water culvert does cross the proposed development area from the east to the west. The culvert appears to originate off site, from the coal transfer areas to the west of the area. The culvert collects the majority of surface water drainage on the development area and directs these flows to the south east, across the A70 Highway and into the watercourse within the agricultural fields to the south of the site. The ordnance survey mapping shows this watercourse drains to the Taiglum Burn to the south/south west.
- 15.3.5 Scottish Water records show no surface water or foul water sewers on the site. There is a 225mm dia foul water sewer shown from the southern site boundary heading across the A70 Highway in a southern direction and then it turns west and runs passed Killoch Farm (see Appendix 15.2).
- 15.3.6 It is estimated that the proposal will affect a 3.6ha area of the site with 3.2ha being undrained and 0.4ha being drained.

15.3.7 Using the Institute of Hydrology Report 124 'Flood Estimation for Small Catchments' 1994,  $Q_{bar}$  from the site is estimated as being 28.5 litres per second (see Appendix 15.3).

### ***Flooding History***

15.3.8 There is no known history of flooding at the site. The site is shown to be wholly within an area of little to no risk (less than 0.1% annual probability) of fluvial flooding as shown on SEPA's flood map (Appendix 15.4).

### ***Geology and Ground Conditions***

15.3.9 Wardell Armstrong have undertaken a Geo-environmental Desk Study Report which considers ground and groundwater conditions on and over the site. The following descriptions have been taken from this report and if further information is required then this report should be referred to.

15.3.10 Available geological mapping from the British Geological Survey (BGS) shows the bedrock geology to comprise igneous rocks of the Mauchline Volcanic Formation, which is overlain by superficial deposits comprising glacial till (predominantly clay). The bedrock is classified by SEPA as the "Ayr bedrock aquifer," which is low productivity aquifer and is vulnerable to those pollutants not readily adsorbed or transformed.

15.3.11 The soils that underlie the proposed site are noncalcareous gleys of the Drongan soil association. Noncalcareous gleys of this association tend to be slow to drain after prolonged rainfall. Ground conditions are likely to exhibit variable rates of infiltration with lower rates occurring where clay predominates.

15.3.12 Based on the initial ground and groundwater findings, it is considered that due to the previous land use and the presence of the underlying clay superficial deposits, the use of ground infiltration techniques for the development's surface water drainage strategy will not be feasible for this site.

## **15.4 Proposed Development**

### ***Description of Proposed Development***

15.4.1 The proposal is to build and operate an energy recovery park on the existing brownfield site, which has historically been used as a coal mining and processing facility. It is proposed to build a facility with the capability to process, recycle and re-use residual waste, which until now has been destined for landfill, to generate

energy in the form of heat and electricity. The redevelopment of the site would involve the construction of a new MRF and EfW plant located on currently derelict land to the west of the site entrance. This land is currently used to stockpile and recycle aggregate as well as an industrial storage area. This area would be cleared to construct the energy recovery park. All other buildings on the site would remain.

### ***Vulnerability Classification***

15.4.2 The vulnerability classification of a development is defined by the SPP and by SEPA in their Land Use Vulnerability Guidance (2012). The proposed development is a non-hazardous waste treatment facility and is classed as a “less vulnerable land use.” As set out in the SPP and SEPA’s guidance, less vulnerable land is suitable for land with little to no flood risk and land with low to medium flood risk. SEPA flood mapping shows that there is little to no risk of fluvial or pluvial flooding to the site and, therefore, the proposed development may be permitted in terms of flood risk.

## **15.5 Flood Risk**

### ***Flood Risk from External Sources***

15.5.1 Potential sources of flooding are from fluvial (rivers), tidal waters, pluvial (surface water), groundwater, sewers/drains and from artificial sources such as canals or reservoirs. An assessment of the flood risk associated with each potential source of flooding is discussed in the following sections and is summarised in Table 15.3.

#### *Tidal Flooding*

15.5.2 The local rivers are non-tidal and the site is not located in a coastal zone. The site is not located in an area at risk of tidal flooding therefore there is no risk of flooding from this source.

#### *Fluvial Flooding*

15.5.3 The proposed development is shown to be wholly within an area of little to no risk (less than 0.1% annual probability) of fluvial flooding as shown on SEPA’s flood map (Appendix 15.4). There are also no known reports of historical fluvial flooding of the proposed development area. The risk of fluvial flooding to the proposal is, therefore, considered to be low.

#### *Groundwater Flooding*

15.5.4 Groundwater flooding can occur when groundwater levels rise up through permeable strata and exceed ground levels. The presence of clay material in the

overlying superficial deposits would inhibit the upward movement of groundwater. Perched water tables occur when an impermeable layer impedes the downward movement of water and is able to contain water above the main water table.

- 15.5.5 The main areas of the proposal will be surfaced, provided with a positive drainage system and levels shaped to direct surface water away from buildings and essential operation areas. On this basis it is considered that the risk of groundwater affecting the site will be controlled and limited and therefore the risk of groundwater flooding is considered to be low.

#### *Flooding from Sewers and Drains*

- 15.5.6 Flooding from sewers and drains can occur during extreme rainfall events that exceed the design capacity of the sewer and drainage systems. The existing surface water drainage system onsite consists of a number of drainage systems connecting to the 600mm diameter culvert that crosses the site. The onsite foul drainage system is considered to connect to the offsite Scottish Water sewer.

- 15.5.7 The condition of the existing drainage system over the site has not been fully confirmed. From the observations completed to date, the existing drainage system appears to be functioning satisfactorily. During the consultation stage, no evidence that the drainage systems have suffered flooding in the past has been identified.

- 15.5.8 It is therefore considered that the existing drainage system is functioning satisfactorily and there is no evidence to indicate that these drainage systems are a flood risk. On this basis it is considered that surface and foul water drainage flood risk is low. Further drainage investigation is being undertaken.

- 15.5.9 The development proposals will consider the existing drainage systems on and crossing the site and the proposed drainage and level design will be completed to ensure flood risk is mitigated for and the development suitably protected.

#### *Pluvial Flooding (Surface Water Flooding)*

- 15.5.10 On land where there is an impermeable surface or where the ground infiltration capacity is exceeded by rainfall there is a potential for ponding of surface water runoff, which can lead to localised flooding.

- 15.5.11 There appears to be limited pluvial flood risk to the site. An earth bund exists around the north, west and southern boundaries of the western and central areas of the site prevents flows from offsite entering. The A70 Highway running along the southern

boundary is typically lower than the site thereby directing flows away from the site. Opportunities for pluvial flows from off site to the north east appear limited due to the extent and levels. The eastern area of the existing facility is positively drained and falls in a north south direction away from the development area.

15.5.12 SEPA available flood risk mapping shows no significant pluvial flood risk. Overall it is considered that the risk of pluvial flooding to the site is low.

#### *Flooding from Artificial Sources*

15.5.13 There are some surface water lagoons to the west of the site however; ground levels and the earth bund to the site boundary protect the development from any flood risk from this source.

15.5.14 A 12" Scottish Water water main is located along the A70 Highway. Flooding from this source is considered low as the site is generally raised above the road and the site is predominately protected by the earth bund running along the southern boundary.

15.5.15 There are no other artificial water bodies (e.g. reservoirs) close to the site, which could act as a source of flooding to the site.

#### *Summary*

<b>Table 15.3 Sources of Flood Risk</b>			
<b>Flood Source</b>	<b>Potential Presence at Site</b>	<b>Potential Risk</b>	<b>Description</b>
Tidal	No	None	The local rivers are non-tidal and the proposed development is not located in a coastal zone. The site is not affected by tidal water.
Fluvial	Yes	Low	The proposed development is wholly within an area of little to no risk (less than 0.1% annual probability) of fluvial flooding. There are no known records of historical flooding for the site.
Groundwater	Yes	Low	The likely presence of clay material in the superficial cover would inhibit the upward movement of groundwater. As the development will be designed to collect and direct surface water from the site it is considered that there will be a low risk of perched water tables affecting the proposed development.
Sewers	Yes	Low	There are existing sewers on and across the site, including a 600mm culvert. There are no known records of historical flooding from these drainage systems and the development will be design to ensure these sewers do no impact on the



<b>Flood Source</b>	<b>Potential Presence at Site</b>	<b>Potential Risk</b>	<b>Description</b>
			development should they flood. On this basis it is considered that this source of flood risk is low.
Pluvial/Overland Flow	Yes	Low	The site is predominately protected by existing earth bunds and landfalls from offsite pluvial flood risk and therefore is considered to have a low risk from this source of flooding.
Artificial Sources	No	None	There are settlement lagoons to the west and a large Scottish Water water main running along the A70 Highway. However, the existing landfall and the existence of an earth bund to the western boundaries are considered to protect the site from this flood risk.

### ***Flood Risk from the Development***

15.5.16 On sites where there is an increase in impermeable area there is always the potential to increase the risk of flooding as a result of the development. Careful surface water management and mitigation measures can remove this risk and prevent any impact from the development.

### ***Floodplain Storage***

15.5.17 The proposed development is located in an area at little or no risk (less than 0.1% annual probability) of fluvial flooding. There will, therefore, be no impact on the flood storage capacity of the floodplains associated with the surrounding field drains, and thus there is no requirement for compensatory floodplain storage.

### ***Flood Flow Routes***

15.5.18 If an extreme rainfall event exceeds the capacity of the drainage then flood flows may be generated. During the detailed design of the onsite drainage system and road/building layout, consideration will be given to flood flow routes during the 1 in 200 year plus climate change event. Flood flows will be designed to be contained on-site within sacrificial and/or non-essential areas.

## **15.6 Surface Water Management and Drainage Strategy**

15.6.1 Detailed surface water management and drainage design will be completed at the next stage. However, the following section details the key criteria and mitigation that will be included in the preparation of the drainage design.

15.6.2 Further investigation and confirmation of the existing drainage system on and across

the site will be required prior to finalising the drainage proposals. Any drainage not in use/abandoned shall be removed. The existing 600mm dia culvert may require diverting to suit the layout proposals. The design will ensure that should the culvert fail for any reason that surface water will discharge temporarily into non-essential and sacrificial areas until such time as remedial works can be completed.

15.6.3 All proposals will be agreed with SEPA and East Ayrshire Council prior to commencement. Any Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR) applications will require to be agreed with SEPA.

15.6.4 It is proposed that the total discharge from the development area will be restricted to the existing  $Q_{bar}$  rate of 28.5 litres per second for the site as estimated in Section 3.3. This discharge will continue to be discharge into the existing 600mm diameter culvert.

15.6.5 The onsite drainage system will be designed to ensure that surface water runoff for storm events up to and including the 1 in 30 year storm event will be contained within the below ground drainage system. Furthermore for storm events up to and including the 1 in 200 year with a 20% climate change allowance surface water runoff will be contained on site using partly underground and above ground surface water storage areas. Any above ground storm water storage will be routed to areas which are sacrificial and/or non-essential to the development and away from buildings.

15.6.6 All surface water from the development will be treated in sustainable drainage systems (SUDs) in accordance with the CAR Regulations. Furthermore, in accordance with SEPA's Land Use Planning System Guidance note, 'Planning Advice on Sustainable Drainage Systems (SUDs)', the surface water drainage design will include the recommended treatment train approach. The treatment train proposed for the site's surface water runoff will be three levels of treatment for hardstanding areas, two levels of treatment to roads and car parking and one level of treatment to roof areas.

15.6.7 The approximate catchment type and associated areas for the proposed development are:

- 0.9ha of Roof (one level of treatment);
- 1.2ha of Road and Car Parking (two levels of treatment);
- 0.5ha of Hardstanding (three levels of treatment); and

- 1.0ha of Landscaping/Open Space (no levels of treatment).

15.6.8 Subject to detail design, based on the above contributing area and  $Q_{bar}$  discharge rate, it is estimated that approximately 650m<sup>3</sup> of storage will be required for the 1 in 30 year storm event and approximately 1300m<sup>3</sup> of storage will be required for the 1 in 200 year with 20% climate change. The initial storage estimations are detailed in Appendix 15.5.

15.6.9 It is considered that these volume of storage can be adequately contained onsite in appropriately design drainage and storage systems. Storage and treatment will be provided using a mix of pipe/tanks, filter drains, permeable paving and detention basins. Some localised ground flooding in non-essential/sacrificial areas may also be utilised where appropriate. At all times the design will ensure that buildings are protected from flooding during these storm events and all surface water runoff is contained within the development area.

15.6.10 All drainage systems will be maintained in accordance with best practice guidance by the site operator.

## **15.7 Residual Risks**

15.7.1 There is always a possibility of a flood in excess of that allowed for which might conceivably cause some flooding to the proposed development. However, such an event would have a very low probability and the risk of flooding to the development would be extremely small. It is therefore considered that the residual risks associated with flooding are not significant.

15.7.2 It is considered that, if the above mitigation and control measures are implemented and maintained, then the residual risk of flooding to and from the development will be within permitted current design standards.

## **15.8 Summary and Conclusion**

15.8.1 This chapter gives details of the Flood Risk Assessment and Surface Water Management strategy, which have been carried out in relation to the proposed development and in accordance with the SPP.

15.8.2 The risk of flooding to the proposed development from tidal flooding is considered to be absent. The risk of flooding to the proposed development from fluvial, pluvial/overland flow, groundwater, sewers and artificial sources is considered to be low.

- 15.8.3 The vulnerability classification of the proposed developments is “less vulnerable,” which is an appropriate land use for areas at little to no risk of fluvial flooding. The SEPA flood map shows that there is little to no risk of fluvial flooding to the proposed development and, therefore, the proposed development may be permitted in terms of flood risk.
- 15.8.4 There are no local site-specific conditions that would adversely affect SEPA’s published flood risk categorisation. Similarly, there would be no significant increase in flood risk to external areas as a result of the development. The site is, therefore, considered suitable, in terms of flood risk, for the type of development proposed.