10 Hydrology and Flood Risk

Introduction and Methodology

10.1 This chapter provides information on the local and catchment-wide hydrology, with particular attention being focused on flood risk, surface water drainage and water quality.

10.2 This chapter describes the assessment methodology; the existing baseline conditions at the application site; and the likely significant environmental effects, taking into account the measures adopted to minimise adverse effects as part of the project.

10.3 The hydrological cycle (Figure 10.1) demonstrates how the effects of one development can be transmitted through the water environment. This shows how hydrological and flood risk issues can be linked to other geographical areas, both in the near vicinity and further afield.

10.4 The hydrological cycle demonstrates the movement of water through the Earth's atmosphere and land mass. This system is initiated through the acquisition of water vapour by evapotranspiration and transpiration from water and land surfaces, including vegetation. This is released to the atmosphere by condensation and deposited on land and water surfaces by precipitation. At the Earth's surface, precipitation is stored as inland waters, rivers, ice sheets and groundwater, or is evaporated or transpired to create the next cycle. The balance of water is returned to the sea by river flow, ice sheet break-up or by groundwater through-flow.

Methodology

10.5 Baseline conditions at the site have been established from the following sources:

- Site walkover undertaken by a hydrologist.
- Review of Flood Zone outlines available on the Environment Agency web site.
- Review of flood information supplied by the Environment Agency
- Consultation with the Environment Agency.
- Review of the existing PPC Permit (reference SP3430BE).
- Review of available site plans and Ordnance Survey maps.
- Review of the existing ground investigation reports for the site and a flood risk assessment, prepared by Lees Roxburgh Limited for an adjacent parcel of land.

Assessment of Effects

10.6 As a matter of best practice, this assessment has been undertaken based on the relevant guidance and legislation specific to surface water quality (chemistry, biology etc) and quantity

(drainage, flooding etc.) and considers a number of key policy and guideline documents that include:

- Planning Policy Statement 25 (PPS25): Development and Flood Risk, 2006;
- Land Drainage Act, 1991;
- Water Resources Act, 1991;
- Environment Act, 1995;
- The Water Act, 2003;
- The Water Environment (Water Framework Directive) (England and Wales), 2003.

10.7 The principal planning policy relevant to this assessment is the consideration of development and flood risk, as outlined in the Planning Policy Statement 25 (PPS25): Development and Flood Risk, 2006. This sets out the responsibilities and requirements of the various parties in the development process and seeks to ensure that flood risk and surface water effects are properly considered during the planning process. A Flood Risk Assessment is included in Appendix 10.1.

10.8 A number of standards and guidelines, which provide details of assessment methodologies and mitigation techniques, are also used in completing the assessment, and these include:

- Pollution Prevention Guidelines (Numbers 1, 3, 5, 6 and 8);
- Control of water pollution from construction sites: guidance for consultants and contractors (C532, CIRIA, 2001);
- Environmental good practice on site (C650, CIRIA, 2005);
- Control of water pollution from linear construction projects (C648, CIRIA, 2006).

Assessment of Significance

10.9 The identification of significant effects is based on the criteria set out in Table 10.1 (with minor and above considered significant in EIA terms), and uses the terms beneficial (for an advantageous or positive effect to an environmental resource and receptor) or adverse (for a detrimental or negative effect to an environmental resource or receptor). Where an effect is considered not to be significant or have no influence it is classified as Neutral. A description of typical effects is also given in Table 10.1, with these reflecting the sensitivity or value of the feature or attribute and also the magnitude of the effect. The duration of the effect has been indicated where known using the terminology short, medium and long-term.

10.10 The assessment of significance takes into account any measures adopted as part of the project.

Table 10.1: Significance/Magnitude Criteria

Significance of Effect		Descriptor
Neutral		No appreciable impact on humans, aquatic flora and fauna, or surface water resources.
Minor	Adverse	Temporary and minor detrimental effect to local watercourses. Minor local flooding adjacent to the site. Minor local scale reduction in surface water quality, reversible with time. Reversible detrimental effects on aquatic flora or fauna.
	Beneficial	Minor reduction in risk to humans, animals or plant health. Minor localised improvement to the quality of surface water resources or minor reduction in flood risk.
Moderate	Adverse	Moderate detrimental effect to local watercourses. Moderate temporary flooding or change to flow characteristics of watercourses. Moderate temporary reduction in the quality of surface water resources. Moderate temporary impact on aquatic flora and fauna.
	Beneficial	Moderate reduction in risk to humans or aquatic fauna and flora. Moderate localised improvement to the quality of surface water resources or minor reduction in flood risk.
Major	Adverse	Severe temporary detrimental effect to local watercourses. Severe temporary flooding or change to flow characteristics of watercourses. Severe temporary reduction in the quality of surface water resources. Severe temporary impact on aquatic flora and fauna.
	Beneficial	Major reduction in risk to humans or aquatic fauna and flora. Major localised improvement to the quality of surface water resources or major localised reduction in flood risk.
Substantial	Adverse	Severe permanent detrimental affect to local watercourses. Permanent flooding or change to flow characteristics of watercourses. Permanent reduction in the quality of surface water resource. Permanent adverse impact on aquatic flora or fauna.
	Beneficial	Substantial reduction in risk to humans or aquatic fauna and flora. Major regionalised improvement to quality of surface water resources. Major regionalised reduction in flood risk.

Measures Adopted as Part of the Project

10.11 The following section highlights those elements and practices that have been incorporated within the design of the scheme to reduce the potential effects on flood risk, surface water quality, water resources and groundwater, both at the site and in the surrounding environment. A Flood Risk Assessment is included at Appendix 10.1. This provides further clarification of the measures discussed in this section. A drainage scheme is provided at Appendix 10.2.

Design

10.12 Redevelopment of the site would afford the opportunity to incorporate design measures which would provide positive environmental enhancement.

10.13 As part of the drainage design, additional storage would be provided to reduce surface water discharge from the site and provide an improvement to the existing situation. The new surface water drainage system would be designed incorporating suitable interceptors and sediment traps to gully pots. These features would be designed to current standards suitable for the project and are intended to trap and intercept any potentially contaminating materials which could otherwise spill or leak on to areas of hardstanding. Further details of the proposed drainage scheme provided in Appendix 10.2.

10.14 Any areas where non-inert materials are to be stored, including waste and chemical storage, would be designed in accordance to the relevant Pollution Prevention Guidelines with an impermeable base and suitable bunding to prevent escape in the event of spillage and leakage. Design would be in accordance with normal Environment Agency requirements and would meet the requirements of an Environmental Permit.

10.15 The project is being designed as a net consumer of water and as part of the process it is proposed to utilise rainwater harvesting to recover water for ash quenching and possibly process water. Additional water would be sourced from the process activities.

Construction

10.16 In addition to design measures, enhancement and control measures would be incorporated within the construction of the project including the following:

- A Construction Environmental Management Plan (CEMP) will be prepared before for the construction phase of the project to ensure that best practice is employed. The CEMP will include method statements for the proposed development and a pollution control and contingency plan.
- Although the CEMP will help to protect surface water quality, it will also benefit other water resource aspects together with associated areas of the environment.
- The potential effects identified in relation to surface water quality are applicable to most construction sites. The CEMP would be applied during the construction of the proposed development to mitigate potential adverse effects on surface water quality.
- The CEMP will draw on the CIRIA document “Control of Water Pollution from Construction Sites” and the Environment Agency guidance on Sustainable Drainage Systems (SUDS), together with the appropriate PPG documents. The following specific measures for the protection of surface water quality during excavation and construction activities will be included within the CEMP prepared for the assessment site:
    - Management of excavation and construction works to comply with the necessary surface water quality standards and consent conditions.

- Surface water run-off from the assessment site would be managed through a drainage scheme, including measures for removing suspended solids and potential contaminants.
- Plant machinery and vehicles would be maintained in good condition, with washing and dust suppression measures to prevent the migration of pollutants (particularly in relation to works using concrete and with areas where dust and mud can build up).
- Areas at risk of spillage would be carefully sited and protected (e.g. bunds) so as to minimise the risk of hazardous substances impacting upon surface water quality – this may include vehicle maintenance and storage areas for hazardous materials.
- The movement of plant machinery and vehicles and the storage of materials during demolition and construction works would be limited near to surface water features.
- Excavation activities would be carefully monitored and co-ordinated with forecast dry periods, where possible. Excavation works would be covered during periods of heavy rain to minimise the entry and collection of rainwater and the transport of pollutants.
- The movement of plant and machinery over bare soil areas would be limited so as to avoid soil compaction and smearing, with suitable preparatory works included where this cannot be avoided in order to minimise effects on the surface water runoff regime.

10.17 Construction operations would be carried out in compliance with the relevant Pollution Prevention Guidelines (PPG) – notably to PPG1 (General Guide to the Prevention of Pollution), PPG3 (Use and Design of Oil Separators in Surface Water Drainage Systems), PPG6 (Working at Construction and Demolition Sites) and PPG18 (Managing Fire Water and Major Spillages).

Operation

10.18 The committed enhancement and control measures to be incorporated within the operational phase of the project are outlined below:

- The site would be operated under an Environmental Permit which would have conditions pertaining to surface water quality limits.
- A management plan would be required for the operation of the site, for control and prevention of pollution and an action plan identified should leakage or spillage occur.
- The drainage system would have a long-term management plan for its upkeep, maintenance and operation.

Baseline Conditions

Legislation and Planning Context

10.19 Appendix 10.3 provides a summary of those policies relevant to hydrology and flood risk issues.

Site Description

10.20 The Lostock site is shown on Figure 1.1 and occupies an area of approximately 80 hectares in total and is used for the production of soda ash using brine, limestone and coke.

10.21 The proposed sustainable energy plant (application site) is to be located on the site of the former Lostock Power Station as shown on Figures 1.1 and 1.2 and the application area occupies approximately 9.2 hectares (including the construction laydown area and relocated coke store) of the overall site. The main (SEP) site is currently occupied by buildings, roadways and associated hard landscaping.

10.22 The nearest watercourse, the Wade Brook is located approximately 20m outside the northern boundary of the project site. The water course is located in a cut. The Trent and Mersey Canal is located to the east of the SEP site, between this area and the construction lay down area.

10.23 A dedicated drainage system is currently in place which drains the buildings and pavement areas to an outfall to the Wade Brook. This drainage does not currently discharge via any surface water balancing features. Surface water discharge is controlled by a discharge consent.

10.24 In compliance with the PPC permit, the quality of surface water discharging to the Wade Brook is regularly monitored. It is understood that no exceedences of the discharge consent values have been measured.

Fluvial Flood Risk

10.25 The Environment Agency web site shows the site to be located within Flood Zone 1. This means that the site is outside of the 1 in 1000-year (0.1%) annual probability floodplain and the risk from external fluvial or tidal flooding is considered to be negligible.

Water Quality

10.26 Data from the Environment Agency regarding water quality shows the Trent and Mersey Canal to be classified as a River Ecosystem Class 4 (fair quality) and the Wade Brook, in to which the site drains as River Ecosystem Grade F (bad).

Ground and Groundwater Conditions

10.27 Details of the ground conditions are given in Chapter 11, Hydrogeology and Ground Conditions and features pertinent to this chapter are summarised below:

10.28 Ground conditions encountered by previous site investigations comprise:

- Made Ground comprising ash and clinker, over
- Made Ground comprising grey lime waste, over
- Boulder Clay, over
- Mercia Mudstone

10.29 The cohesive Boulder Clay and Mercia Mudstones are noted to be non aquifers.

Construction Assessment

SEP

Flood Risk

10.30 The site is currently shown as being in Flood Zone 1 and is therefore is located outside the 1 in 1000 year flood zone. Therefore it is considered that there are not likely to be any significant construction effects on flood risk and this is considered to be a **Neutral** effect.

Surface Water Run Off

10.31 It is anticipated that the existing drainage would be retained for much of the construction period. As part of the CEMP, measures would be designed and incorporated into the construction stage to ensure that surface water run off discharging to the Wade Brook does not increase.

10.32 Therefore it is considered that there are no significant construction effects on surface water run off and this is considered to be a **Neutral** effect

Surface Water Quality

10.33 There is a risk associated with leakage spillage of oils used on site during the construction stage. In addition, material stored in the open can be washed in to the drainage system and receiving water course during rainfall events.

10.34 Measures would be incorporated into the CEMP to design out and manage these risks. It is considered that with the incorporation of a CEMP, construction activities are not likely to result in significant adverse effects on surface water quality and this is therefore considered to be a **Neutral** effect.

Grid Connection

10.35 The connection to the grid would be via an underground cable. T he route is anticipated to be along Griffiths Road (A530) and then the A556 to the existing Hartford substation, using the existing cycle path/road verges. The route of the cable would cross several watercourses, including the River Dane and its associated flood plain.

10.36 By installing the cable below the cycleway/verge adverse impacts on flood risk and hydrology would be minimal. This would allow the cable to utilise existing crossing points to the water courses or to utilise horizontal directional drilling where required.

10.37 Construction and installation of the cable would be undertaken in accordance with a CEMP and as such the works would be designed to minimise any adverse construction impacts. Typically measures would include compliance with best practice measures to avoid the release of sediment and contaminants in to water courses and bunding of materials storage areas.

10.38 Therefore it is considered that with suitable control measures in place there are not likely to be significant construction effects on surface water run off and surface water quality and this is considered to be a **Neutral** effect

Operational Assessment

SEP

Flood Risk

10.39 A Flood Risk Assessment has been undertaken which shows that the site is located within Flood Zone 1 (flood return period greater than 1 in 1000 year) and therefore has the lowest category of flooding risk. Details are provided in Appendix 10.1. The drainage system includes provision for attenuation features to control runoff from the site. It is not considered that there are likely to be any significant operational risks in relation to flood risk and this is considered to a **Neutral** effect.

Surface Water Run Off

10.40 The measures adopted as part of the project include providing additional surface water storage at the site to give a reduction in the peak rates of run off to the Wade Brook. This would provide environmental improvement and would contribute towards reducing the risk of flooding down stream of the site. Given the improvement provided by the scheme it is considered that at the operational stage the scheme would provide a **Moderate Beneficial** effect.

Surface Water Quality

10.41 The measures adopted as part of the project would include pollution prevention measures to the surface water drainage system, designed, installed and operated to current standards.

These measures would mitigate risk associated with potential release of contaminants via the surface water drainage system.

10.42 The site would also be subject to an Environmental Permit, which would include conditions requiring a management plan for the site to avoid release of contaminants to the environment, an accident plan should a release occur and monitoring requirements for surface water discharge from the site.

10.43 The effect of the proposed scheme is therefore considered to be **Neutral**.

Water Balance

10.44 The project is being designed as a net consumer of water and therefore as part of the design is incorporating rainwater harvesting and grey water re-use where possible. This would reduce water demand, but also provide attenuation of surface water run off.

10.45 Some unusable water may be generated from the process which would be mitigated through an existing effluent treatment plant thereby mitigating impact as part of the design process.

10.46 It is considered that with the design mitigation measures in place the effect of the project on the water balance would be **Neutral**.

Recommendations for Further Mitigation

10.47 The assessment of effects has not identified any significant adverse effects, taking into account the measures already proposed as part of the project. Therefore, it is considered that no further mitigation is required.

Cumulative Effects

10.48 Other schemes under consideration would be subject to the same requirements as the SEP to mitigate any surface water run off discharging to the receiving water course to no greater than that discharging from the site currently. The SEP would offer an improvement over the existing situation in relation to runoff and therefore would not contribute to any cumulative adverse effects in this respect.

10.49 Other schemes under consideration would be subject to requirements to manage surface water discharge to ensure no detrimental impact on surface water quality of the receiving water course. As such any schemes would include appropriate mitigation measures to ensure compliance with water quality protection requirements under planning and also to meet their discharge consents. As such there is not anticipated to be any degradation of water quality from cumulative effects of various surface water discharges. The SEP would include a drainage system designed to ensure no adverse effects on water quality and would nto therefore significantly contribute to any adverse cumulative effects.