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7 HYDROLOGY AND HYDROGEOLOGY

7.1 Introduction

The purpose of this chapter is to give an understanding of the water resources and drainage in relation to the site for the proposed development of the Ince Resource Recovery Park (RRP) as well as likely contamination issues to these resources. Factors such as flood risk, drainage design and water resource management would affect the development in terms of its sustainability, safety and integrity. This in turn would have direct and indirect impacts on the environment. The section should be read in conjunction with Section 6 Geology and Soils which also discusses potential pollution issues.

Separate assessments of the CCC Planning Application and DBERR Section 36 Electricity Act Application have been provided to allow each application to be considered on its own merits.

7.1.1 Existing Environment

The Ince Marshes site occupies approximately 134 hectares of low-lying reclaimed marshland and undulates slightly between 2.9m to 6.0m AOD. The Manchester Ship Canal forms the northern boundary of the site and beyond the Canal are the Ince Banks and the Mersey Estuary. The site is centred on National Grid Reference SJ 467 770.

To the south east of the site lies the Kemira fertiliser plant, which extends to approximately 67 hectares. To the east of the site lies approximately 35 hectares of reclaimed marshland. Land immediately to the south of the site was formerly occupied by the Ince Power Stations and has now been developed for a glass plant operated by Quinn Glass.

The Ince Marsh area together with Elton and areas south of the M56 are drained by a network of ditches flowing northward towards the Ince Marsh pumping station located approximately midway along the northern boundary of the site. This station then discharges directly to the canal to the north. The Western Boundary Drain, West Central Drain, East Central Drain, Tang Running, Hoolpool Gutter and Manchester Ship Canal are all classified as ‘main rivers’.

The Ince Marsh pumping station is currently under the control of the Environment Agency (EA) and its primary function is to drain agricultural land within the total Ince Marshes catchment area of 729 hectares.

In addition the Hornsmill Brook is located to the east of the site. This watercourse is at a higher elevation than the site drainage and its catchment is further to the south of the M56. Again this discharges to the north bypassing the canal, and is discharged to the estuary by means of a flap valve.

The EA have confirmed that the site is subject to potential flooding from both the fluvial (river) sources of the Ince Marsh Catchment and from sea inundation, which could follow as a result of failure of the tidal defences. The EA Flood Zone Map shows that part of the site is within the predicted flood zone for areas at risk of flooding from the sea by a flood that has a 0.5% (1 in 200) or greater or from a river by a flood that has a 1% (1 in 100) or greater. The current EA Flood Zone Map for the entire site site is shown on Figure 7.1a, for the CCC Application on Figure 7.1b and for the DBERR Application on Figure 7.1c.

7.1.2 Characteristics of the Proposed Development

7.1.2.1 CCC Planning Application

The proposed development for a Resource Recovery Park (RRP) includes a number of waste management processes that reflect and support government priorities for managing waste. It includes recycling for both municipal and commercial/industrial wastes, green waste composting, and energy recovery to provide a source of power and potential heat to the local community. The development area lies within the same 134 hectares of which approximately 51 hectares is to be developed, with the remainder being utilised for landscape and habitat creation works.

In keeping with the locality much of the existing drainage network is to be retained and enhanced with a system of interlinked sustainable drainage features. Some bridging or culverting of existing watercourses would be required in order to link the development areas.

Development of the site would increase the total impermeable area and hence attenuation of surface water flows would be required. This would be achieved by the construction of balancing ponds in five main areas in the form of wetland features that would add ecological and amenity value in addition to the drainage function. A preliminary drainage layout is shown on Figures 7.2 to 7.6.

Surface water at the site would initially be collected close to buildings and hardstanding areas in underground drainage pipes. These would discharge into existing or new perimeter drainage ditches. It is proposed to use open ditches and swales as much as possible to contain and convey storm water as well as provide a means to increase water quality through natural processes.

Attenuation in the form of ecological wetland areas would provide balancing for rainfall events as well as flood compensation volumes. The attenuated flows would pass through to the existing Ince Marshes pumping station for discharge into the Manchester Ship Canal.

It is intended that many of the proposed outfalls into the ditch network would incorporate flap valves to minimise back water effects into the site drainage at times of high water levels within the ditch network.

Provision would be made to ensure that polluted surface water is not discharged into the existing ditches. To safeguard against possible spillages of fuel or cargo at the site, all tanks and storage areas are to be bunded with all potentially contaminated surface directed to the water treatment plant on site. Water from car parks etc. would pass through petrol/oil interceptors that would also act as a settlement tanks. Catch pits are to be included within the drainage network.

All discharges are to be consented by the Environment Agency and sewerage undertaker, as appropriate.

7.1.2.2 DBERR Section 36 Electricity Act Application

This application, for around 7.5ha together with associated berth facilities of 11.4ha, again lies within the overall Ince Marshes site. The general site arrangement is shown on Figure 7.7. In terms of drainage the site would increase the total impermeable area and hence attenuation of surface water flows would be required. This would be achieved by the construction of balancing ponds in two main areas in the form of wetland features. The first is to the immediate west of the berth and attenuates flows from the berth area. The second is to the immediate southeast of the RDF plant and designed to attenuate runoff from this area.

The principles of the drainage are as described above (Section 7.1.2.1) balancing flows together with providing flood storage for severe events. Some culverting of watercourses would be required to provide access to the site.

The drainage from the Section 36 Application area is ultimately controlled by the Ince Marshes pumping station.

7.1.2.3 Combined Application

The drainage proposal for the whole site would be an slight expansion of that described in 7.1.2.1 with a total developed area in the order of 58ha.

Again, the principles of the drainage are as described above (Section 7.1.2.1), balancing flows together with providing flood storage for severe events. By combining the applications, surface water runoff is also to be combined and attenuated in the ecological wetland areas, prior to passing through to the existing Ince Marshes pumping station for discharge. No additional facilities are required over and above providing the total attenuation and compensation volumes.

7.2 Study Methodology

7.2.1 Scope of Study – Flood Risk Assessment

RSK were commissioned to undertake a flood risk assessment (FRA) of the Ince site arising from the proposed development as well as consideration of development in the surrounding areas. An original report was undertaken in 2004 to PPG25 and was approved by the Environment Agency (confirmation of this is provided within the FRA contained as Appendix 7.1). Following the publication of PPS25 in 2007 this earlier report has been updated following additional consultation with the EA.

The FRA has therefore been prepared in accordance with The Communities and Local Government publication Planning Policy Statement (PPS) 25 *Development and Flood Risk* and the Interim Code of Practice for Sustainable Drainage.

The scope of the study has been the subject of discussions and agreement with the Environment Agency. The resultant FRA was approved in principle by the EA on 7 August 2007, subject to the inclusion of minimum road levels within the site for safety reasons. A copy of the updated FRA is included as Appendix 7.1.

7.2.2 Planning Policy

As above, he main National Planning Policy guidance that applies to the site is *Planning Policy Statement (PPS)* 25 *Development and flood risk.* There are no specific local planning policy statements in relation to drainage or water environments other than the indirect references made in Policy statements such as:

Cheshire 2011 Replacement Structure Plan GEN3: Development should minimise adverse environmental impacts; have good landscaping; be appropriate in scale, design, height and materials; be accessible by various transport modes; not be at unacceptable risk from flooding nor increase risk of flooding elsewhere; promoting energy and resource conservation; cover costs associated with the development.

Regional Planning Guidance for the North West (RPG13) (March 2003) ER8: The precautionary principle, using the sequential approach, should be applied to developments in areas at risk of flooding, such as the River Mersey network, to discourage inappropriate development.

Planning Policy Statement (PPS) 23: Planning and Pollution Control is intended to complement the new pollution control framework under the Pollution Prevention and Control Act 1999 and the PPC Regulations 2000. It replaces PPG 23, and puts pollution as a 'material consideration' in the planning process.

Strategic Flood Risk Assessment (SFRA): Vale Royal Borough Council, together with Chester City Council and Ellesmere Port and Neston Borough Council have appointed specialist consultants, Faber Maunsell, to carry out a strategic flood risk assessment of north Cheshire. This would highlight strategic flooding implications for areas of new development and would inform the preparation of the Core Strategy. It is due to be completed by the end of 2007.

7.2.3 Drainage and Flood Risk Assessment

The flood risk assessment carried out for the Ince Marshes area considered the effects of new development on the existing identified potential flood areas. The EA Flood Zone Maps indicate that part of the site is at risk from both fluvial and tidal flooding.

The assessment included the following:

- Information on the hydrology and hydrological regime in and around the site.
- The views of the EA including scope, location and impacts.
- The extent of new flooding provision and the influence on the site.
- A review of site surface water drainage based on the proposed layout to determine the extent of infrastructure required.
- A review of client and planning information and other studies to determine the existing site conditions.
- The impact on the site from global warming effects and anticipated increases in rainfall over a 60 year period for commercial uses.
- The effects of tidal inundation following a breach of sea defences.
- A summary of the calculations and summaries of the source information and elements reviewed.

7.2.4 Calculations

Flood flows and levels have been calculated based on a combination of LIDAR ground model of the Ince Marsh site and a site-specific topographical survey of the development areas, together with the catchment characteristics and flow parameters contained within the Flood Estimation Handbook and the data contained in the FEH CD ROM.

7.2.5 Scope of Study – Water Quality Impacts

This has been undertaken through a desk-top study based on information provided from the Envirocheck report for the site (see Section 6.2.1) and liaison with consultees.

7.2.6 Pollution Prevention Guidance

The Environment Agency has published a number of Pollution Prevention Guidelines (PPGs) many of which apply to this site and the proposed development. These are:

PPG 1 - General guide to the prevention of water pollution

PPG 2 - Above ground oil storage tanks - February 2004

PPG 3 - The use and design of oil separators

PPG 5 - Works in near or liable to affect watercourses

PPG 8 - Storage and disposal of used oils - February 2004

PPG 11 - Preventing pollution at industrial sites

PPG 13 - High pressure water and steam cleaners

PPG 18 - Control of spillages and fire fighting run-off

PPG 19 - Garages and vehicle service centres (July 2003)

PPG 23 - Maintenance of structures over water

PPG 26 - Storage and handling of drums & intermediate bulk containers – Feb 2004

7.3 Baseline

7.3.1 Hydrogeology

The Environment Agency (EA) classifies the majority of the site as being underlain by a minor aquifer and soils are classified as having a high leaching potential. A minor aquifer is of variable permeability and may comprise potentially fractured or fractured rocks enabling it to produce water supplies for local abstractions and provide base flows for rivers. Soils may easily transmit liquid substances due to their shallow or susceptible nature. The southwestern corner of the site and access routes are classified by the EA as a minor aquifer with soils of an intermediate leaching potential. These soils have the potential to transmit some pollutants and liquids, but are unlikely to be able to transmit adsorbed substances.

Due to the proximity of the site to the coast, saline intrusion (which is known to have taken place further west beneath Ellesmere Port) may have occurred to some degree. The drift deposits may generally be of low permeability, but there is potential for pathways from surface flows to groundwater where drift is thin or absent.

The groundwater beneath the site is anticipated to be present within the alluvium (shallow) and also within the underlying sandstone (deep). Depending upon the permeability of materials overlying the sandstone, the groundwater tables may be in continuity. However, if low permeability materials are present as suggested, they may offer some degree of protection and separation between groundwater regimes. The presumed groundwater flow direction is to the north, towards the Manchester Ship Canal and Mersey Estuary. Borehole logs for the site and surrounding area indicate groundwater was encountered at rest level immediately following intrusive investigations at a depths ranging from 0.9m bgl to 1.8m bgl. Groundwater vulnerability is shown in Figures 7.8a, 7.8b and 7.8c for the Entire Site, CCC and DBERR Applications respectively.

7.3.1.1 CCC Application

The extent of the CCC site encompasses the majority of the application area and as such there is no significant hydrogeological differences between this application and the combined site.

7.3.1.2 DBERR Application

The hydrological regime is generally the same as the CCC Application but does not include the south-western corner of the CCC site, which is classified by the EA as a minor aquifer with soils of an intermediate leaching potential. A lesser area of minor aquifer is affected by this application when compared to the entire site or CCC application.

7.3.2 Hydrology & Water Quality

The Envirocheck report obtained for the site in December 2004 (Ref 785841-1-2) and updated in October 2005 and October 2007 indicates that one discharge consent was previously located on-site which has now been revoked. Further discharge consents are identified within the area immediately surrounding the site, however many of these have also been revoked. The closest authorised discharge consent is situated on the northern site boundary. Powergen Plc are authorised to discharge final/treated effluent into the Manchester Ship Canal, .

Hornsmill Brook is located approximately 114m to the east of the site. The brook passes beneath the Manchester Ship Canal and discharges to the north via a flap valve to the Mersey Estuary The catchment area for this watercourse has been identified to be from the south and east with the watercourse at a higher elevation than the on-site drainage ditches. Environment Agency data from 2004 to 2006 indicates that the stretch of the brook from BICC to the Mersey Estuary had a chemical water quality of grade E (poor). Nitrate and phosphate levels were classed as grade 6 (very high and excessively high respectively).

Three pollution incidents have been recorded within 1km of the site boundary and were categorised as minor incidents (Category 3). The closest incident was located approximately 150m to the west east of the site. An accidental spillage or leak of petrol entered a tributary of the River Gowy on 31 October 1995. A further incident was reported 135m to the northeast of the site. Poor operational practice resulted in inert suspended solids being released into the Manchester Ship Canal. One other pollution incident from November 1991 was reported by the EA within 300m of the site, the accidental spillage of phosphoric acid.

A number of ditches bound the site and are part of the network of man-made ditches that drain the marshes area for agricultural purposes. These in turn flow towards the Ince Marshes pumping station. The local ditch network is shown on Figures 7.9a, 7.9b and 7.9c for the Entire Site, CCC and DBERR Applications respectively.

The EA has indicated that four watercourses designated as 'main rivers' are located on and in the immediate vicinity of the site. Western Boundary Drain, West Central Drain, East Central Drain and Tang Running lead to the pumping station. Hoolpool Gutter to the east of the site is also designated as a 'main river' and flows into the River Mersey, passing beneath the Manchester Ship Canal.

Water from the Manchester Ship Canal is reportedly used for cooling/processing by many industries located along the canal. One current, albeit unused, surface water abstraction was identified within the site boundary. Powergen are permitted to abstract 109,104m^3 per day of water from the Manchester Ship Canal for cooling. In addition, Shell Chemicals UK Ltd were permitted to abstract water from West Central Drain for pipeline testing, however the licence has since been revoked.

As part of the on-going maintenance works for the canal, the canal and berth area are subject to regular dredging works to maintain the usability of the canal by shipping.

The wastes generated by these activities are generally short term settlements (less than 10 years). Due to a slight organic content resulting from leaves and other plan debris, the dredgings cannot be classed as inert, but as non-hazardous.

7.3.3 Drainage

A key feature of the site is the Ince Marshes Pumping Station, which is controlled and maintained by the EA. It is located on the northern boundary within the area indicated for the northeast SUDS area. This pumping station is designed to drain the surface water runoff collected by the local ditch network from a mainly agricultural catchment covering an area of approximately 8.31km^2 immediately to the south of the station extending some 3km south to the hamlet of Hapsford. The station then discharges in a controlled manner into the Manchester Ship Canal.

The pumping station includes four pumps each with a capacity of 280 l/sec. The normal operational running of the station is for three pumps on-line and the fourth as standby. This gives a peak operational discharge rate of 840 l/sec.

The EA have confirmed that the current emergency procedures are as follows:

- Following the reporting of a failure via the telemetry system of the station the EA would respond immediately to assess the problem.
- Should a total station failure have occurred, the EA would generally respond within 6-8 hours and have an on-going arrangement with pump suppliers to provide emergency overpumping. The EA have applied a caveat such that the minimum response times would be likely to apply to heavy rainfall periods or winter months only, when catchment runoff would be expected to be high. During dry periods the response time may be extended as the risk of flooding would be minimal.

7.3.4 Flood Risk

The EA Flood Zone Maps indicate that parts of the Ince Marshes area are at risk from both fluvial and tidal flooding and that these areas overlap to a great extent.

The fluvial flooding would be the result of a failure of the Ince Pumping Station and the resultant backing up of flood waters in the surrounding ditch network and overtopping into the low lying areas.

The sea defence failure has been assessed in previous studies carried out for the EA (2004) in which it is stated that the site would be subject to a 1 in 200 year design tidal flood level of 4.08m AOD. Allowing for sea level rise the updated value for 2007 is 4.088m AOD.

Discussions have been held with Peel Ports, operators of the Manchester Ship Canal. These have established that the existing canal structure is monitored by Peel Ports and a continuous repair and monitoring program is in place. Their records do not indicate any significant failure of the canal embankments since its original construction. Both the EA and Peel Ports state that a breach failure is extremely unlikely. However, the modelled flood levels suggested above have been included in the flood risk analysis.

An assessment carried out as part of the Flood Risk Assessment calculated the flood water levels that may result from each of two scenarios:

- Total pumping station failure during a wet period and the subsequent occurrence of a 1 in 100 year storm event while the station is out of action. In addition a response time of 8 hours with pumping at 500 l/sec (340 l/sec below the station capacity) has been considered.
- Normal operation with 3 pumps discharging at a rate of 280 l/sec each (840 l/sec) during a 1 in 100 year storm event.

The results are summarised below based on the calculated data given in Table 7.1.

Table 7.1: Fluvial Flooding Data

Description	Value
Catchment Area	8.31 km^2
SAAR (standard average annual rainfall)	718 mm
Nearest Gauging Station	68020 Gowy@Bridge Trafford (Replaced Gowy@Picton)
QMED (median annual maximum flood flow)	1.458 m3/sec
Growth Factor to 1 in 100 year storm event	1.790
1 in 100 year Peak Flow (from catchment descriptors)	2.610 m3/sec
Growth factor for 50 year global warming effect	1.20
1 in 100 year Peak Flow in 2054	3.132 m3/sec
Time to Storm Peak	11.70 hours
Storm Duration	14.75 hours
Response Hydrograph Duration (a)	23.41 hours
Runoff Volume (2007)	102,023 m3
Runoff Volume in (2067)	122,428 m3
Discharge Volume of Pumping Station during design storm (a x 0.84 m^3/sec)	70.790 m3
NOTES: Calculations based on FEH – Flood Estimation Handbook, Institute of Hydrology, 1999	

Applying the above data to the first scenario, the total volume requiring storage during a total shut down is a direct result of the shutdown duration (8 hours) and the amount of rainfall during that period. As shown above, the predicted 1 in 100 year storm event runoff hydrograph is estimated at around 23.41 hours with a peak occurring some 11.70 hours after the start of the storm.

To calculate the peak volume, a pumping station failure during the most intense part of the runoff period has been considered, centred around the peak flow of 2.610m^3/sec.

The calculated volume of runoff within this time band is 63,750m^3, some 62% of the total runoff generated by the catchment during a 1 in 100 year storm event.

Extending the ground model to include areas to the immediate east of the site up to the Hornsmill Brook and west towards Stanlow, the calculated storage volume below 4.088m is 68,000 m^3. This is in excess of the required volume. Additional analysis predicts that the flood level for this event would be around 4.020 mAOD, 68mm below the predicted tidal flood levels.

In addition applying global warming effects increases the area of the graph by 20% to an estimated volume of 76,500m^3. From the assessment of available areas this increase in volume could result in up to 100mm increase in flood water depth to a 1 in 100 year flood level of 4.160m AOD, which is well below the sea level increase within the same time period.

In the second scenario the peak runoff flow is estimated at 2.610m^3/sec, which exceeds the maximum pumping rate for the station (0.84m^3/sec). However over the predicted 23.41-hour runoff period the station is capable of discharging the full runoff quantity.

The assessment therefore is to estimate the resulting peak storage volume required during the event where the runoff exceeds 0.84m^3/sec. This is equivalent to the area of the hydrograph above the 0.84m^3/sec pumping rate. This volume has been estimated to be in the order of 45,220m^3.

It can clearly be seen that this would produce a flood water level below both the Scenario A situation and the tidal flood levels. The estimated flood level for this event is approximately 3.92m AOD.

The flood assessment analysis indicates that the worst case flood event would be the failure of sea defences and the resultant flooding due to a 1 in 200 year event. It should also be noted that of all the possible events this is also the least likely. The extent of the predicted flooding is shown on Figure 7.10.

7.4 Construction Impacts

7.4.1 General Construction Impacts – All Applications

Due to the close relationship between the site and a number of watercourses, the Manchester Ship Canal and a high groundwater table, the potential impacts to the water environment during the construction phase have the potential to be significant. The primary impacts would be related to:

- site drainage;
- surface water outfalls (existing and proposed);
- construction of the new berth within the Manchester Ship Canal
- delivery/storage of construction materials;
- storage/handling of materials/oils/chemicals;
- introduction of flood protection works;
- site compounds and welfare facilities;
- siltation;
- refueling;
- concrete mixing; and
- cross contamination of geological strata due to piling.

During construction, the greatest risk would be when construction works are being undertaken prior to completion of the proposed drainage system. Sudden rainfall events can mobilise silt and materials held within the site, and if not controlled these would be conveyed to the surrounding ditch network and then on to the pumping station and from there to the Canal.

To a lesser degree the potential risk of accidental spillages from oil and fuel storage facilities as well as construction materials would be present. Cement, if leached into a watercourse would potentially have detrimental effects by drawing oxygen from the water and altering the pH of the water. If these effects occur prior to the construction of the drainage network then direct discharge to the watercourses or groundwater may be a consequence.

In respect of potential impacts to receptors (the local environment, residents and construction workers) during the construction phase, the surface water conditions in the local watercourses are not understood, from information currently available, to have been impacted by contaminative substances though potential sources do exist on site. In terms of pollution linkages, there is a low level of potential sources present and hence a low predicted potential impact to these receptors.

7.4.1.1 CCC Planning Application

The construction of the component areas of the RRP and minimal localised dredging of the canal is anticipated to create short term disturbance to the hydrology of the canal. The berth was used for fuel oils and there has been no significant record of spillages or contamination from this source. There may be some residual heavy metals resulting from deposits from the ships themselves when berthed, but these would have been restricted to the current berth location and have not been encountered in dredging works.

Water levels would not alter in the canal due to any of the proposed works.

The construction of a roadway and railway line adjacent to West Central Drain may pose additional potential pollution risks to this watercourse. The magnitude of the potential impact to water quality is therefore considered to be medium.

A short term impact in respect of the Manchester Ship Canal comes from the re-engineering of the canal berth along the northern boundary of the site. These works, including dredging have the potential to disrupt the canal traffic. Construction management and programming of the works would minimise the disruption and the resultant impact is deemed medium. Impacts upon sediments are discussed in Section 6.

7.4.1.2 DBERR Section 36 Electricity Act Application

The DBERR Application would include the short term impacts in respect of the Manchester Ship Canal related to the construction and reinforcement of the canal berth along the northern boundary of the site. The extent and significance of the impact does not differ from that described above (7.4.1.1).

7.4.1.3 Entire Site

There are no additional impacts for a combined application to those described in 7.4.1.1 as the extent of canal works would be equivalent to both the CCC and DBERR applications.

7.4.2 Hydrogeology

7.4.2.1 CCC Planning Application

The development of the site has the potential to affect the groundwater, as the groundwater elevation is high due to the nature of the underlying geology and low lying land. Impacts could result from berth works and excavation below 1-2m, such as piling, lift and loading bay pits as well as petrol interceptor bases. There would be an increased risk of deep excavations collapsing and construction activities would have to take into consideration the potentially shallow groundwater table (dewatering from sumps or well points for example). The risk to groundwater from potentially polluting substances would be high, if encountered during excavation work.

In respect of potential impacts to receptors (the local environment, residents and construction workers) during the construction phase, the groundwater is not understood to have been impacted by contaminative materials. Therefore in terms of pollution linkages there is no potential source present from the currently available data. However, there is the potential for limited ground contamination to be present on the site.

Again the canal side works, including the new piling works would extend below existing ground water levels. This would have a localised impact initially, but groundwater levels are anticipated to return to normal levels within the construction period. It is therefore considered to have only a slight, short term impact.

7.4.2.2 DBERR Section 36 Electricity Act Application

This application would include the berth works as described above as well as include excavations below 1-2m, such as piling, lift and loading bay pits as well as petrol interceptor bases. There would be an increased risk of deep excavations collapsing and construction activities would have to take into consideration the potentially shallow groundwater table (dewatering from sumps or well points for example). The risk to groundwater from potentially polluting substances would be high, if encountered during excavation work. The area of aquifer affected by this application is less than for the CCC application.

7.4.2.3 Combined Application

There are no additional impacts related to the combination of applications. However, the increase in development area and construction activities does slightly increase the statistical possibility of an occurrence of any individual pollution incidence, such as spillage from refuelling plant or stored materials.

However, this statistical risk is mitigated by the corresponding expansion of the control measures as described in the mitigation section below and in Section 6.5.

7.5 Operational Impacts

7.5.1 Hydrology

7.5.1.1 CCC Planning Application

The redevelopment of the site would result in an increase in impermeable area of approximately 72% excluding the proposed landscaping and wetland areas. This would significantly influence the volume of surface water runoff and decrease potential infiltration. The surface water discharges for the Ince Marshes catchment are currently controlled by the pumping station, which has a set discharge capacity. It is understood that the EA itself does not intend to increase the capacity of the pumping station for proposed development in the area as the station was originally intended to drain agricultural land.

Conversion of agricultural land to hardstanding would generate significant surface water flows that are both larger in volume as well as having larger peak flows. In addition the time of concentration of runoff is lessened and could result in peak flows reaching the pumping station earlier than the existing peak flows. Table 7.2 below identifies the development areas and the estimated impermeable areas.

Increased runoff may also exceed the capacity of some of the local ditches leading to localised flooding with higher peak flows increasing the risk of bank erosion. This may occur where there are physical constraints such as outfalls and culverts.

Petrol interceptors would be required around the site. These by necessity are placed below ground level and with invert levels close to that of the surrounding ditch network. There would be the potential for backwater effects where flows within the ditch flood back into the pipework leading to the interceptors.

Table 7.2: CCC Application Estimated Impermeable Areas

Plot No.	Planned Development Area (ha)	Estimated Impermeable Area (ha)	%
North West SUDS Area			
1 Berth	11.318	10.828	96
1 Berth Petrol Filling Station	0.072	0.072	100
2 Soils	2.950	1.605	54
3 WEEE	5.270	3.400	65
SUB TOTALS	**19.610**	**15.905**	**81**

Plot No.	Planned Development Area (ha)	Estimated Impermeable Area (ha)	%
West SUDS Area			
10a Education	1.780	1.063	60
10b B1 Office	0.630	0.333	53
11 Waste Transfer Station	1.870	1.000	53
12 Resource Recovery Village	5.000	3.068	61
SUB TOTALS	**9.280**	**5.464**	**59**

Plot No.	Planned Development Area (ha)	Estimated Impermeable Area (ha)	%
Central SUDS Area			
4 Timber	5.000	3.625	73
5 Waste Management	5.000	3.901	78
SUB TOTALS	**10.000**	**7.526**	**75**

Plot No.	Planned Development Area (ha)	Estimated Impermeable Area (ha)	%
South East SUDS Area			
9 Ethanol Plant	4.000	2.722	68
13 Resource Recovery Village	2.740	1.970	72
14 Block Making	1.770	1.080	61
SUB TOTALS	**8.510**	**5.772**	**68**

Plot No.	Planned Development Area (ha)	Estimated Impermeable Area (ha)	%
North East SUDS Area			
6 Plastics Village	2.760	1.464	53
7 Water Treatment	1.000	0.740	74
SUB TOTALS	**3.760**	**2.204**	**59**

CCC Application TOTAL	**51.160**	**36.871**	**72**

The above areas include all associated access, rail track and hardstanding required to service the plots.

To accommodate the CCC Application and associated works all the SUDS areas shown on Figures 7.2-7.6 would need to be constructed, partly for drainage purposes and partly as wetland habitat. For general drainage events (not flooding) the SUDS scheme provides the storage required to enable the Ince Marshes pumping station to operate as normal with slightly longer pumping times for some rainfall events. For the CCC Application the following design parameters have been used for this assessment:

Table 7.3: CCC Application Estimated Runoff Attenuation Volumes

Plot No.	Total Site Area (ha)	Impermeable Area (ha)	Limiting Discharge l/sec (1 in 1 year)	Storage Volume Required for 1 in 100 event (m^3)*	Storage Volume Provided (m^3)
North West SUDS Area					
1 Berth	11.318	10.828	40.6	4,754-6,437	
1 Berth Petrol Filling Station	0.072	0.072	1.0	22-31	
2 Soils	2.950	1.605	12.3	573-787	
3 WEEE	5.270	3.400	20.6	1,288-1,765	
			TOTALS	**6,637-9,020**	**12,850**

Plot No.	Total Site Area (ha)	Impermeable Area (ha)	Limiting Discharge l/sec (1 in 1 year)	Storage Volume Required for 1 in 100 event (m^3)*	Storage Volume Provided (m^3)
West SUDS Area					
10a Education	1.780	1.063	7.8	384-527	
10b B1 Office	0.630	0.333	3.1	256-345	
11 Waste Transfer Station	1.870	1.000	8.2	775-1,050	
12 Resource Recovery Village	5.000	3.068	19.6	1,147-1,571	
			TOTALS	**2,562-3,493**	**2,270**

Plot No.	Total Site Area (ha)	Impermeable Area (ha)	Limiting Discharge l/sec (1 in 1 year)	Storage Volume Required for 1 in 100 event (m^3)*	Storage Volume Provided (m^3)
Central SUDS Area					
4 Timber	5.000	3.625	19.6	1,420-1,941	
5 Waste Management	5.000	3.901	19.6	1,559-2,126	
			TOTALS	**2,979-4,067**	**7,000**

Plot No.	Total Site Area (ha)	Impermeable Area (ha)	Limiting Discharge l/sec (1 in 1 year)	Storage Volume Required for 1 in 100 event (m³)*	Storage Volume Provided (m³)
South East SUDS Area					
9 Ethanol Plant	4.000	2.722	16.1	1,039-1,423	
13 Resource Recovery Village	2.740	1.970	11.5	755-1,033	
14 Block Making	1.770	1.080	7.8	392-538	
			TOTALS	**2,186-2,994**	**7,000**

Plot No.	Total Site Area (ha)	Impermeable Area (ha)	Limiting Discharge l/sec (1 in 1 year)	Storage Volume Required for 1 in 100 event (m³)*	Storage Volume Provided (m³)
North East SUDS Area					
6 Plastics Village	2.760	1.464	11.6	517-712	
7 Water Treatment	1.000	0.740	4.7	277-379	
			TOTALS	**794-1,091**	**8,200**

	Storage Volume Required for 1 in 100 event (m³)*	Storage Volume Provided (m³)
North West SUDS Area	6,637-9,020	12,850
West SUDS Area	2,562-3,493	2,270
Central SUDS Area	2,979-4,067	7,000
South East SUDS Area	2,186-2,994	7,000
North East SUDS Area	794-1,091	8,200
TOTALS	**15,158-20,665**	**37,320**

*The range of storage volumes identified is an approximation based on different control structure performance. This would be refined once detail design is carried out and the type of outfall structure is known. It should also be noted that the 1 in 1 year discharge limitation is a worst-case requirement of the EA.

This demonstrates that there is more than adequate attenuation volume available within the SUDS wetlands proposed as part of this scheme and so no impacts in relation to site drainage are anticipated.

In addition to surface water control, the operation of the berth area is likely to involve the movement of bulk cargos unloaded from ships. There is therefore, a potential risk of spillage of materials into the canal during these operations. As with all lifting operations there are legal requirements (health and safety legislation) and site-specific procedures that would need to be adhered to at this site. This would minimise the potential for such an incident.

The bulk materials themselves would either consist of inert materials (timber etc) or, if potentially contaminative (oils etc), these contained in sealed containers. As a result the actual materials that could enter the canal would also be inert. Thus the potential for an incident of this type would be low (of small magnitude) and the receptor, the canal, would not be adversely affected.

7.5.1.2 DBERR Section 36 Electricity Act Application

The redevelopment of the site would result in an increase in impermeable area of approximately 60% excluding the proposed landscaping and wetland areas. This would influence the volume of surface water runoff and decrease potential infiltration.

Conversion of agricultural land to hardstanding for the berth and RDF areas would generate significant surface water flows that are both larger in volume as well as having larger peak flows. In addition the time of concentration of runoff is lessened by development and could result in peak flows reaching the EA controlled pumping station earlier than the existing peak flows. Table 7.4 below identifies the development areas and the estimated impermeable areas.

Table 7.4: DBERR Application Estimated Impermeable Areas

Plot No.	Planned Development Area (ha)	Estimated Impermeable Area (ha)	%
South East SUDS Area			
1 Berth (included on both applications)	11.318	10.828	96
1 Berth Petrol Filling Station	0.072	0.072	100
8 RDF Plant	7.400	4.51	61
DBERR Application TOTAL	**18,790**	**11.351**	**60**

The above areas include all associated access, rail track and hardstanding required to service the plots.

Increased runoff may also exceed the capacity of some of the local ditches leading to localised flooding with higher peak flows increasing the risk of bank erosion. This may occur where there are physical constraints such as outfalls and culverts.

Of particular note is the close proximity of the West Central Drain, immediate west of the RDF plant. This is the main watercourse leading to the Ince Marshes Pumping Station and conveys much of the wider catchment area flows to the station. Any direct, un-attenuated, discharge into this watercourse could result in changes to the operation of the pumping station.

To accommodate the RDF plant and associated works both the North West SUDS area and the South East SUDS area would need to be constructed. For general drainage events (not flooding) the SUDS scheme provides the storage required to enable the Ince Marshes pumping station to operate as normal with slightly longer pumping times for some rainfall events. For the RDF plan the following design parameters have been used for this assessment:

Table 7.5: DBERR Application Estimated Runoff Attenuation Volumes

Plot No.	Total Site Area (ha)	Impermeable Area (ha)	Limiting Discharge l/sec (1 in 1 year)	Storage Volume Required for 1 in 100 event (m³)*	Storage Volume Provided (m³)
North West SUDS Area					
1 Berth	11.318	10.828	40.6	4,754-6,437	12,850
1 Berth Petrol Filling Station	0.072	0.072	1.0	22-31	
South East SUDS Area					
8 RDF Plant	7.400	4.510	27.8	1,729-2,368	7,000

	Storage Volume Required for 1 in 100 event (m³)*	Storage Volume Provided (m³)
North West SUDS Area	4,776-6,468	12,850
South East SUDS Area	1,729-2,368	7,000
TOTALS	**6,505-8,836**	**19,850**

*The range of storage volumes identified is an approximation based on different control structure performance. This would be refined once detail design is carried out and the type of outfall structure is known. It should also be noted that the 1 in 1 year discharge limitation is a worst-case requirement of the EA.

This demonstrates that there is more than double the attenuation volume available within the SUDS wetlands proposed as part of this scheme and so no impacts in relation to site drainage are anticipated

Petrol interceptors would be required around the site, within car parking areas and storage areas. These by necessity are placed below ground level and with invert levels close to that of the surrounding ditch network. There would be the potential for backwater effects where flows within the ditch flood back into the pipework leading to the interceptors.

Although the berth would be in operation as part of this application, due to the overall lesser operation of the berth would reduce the potential occurrence of a spillage of bulk materials from unloading operations. The impact is therefore considered negligible.

7.5.1.3 Combined CCC and DBERR Application (Entire Site)

The redevelopment of the total site would result in an increase in impermeable area of of the wider site by approximately 71% excluding the proposed landscaping and wetland areas. This increase is not a direct aggregation of the two applications as the berth facility is duplicated in both applications. This combined development would significantly influence the volume of surface water runoff and decrease potential infiltration.

Again, the conversion of agricultural land to hardstanding areas would generate significant surface water flows that are both larger in volume as well as having larger peak flows. In addition the time of concentration of runoff is lessened by development and could result in peak flows reaching the EA controlled pumping station earlier than the existing peak flows. Table 7.6 below identifies the total development areas and the estimated impermeable areas.

Table 7.6: Combined CCC and DBERR Application

	Planned Development Area (ha)	Estimated Impermeable Area (ha)	%
North West SUDS Area (CCC)	19.610	15.905	81
West SUDS Area (CCC)	9.280	5.464	59
Central SUDS Area (CCC)	10.000	7.526	75
South East SUDS Area (CCC)	8.510	5.772	68
North East SUDS Area (CCC)	3.760	2.204	59
South East SUDS Area (DBERR)	7.400	4.510	61
Combined Application TOTALS	**58.560**	**41.381**	**71**

To accommodate both applications and their associated works all the SUDS areas shown on Figures 7.2-7.6 would need to be constructed, again, partly for drainage purposes and partly as wetland habitat. For general drainage the SUDS scheme provides the storage required to enable the Ince Marshes pumping station to operate as normal with slightly longer pumping times for some rainfall events. For the Entire Site the following design parameters have been used for this assessment:

Table 7.7: Combined Application Estimated Runoff Attenuation Volumes

	Storage Volume Required for 1 in 100 event (m^3)*	Storage Volume Provided (m^3)
North West SUDS Area	6,637-9,020	12,850
West SUDS Area	2,562-3,493	2,270
Central SUDS Area	2,979-4,067	7,000
South East SUDS Area	3,915-5,362	7,000
North East SUDS Area	794-1,091	8,200
TOTALS	**16,887-23,033**	**37,320**

The Entire Site requires up to an additional 2,368m^3 of storage volume. However, this is still less than the volume available within the SUDS wetlands proposed and so no impacts in relation to site drainage are anticipated.

The berth would be in operation as part of the whole. The operation of the berth would not significantly increase the potential occurrence of a spillage of bulk materials from unloading operations over that described for the CCC application. The impact is therefore also considered negligible.

7.5.2 Flooding

7.5.2.1 CCC Application

The construction of large areas of new hardstanding and roofs would have the potential to generate more concentrated surface water runoff than could be attenuated by natural processes such as infiltration, evaporation and storage within the ditch network.

However, the EA confirms that the existing ditch network is controlled by pumping rather than gravity, and as such the ditch network acts as a series of interlocking storage channels that are then emptied by the pumping station when waters reach predetermined levels.

The additional concentration of surface water generated by the site would locally raise the water within the channels marginally earlier thus activating the pumping station at an earlier stage in the storm runoff profile. For the majority of storm events any excess runoff within the catchment would be dealt with by a slight increase in pumping durations at the Ince Marshes pumping station. The overall impact within the site and its immediate environs would be minimal.

During a more intense storm event the Flood Risk Assessment (FRA) has shown that extensive shallow flooding would occur throughout the Ince Marshes area due to the constraint of the maximum pumping rates available at the station. The additional runoff from this development would be minimal in comparison to the overall catchment.

The Flood Risk Assessment also determined that the worst-case flooding event would result from tidal inundation following a breach of sea defences. In such a case, the contribution to flood waters from the development would be even less as much of the proposed site infrastructure would be flooded.

There would be an impact of flood storage resulting from both the changes to the surrounding ditch network and from the localised raising of building floor levels to the EA agreed minimum level of 5.063m AOD, as requested by the EA. The reduction in available flood storage volume would be a result of the amount of building footprint within the predicted flood area. Figures 7.2 to 7.6 show the predicted extent of the tidal flooding. From this it can be deduced that flooding may be present to the south and central development areas of the site. Table 7.8 below indicates the estimated areas of proposed buildings in areas either below predicted flood levels or where finished floor levels would be raised to achieve the required 5.063m level.

Table 7.8: CCC Application Estimated Flood Compensation Areas

Plot No.	Building Area Below Minimum Floor Level 5.063m (m²)	Building Area Below Flood Level 4.088m (m²)	Estimated Flood Compensation Volume (m³)	Compensation Provided (m³)
North West SUDS Area				
1 Berth	0	0	0	
1 Berth Petrol Filling Station	0	0	0	
2 Soils	3,000	1,650	145	
3 WEEE	24,000	8,500	748	
SUB TOTALS	**27,000**	**10,150**	**893**	**12,850**

Plot No.	Building Area Below Minimum Floor Level 5.063m (m²)	Building Area Below Flood Level 4.088m (m²)	Estimated Flood Compensation Volume (m³)	Compensation Provided (m³)
West SUDS Area				
10a Education	0	0	0	
10b B1 Office	0	0	0	
11 Waste Transfer Station	300	280	255	
12 Resource Recovery Village	8,210	4,320	1,277	
SUB TOTALS	**8,510**	**4,600**	**1,532**	**2,270**

Plot No.	Building Area Below Minimum Floor Level 5.063m (m²)	Building Area Below Flood Level 4.088m (m²)	Estimated Flood Compensation Volume (m³)	Compensation Provided (m³)
Central SUDS Area				
4 Timber	7,000	3,000	264	
5 Waste Management	4,500	100	91	
SUB TOTALS	**11,500**	**3,100**	**91**	**7,000**

Plot No.	Building Area Below Minimum Floor Level 5.063m (m²)	Building Area Below Flood Level 4.088m (m²)	Estimated Flood Compensation Volume (m³)	Compensation Provided (m³)
South East SUDS Area				
9 Ethanol Plant	8,510	0	0	
13 Resource Recovery Village	7,800	1,960	775	
14 Block Making	2,600	0	0	
SUB TOTALS	**18,910**	**1,960**	**775**	**7,000**

Plot No.	Building Area Below Minimum Floor Level 5.063m (m^2)	Building Area Below Flood Level 4.088m (m^2)	Estimated Flood Compensation Volume (m^3)	Compensation Provided (m^3)
North East SUDS Area				
6 Plastics Village	360	0	0	
7 Water Treatment	200	0	0	
SUB TOTALS	**560**	**0.000**	**0**	**8,200**

	Building Area Below Minimum Floor Level 5.063m (m^2)	Building Area Below Flood Level 4.088m (m^2)	Estimated Flood Compensation Volume (m^3)	Compensation Provided (m^3)
North West SUDS Area (CCC)	**27,000**	**10,150**	**893**	**12,850**
West SUDS Area (CCC)	**8,510**	**4,600**	**1,532**	**2,270**
Central SUDS Area (CCC)	**11,500**	**3,100**	**91**	**7,000**
South East SUDS Area (CCC)	**18,910**	**1,960**	**775**	**7,000**
North East SUDS Area (CCC)	**560**	**0.000**	**0**	**8,200**
TOTALS	**93,680**	**19,810**	**3,291**	**37,320**

The secondary flooding impact of the CCC site results from more frequent and longer duration pumping operations of the Ince Marsh pumping station discharging into the Manchester Ship Canal. It has been suggested that at the minimum current base water losses within this section of the canal (through lock gates, sluices etc) are in the order of 1 m3/sec. This quantity is approximately equal to that of the maximum discharge rate of the Ince Marsh pumping station. Added to the base flow within the canal are flows produced by the operation of the locks, estimated by an earlier study carried out on behalf of Central Electricity Generating Board in 1967, to be an average of 2.1 m^3/sec. Therefore the canal is flowing at an average minimum rate of 3.1 m^3/sec well above the maximum rate of the Ince Marsh pumping station.

A main safety aspect of flooding, is that of the availability of a dry safe means of access from the site during a flood event. For this site the easiest means of escape would be via the canal embankment some 2.4m higher in elevation than the main site area and 2.5m above the maximum predicted tidal flood level. Most development areas would also be accessible via the proposed road network, which is already above the flood level. The EA have stated that a minimum road level of 4.763m AOD is to be provided on all roads that would serve as a means of egress during flood events. Localised raising of the roads around Plots 2 and 3 would be required to ensure this safe dry route (between 1.5 and 2.0m). In addition the main road from Kemira Road to the berth needs to be constructed above existing ground levels at the following locations:

- From the gatehouse east to the level crossing close to Plot 9 (approximately 100-200mm).
- From Plot 9 north to the berth (approximately 200-350mm).

As can be seen from Table 7.8 above, more than adequate compensation flood storage would be provided and so no impacts are anticipated in relation to flooding.

7.5.2.2 DBERR Section 36 Electricity Act Application

The berth element of this application is at elevations well above the predicted flood levels. Although the RDF site itself has levels below the minimum finished floor level, they are above the 1 in 200 year flood level. In general the existing ground levels in and around the RDF plant are at between 4.20 and 4.50 mAOD. This places the site outside Flood Zone 3. This is demonstrated in Table 7.9 and shown on Figure 7.10.

To provide a safe means of egress from the site during flood events the main road from Kemira Road to the berth needs to be constructed above existing ground levels at the following locations:

- From the gatehouse east to the level crossing close to RDF Plant (approximately 100-200mm).
- From RDF plant north to the berth (approximately 200-350mm).

Table 7.9: DBERR Application Estimated Flood Compensation Areas

Plot No.	Building Area Below Minimum Floor Level 5.063m (m^2)	Building Area Below Flood Level 4.088m (m^2)	Estimated Flood Compensation Volume (m^3)	Compensation Provided (m^3)
1 Berth	**0**	**0**	**0**	
1 Berth Petrol Filling Station	**0**	**0**	**0**	
8 RDF Plant	27,200	0	0	
TOTALS	**27,200**	**0**	**0**	**19,850**

The compensation volume provided in connection to the berth and RDF plant are a consequence of the provision required to attenuate storm water runoff as discussed in 7.5.2 above. As can be seen from Table 7.9 above, more than adequate compensation flood storage would be provided and so no impacts are anticipated in relation to flooding.

7.5.2.3 Combined CCC and DBERR Application

The construction of the combined site with large areas of new hardstanding and roofs would have the potential to generate more concentrated surface water runoff than could be attenuated by natural processes such as infiltration, evaporation and storage within the ditch network.

It is not anticipated that the additional concentration of surface water generated by the combined development would locally raise the water within the channels significantly more than either of the separate options. However, these water level increases may cause marginally earlier activating of the pumping station during a storm runoff event. For the majority of storm events any excess runoff within the catchment would be dealt with by a slight increase in pumping durations at the Ince Marshes pumping station. The overall impact within the site and its immediate environs would be minimal.

There would be an impact of flood storage resulting from both the changes to the surrounding ditch network and from the localised raising of building floor levels to the EA agreed minimum level of 5.063m AOD, as requested by the EA. The reduction in available flood storage volume would be a result of the amount of building footprint within the predicted flood area. The extent of land raising required is shown in Table 7.10.

Table 7.10: Combined CCC & DBERR Application Estimated Flood Compensation Areas

	Building Area Below Minimum Floor Level 5.063m (m^2)	Building Area Below Flood Level 4.088m (m^2)	Estimated Flood Compensation Volume (m^3)	Compensation Provided (m^3)
North West SUDS Area	27,000	10,150	893	12,850
West SUDS Area	8,510	4,600	1,532	2,270
Central SUDS Area	11,500	3,100	91	7,000
South East SUDS Area	46.110	1,960	775	7,000
North East SUDS Area	560	0.000	0	8,200
Combined Application TOTALS	93,680	19,810	3,291	37,320

As with the individual applications a dry safe means of egress from the site during a flood event is to be required. For this site the easiest means of escape would be via the canal embankment some 2.4m higher in elevation than the main site area and 2.5m above the maximum predicted tidal flood level. Most development areas would also be accessible via the proposed road network, which is already above the flood level. Localised raising of the roads around Plots 2 and 3 would be required to ensure a safe dry route.

As can be seen from Table 7.10 above, more than adequate compensation flood storage would be provided and so no impacts are anticipated in relation to flooding.

7.5.3 Hydrogeology

The development of the site has the potential to affect the groundwater, as the groundwater elevation is high due to the nature of the underlying geology and low lying land.

During periods of high rainfall, surface water levels within the surrounding area are likely to increase and subsequently raise the local groundwater table. Structures below ground level may therefore be subject to groundwater seepage. Consideration of the possibility of groundwater infiltration into the site drainage would be included in the design of the underground drainage systems and interceptors and is described in more detail in Section 7.6 below.

The requirement for petrol interceptors around the site could also impact upon hydrogeology. The interceptors are placed below ground level and with invert levels close to that of the surrounding ditch network and potentially close to or below groundwater levels. There is the potential risk of groundwater to flood back into the pipework leading to the interceptors. Again, this is reflected in the drainage design below.

7.5.4 General Site Operations

There are a number of general activities on site applicable to all applications that pose potential risks to water quality and these include:

General Operational Impacts

- Refueling;
- Vehicle movement;
- Vehicle maintenance;
- Washdown waters;
- Materials handling.

Accidental Impacts

- Accidental liquid releases from storage;
- Fire or explosions;
- Fire-fighting water:
- Vandalism.

The proposed development would include garage areas as well as vehicle washdown facilities at a number of locations. These would be constructed and maintained in accordance with best practice and the EA PPGs.

In addition, it would be necessary to construct a number of crossings of the surrounding watercourses. These would be in the form of either bridges or culverted sections of the watercourse. Culverting is not the EA preferred option as it reduces the ecological benefit of the watercourse, and presents a possible constraint to flow capacity. Therefore, bridges are proposed to be used on the larger crossings with culverts only on smaller shorter crossings.

7.5.5 Site-Specific Impacts

For site-specific uses, and in particular where any process waters are to be used, the following impacts have been assessed. A more detailed description of the development proposals is contained in Section 2.

Plot 1 – Berth (Both DBERR and CCC Applications)
The proposals are to convert the existing piped cargo import berth into a multi modal general cargo facility, with appropriate handling and storage facilities. The facility would be rail linked to enable the transhipment of cargo direct from rail to sea and vice versa. Sheds, providing undercover storage, and open storage areas would be available for the receiving of bulk materials and their segregation from each other. The sheds only form part of the CCC application, however.

This site would be predominately hardstanding and the impacts would be from surface water runoff with the potential to contain contaminates from uncovered stockpiles as well as accidental spillage from liquid storage vessels.

All hardstanding areas on the berth would be designed with a suitable drainage system separating “clean” roof drainage from drainage from hardstanding and parking areas, which are to pass through interceptors before discharging to the ditch network. No potentially polluting materials would be stored uncovered in this area.

Only a small area to the northwest of the Berth is within the predicted floodplain extent. None of proposed building footprint would be within the floodplain.

By providing a finished floor level 150mm above existing ground level, none of the buildings within the berth area would require any additional land raising.

The existing canal berth was designed for importing liquids for adjacent industry, a function, which is to be maintained. In order to allow importation of dry cargo, existing structures on the quay would be removed and further hard standing areas installed to allow discharge of bulk and container carrying vessels. The existing ammonia pipeline used by Kemira for loading and discharging would be re-positioned to the east end of the berth, out of the way of day-to-day operational equipment.

The quay area would also have to be strengthened for a 11m wide and 200m long section and upgraded to allow the use of Mobile Harbour cranes. The strengthening would involve piles being placed 3 abreast in 40 rows along the length of the quay.

Some maintenance dredging would be required to ensure water depth of 8.08m along the berth. This would be carried out as part of the on-going dredging works that are carried out as part of the normal maintenance of the canal. All dredging spoils would go to the Ship Canal deposit grounds, which are an established and licensed receptor site for these materials.

As part of the Berth provision a new petrol filling station is to be provided at the south west corner of the plot. This station would be designed to all filling station design standards and Environment Agency PPGs. It is not located within the flood zone and does not require uplifting to achieve the minimum floor levels. Foul drainage and potentially contaminated waters from the forecourt area are to be directed to the foul treatment plant.

There are no process waters generated within this plot, hence it is assessed to have a negligible impact.

Rail Link (Both CCC and DBERR Applications)
The route would cross the estimated extent of the flood plain between Plots 4 and 8 and would be constructed at a level of 5.5m AOD (as shown on application plan 0775/SK/02 Rev B). This would lead to some lengths of track being raised, particularly towards the north (around 0.7m) and to the south of the RDF Plant (around 1.1m). It is not anticipated that the rail link would act as a barrier to flood waters as numerous culverts/bridges exist or are planned linking the ditch network to the west with West Central Drain.

There is the potential for fuel oils and lubricants to be deposited by the train engines and units should they be standing for long periods close to the berth. However, it is anticipated that these volumes would be low and the inclusion of ballast below the rails would act as a natural attenuation system improving biodegradation of the materials.

The rail line, however, is in close proximity to the West Central Drain and a cut off ditch or French Drain is to be provided along the eastern side of the railtrack in order to intercept runoff from the ballast. Flows in this drain/ditch are to pass through an oil interceptor before discharge into the West Central Drain.

Main Spine Roads (Both CCC and DBERR Applications)
All road areas on the site would be designed with a suitable drainage system incorporating trapped road gullies before discharging to the ditch network. The drainage to the road would be separate from that of the individual plot hardstanding areas.

There are no water generating activities within the spine roads. However, there is the potential for fuel oils and lubricants to be deposited by vehicles using the roads as well as mud and silt from wheels. However, these volumes would be low as no vehicles will be parked on the road network. The impact is assessed as being negligible.

The FRA for the site has established that in order to maintain safe dry access to the site a minimum road level of 4.763m AOD would be applicable. This will be applied to all main road links around the site. Areas of hardstanding and car parking would be constructed at grade with a separate safe access provision if required.

Wetland Areas (Both CCC and DBERR Applications)
The two main ecological mitigation areas (A and C) are to be established for either or both CCC and DBERR applications. However, Area B (Ecological Core) would only form part of the CCC application.

The proposed wetland areas are to function on several levels. In hydrological and hydrology terms, their main functions are to balance surface water flows and provide water quality treatment.

The Ince Marshes pumping station provides a widespread area of relatively flat controlled water. This enables the opportunity for a structured wetland that would include deeper channels and ponds for more frequent surface water balancing, together with shallower flood compensation areas. By combining these, water quality and flood storage would be addressed.

Construction of these areas would temporarily cause disruption to the ditch network, as by definition these areas are to be located close to watercourses. A detailed construction methodology would be in place that would control construction such that these areas are constructed separately from the ditch network until such time as silt and contamination issues are minimised. They would then be connected to the surrounding network.

There are no water related processes undertaken in the wetland areas and hence no potentially contaminative or additional quantities of flow generated within this area.

Plot 2 - Soil Treatment (CCC Application)
The site would be able to accept up to 100,000 tonnes of soils to be treated per annum. Soils would be imported from a combination of individual development sites. It is estimated that 90,000 tonnes of clean sand and gravel could be produced, suitable for use in building site works.

Soils would be placed on concrete hardstanding areas where the soils would be fed by conveyor to the soil washing facility to begin contaminant removal from the soil using water, surfactants and solvent where required. Soil washing would involve classifying soils into classes according to particle size, floatation using surface additives to adsorb particles, which contain contaminants, and separation by gravity of heavy and light particles. A proportion of waste waters would be re-circulated through the washing process to reduce water consumption. ‘Biopiles’ for bioremediation and in-vessel composting systems could be used (see Sections 2.5.4 and 2.6.4).

Leachate from the composting materials in the vessels is collected and used to keep the compost wet. Any excess would be passed to the site water treatment plant prior to release as a controlled discharge to foul sewer, although the composting plant is likely to be a net consumer of process water.

Windrows and material stockpiles would be located outside of low lying areas that could be subject to flooding and would be bunded to control surface water runoff and with water suitably treated to ensure no off-site contamination. Storage areas would be covered.

All of the building within Plot 2 is to be located on land with elevations approximately 300mm below the estimated flood level. The finished floor level of this block would be raised to the minimum level of 5.063m AOD. This would necessitate raising of accesses to the building and provision of ramps for vehicles and pedestrians. Loading bays would be designed such that no land raising is required.

A safe dry access would be provided in this plot linking it to land at higher elevation to the north and east. The raising of the access road would be minimal to achieve this.

Compensation areas and volumes for this would be easily accommodated within the wetland area to the northwest.

Plot 3 – WEEE (CCC Application)
It is anticipated that the facility would accept 250,000 tonnes of WEEE goods each year. Certain goods would be stored in the open, on a concrete pad with interceptor drains. All processing would take place within a steel portal framed building including: inspection, manual dismantling and mechanical shredding of plastics and metals. The non-recoverable “fluff” would either be transported off-site for disposal or utilised as a refuse derived fuel.

There is minimal process water involved in these operations and any excess water would be passed to the water treatment plant. There is a small risk that the long term storage of equipment in open areas could produce contaminated runoff due to the leaching of chemicals from rusting metals or the release of chemicals from fridges and other products containing sealed potentially hazardous liquids. These materials if released are not likely to be in large quantities but could be of a particularly harmful nature. Possible pollutants could include copper, chromium, arsenic, asbestos, volatile organic compounds, and PCBs.

All of the buildings within Plot 3 are to be located on land with elevations approximately 1.0m below the estimated flood level. The finished floor level of the blocks within this plot would be raised to the minimum level of 5.063m AOD. This would necessitate raising of accesses to the buildings and provision of ramps for vehicles and pedestrians. Loading bays would be designed such that no land raising is required.

A safe dry access would be provided in this plot linking it to land at higher elevation to the south and east. The raising of the access road would be around 1.0m to achieve this.

Compensation areas and volumes for this will be partly accommodated within the wetland area to the northwest, with the remainder accommodated within the wetland to the northeast.

Plot 4 – Timber (CCC Application)

Around 150,000 tpa of post industrial and post consumer timber waste would be imported and tipped into the central stockpile area prior to the hand sorting of recyclable and non-recyclable timber.

The recyclable waste stream would then feed through a covered chipper and screen to produce a standard chip size. A combination of band magnets and air eddy separators would remove fittings and detritus from the processed timber. Chipped timber would be dampened to reduce dust generated by the process.

The further preparation of selected chipped timber would take place within a building where washing, screening and bagging facilities would be located.

Process water would be reused with excess water passed to the site water treatment plant. Non-recyclable wood would either be transported by skip to landfill or chipped to produce a refuse derived fuel or utilised in the manufacture of ethanol.

This site would be served by a fire water system including the provision of dry risers at sensitive locations and water hoses for extinguishing fires in the dry storage areas. The required fire systems would be agreed with the local Fire Officer, but are likely to take water directly from the nearby Ship Canal.

There is a potential impact from the storage of contaminated wood products that are unsuitable for recycling and chipping. The materials could be mobilised, as they are light in nature and easily transported by flood waters and these materials may contain chemicals that could be leached into receiving water courses or soils.

Based upon the DOE Industry Profile on Timber Treatment Works the contaminants which are considered to represent the greatest risk are copper, chromium, arsenic, asbestos, volatile organic compounds, tars, PCBs, fuel, coal and ash, effluent treatment chemicals and sludges.

There is therefore a moderate risk that long-term storage of the contaminated wood products could contaminate surface water runoff and hence the wider hydrological regime. These areas would be subject to a contained drainage system as with other potentially contaminating storage areas on site, with runoff directed to the water treatment plant.

The majority of the building within Plot 4 is located on land with elevations above the estimated flood level. The finished floor level of this block will, however, require raising to the minimum level of 5.063m AOD. This would necessitate raising of accesses to the building and provision of ramps for vehicles and pedestrians. Loading bays would be designed such that no land raising is required.

Much of the timber storage yard would be at levels close to or below the estimated flood levels. However, this is not anticipated to have significant impacts.

A safe dry access would be provided in this plot linking it to land at higher elevation to the south. This will be achieved across the lorry and timber yard immediately to the south of the main building.

Compensation areas and volumes for this plot would be accommodated within the central wetland area.

Plot 5 – Integrated Waste Management Facility (CCC Application)
This plot includes three distinct process elements: a Mechanical Biological Treatment Plant (MBT), Segregated Materials Recovery Facility (MRF) and an In-Vessel Composting Facility.

The MBT plant separates out the water, recyclable and energy rich elements of the delivered waste. Refuse Derived Fuel is also produced.

The plant operates two treatment streams; the first stream is mechanical where waste is shredded and sorted, by a combination of rotating drums (trommels), air separators and vibrating screens. Metal is separated by magnets (ferrous) and eddy current separators (non-ferrous). The second stream is biological where the putrescible content of the waste is allowed to ferment, or compost, under controlled conditions. This produces heat that drives off moisture from the waste.

The complete MBT Plant is housed in an enclosed building enabling odour, dust and flies to be controlled. Leachate from the waste in biological treatment areas is collected and transferred to a storage tank. After settling, this water would be re-used in the first stage of the composting facility if water is required to wet the green/kitchen waste. Any excess water would be treated on site via the water treatment plant.

The materials typically segregated for recycling within the MRF are newspaper and magazines, cardboard and mixed paper, steel and aluminium beverage cans, plastic bottles, textiles, and glass. The materials are all dry products and would be handled within an enclosed building, designed to contain dust and to reduce noise. The plant would not use process water and there would be no effluent from the processes.

At the internal reception area for each facility, waste would first be inspected to check suitability prior to tipping. If the waste is unsuitable, it would either be redirected to another facility on site, or rejected. Suitable waste would then be tipped and subjected to further controls prior to feeding into the process areas.

The In-Vessel Composting Facility would handle kitchen and garden waste collected directly from households and civic amenity sites and may also accept suitable waste from parks and gardens, to produce a granular material, which would be applied to land for soil improvement. As with the other processes the composting facility is to be housed in an enclosed building. Leachate from the composting materials in the vessels is collected and used to keep the compost wet. The composting plant is likely to be a net consumer of process water, however any excess would be transferred to a storage tank before being treated at the on-site water treatment plant.

The Waste Management Facility would be served by a fire water system including the provision of dry risers at sensitive locations and water hoses for extinguishing fires in the waste bunker or biological treatment area. The required fire systems would be agreed with the local Fire Officer, but are intended to take water directly from the nearby Ship Canal.

Housing of the processes within covered buildings reduces the risk of contamination resulting from surface water runoff. The control of process waters within buildings would also minimise the impact of the development.

Only a small area to the southwest of this plot is within the predicted floodplain extent. Around 3,060m^2 of proposed building footprint would be within the floodplain with very shallow water depths an estimated 807m^3 of flood storage would be taken up. Compensation areas and volumes for this would be accommodated within the central wetland area.

The composting building floor space (4,500m^2) would need to be raised to the minimum level of 5.063m AOD. However, much of this would be achieved simply by providing a finished floor level 150mm above existing ground level, this figure being the standard required for damp proof course construction.

Plot 6 – Plastics Village (CCC Application)
Around 100,000 tonnes per annum of plastics would be delivered to the site as loose bulk or baled from a variety of sources and would be delivered to a reception area where they would be initially sorted by polymer type.

Once sorted, the plastics would be mechanically chipped, washed (depending on type) and bagged. All treatment operations would take place within a building other than the storage of product, which would take place on external hardstanding. This would have no impact on any watercourse.

Process water would be required for washing with any excess water treated on site and released as a controlled discharge to foul sewer/watercourse as appropriate.

Surface water runoff from the plastics stockpiles is unlikely to contain many chemical contaminates but could mobilise material that is light in nature and easily transported by flood waters. The plastics could potentially be transported relatively large distances by the Ince drainage and ditch system unless proper controls are in place to contain loose material and channel surface water runoff flows. The bagging of the product and suitable containment of raw materials would enable control of the material to be maintained and minimise the risk of uncontrolled movement of materials.

This plot is outside the predicted floodplain extent with only a small area (360m^2) requiring raising to the minimum level of 5.063m AOD. However, much of this would be achieved simply by providing a finished floor level 150mm above existing ground level, this figure being the standard required for damp proof course construction.

Plot 7 – Water Treatment Plant (CCC Application)
Discharges of process water to watercourses and foul sewer would be subject to the requirements of the Environment Agency and sewerage undertaker under respective consents. The WTP would treat water from all parts of the site including water from storage and process areas. It would also contain the water treatment plant for the treatment of discharges of water from the RDF plant, should both applications be approved.. Otherwise, the RDF plant would include this treatment within its plot. Monitoring would include both water quality testing and temperature.

This plot is outside the predicted floodplain extent with only a small area (200m^2) requiring raising to the minimum level of 5.063m AOD. However, much of this would be achieved simply by providing a finished floor level 150mm above existing ground level, this figure being the standard required for damp proof course construction. All containment areas would be raised above this level.

Plot 8 - Refuse Derived Fuel Power Facility (DBERR Application)
The reception area would handle dry fuel and there would be no water effluent. Water from the vehicle cleaning area would be passed to the water treatment plant or used in the Ash Conditioning Unit.

No parts of this plot are within the predicted floodplain.

Some 27,200m^2 of building floor space would need to be raised to the minimum level of 5.063m AOD. However, much of this, in particular the combustion facility, would be achieved simply by providing a finished floor level 150mm above existing ground level, this figure being the standard required for damp proof course construction.

The Power Plant would be cooled with an evaporative cooling system. Make-up water for the power station would be abstracted from the Manchester Ship Canal at the rate of about 500 m^3/h (0.14 m^3/sec). This water would be treated with chemicals to prevent scaling and algae growth, together with a biocide (sodium chlorite at c. 0.5ppm) for legionella prevention and a small amount of acid (likely to be sulphuric) acid) for pH control. To maintain the cooling water quality, some of the water would be released back to the canal under controlled conditions ("blowdown"), at the rate of about 150 m^3/h (0.042 m^3/sec). Although a large amount of water is transferred in and out of the canal for use by the power station the quantity is significantly less than the 11,160 m^3/h (3.1m^3/sec) that is the base flow within the canal. The chemicals used are standard for such uses and at low concentrations, while the pH of the discharged water is likely to be approximately 7.4 and there would be no oil or grease contamination. Due to the relative volumes of the canal and discharge, no significant impact is expected. Both abstraction and discharge would be subject to consent from the Environment Agency.

In addition, there would be water released from boilers, which would be treated in an ion exchange system and treated with hydrochloric acid, sodium hydroxide, corrosion and scale inhibitors. This would either be reused in the ash maturation facility or passed to the site water treatment unit for treatment prior to release, again subject to a discharge consent.

The power station has the potential for the largest foundation requirement. As with the majority of the site the foundations are likely to be piled and as such would minimise the disturbance to the underlying groundwater flow. However, the introduction of piles has the potential to create potential pathways for pollutants to lower levels of strata and groundwater. Any potential impact would be mitigated for through sealing, so no significant impact is expected.

Plot 9 - Ethanol Plant (CCC Application)
Bio-ethanol is produced from a combination of agricultural feedstocks and commercial, industrial and municipal wastes that contain a high proportion of woody biomass.

The plant would operate a two stage hydrolytic process that initially utilises a thermo-chemical conversion process that produces furfural, a chemical utilised in the fine chemicals industry, followed by a fermentation stage to produce fuel grade ethanol. Other key by-products include carbon dioxide, used in refrigeration and beverage manufacture, lignin, a high calorific value fuel and distillers grains, an animal feed.

Ethanol or ethyl alcohol (C_2H_5OH) is a clear colourless liquid, it is biodegradable, low in toxicity and causes little environmental pollution if spilt in small quantities. However it is flammable. The plant would be built to high standards of design and containment to ensure that any potential impact is insignificant.

This plot is outside the predicted floodplain extent with only an area of 8,510m^2 requiring raising to the minimum level of 5.063m AOD. However, much of this would be achieved simply by providing a finished floor level 150mm above existing ground level, this figure being the standard required for damp proof course construction.

Plots 10a & 10b – Resource Recovery Business Centre (CCC Application)
The facility would use the site's main's water supply for staff amenities and washrooms. Sewage from the washrooms would be disposed of to sewer.

Only parts of this plot (the northwest block and part of the northeast block) are within the predicted floodplain extent amounting to around 1,960m^2 of proposed building footprint. These areas would have shallow water depths up to 500mm at the northwest corner of the plot and an estimated 775m^3 of flood storage would be taken up. Compensation areas and volumes for this would be accommodated within the west wetland area

Extensive potentially polluting activities or generation of process waters would not be involved on this plot. Hence, there is negligible potential impact on the surrounding watercourses or groundwater.

Some 7,800m^2 of building floor space would be raised to the minimum level of 5.063m AOD.

Plot 11 – Waste Transfer Station (CCC Application)
All waste entering the site by road would be weighed on the weighbridges before dispatching it to the correct reception area.

Only a small area to the southern corner of the main building is within the predicted floodplain extent. Around 280m^2 of proposed building footprint would be within the floodplain and with very shallow water depths an estimated 19m^3 of flood storage would be taken up. Compensation areas and volumes for this would be easily accommodated within the west wetland area.

There are no water demand processes on this site apart from washdown facilities. Any excess water would be passed to the site water treatment plant. Hence, there is only a slight potential impact on the surrounding watercourses or groundwater related to the requirement for flood compensation.

Some 300m^2 of building floor space would be raised to the minimum level of 5.063m AOD.

Plots 12 and 13 – Resource Recovery Village (CCC Application)
These plots are all proposed small light industrial use and each facility would use the site's mains water supply for staff amenities and washrooms. Sewage from the washrooms would be disposed of to sewer.

Areas and blocks to the east side of the plots are within the predicted floodplain extent. Around 4,320m^2 of proposed building footprints would be within the floodplain with shallow water depths an estimated 1,277m^3 of flood storage would be taken up. Compensation areas and volumes for this would be accommodated within the west and central wetland areas.

Extensive potentially polluting activities or water generation would not be involved on this site. However, all end uses would be subject to the relevant Pollution Prevention Guidance and controls. Hence, there is a negligible impact on the surrounding watercourses or groundwater.

Some 8,210m^2 of building floor space would be raised to the minimum level of 5.063m AOD.

Plot 14 – Block Making (Both CCC and DBERR Application)
Some 2,600m^2 of building floor space would be raised to the minimum level of 5.063m AOD. However, much of this would be achieved simply by providing a finished floor level 150mm above existing ground level, this figure being the standard required for damp proof course construction.

None of this facility is below the predicted flood level and hence compensation volumes would not be required.

Extensive potentially polluting activities or generation of process waters would not be involved on this plot. Hence, there is only a negligible impact on the surrounding watercourses or groundwater.

Foul Drainage (Both CCC and DBERR Application)
Foul drainage would be collected in a separate drainage system to the surface water.

The drainage system would be designed to minimise the risk of back flooding during severe storm events where ground water or surface water could enter the foul system. Sealed covers to manholes and pumping stations would be provided. Any foul pumping facilities would be located at higher elevations increasing the level of protection from flooding.

Foul drainage would be treated at the water treatment plant. Hence, there is only a slight potential impact on the surrounding watercourses or groundwater

7.5.6 *Cumulative Impact*

There is the potential for concurrent developments close to this site to contribute to both flooding and pollution impacts. However, contained within the *Cheshire 2011 Replacement Structure Plan* is GEN3, which states that:

"Development should minimise adverse environmental impacts and not be at unacceptable risk from flooding nor increase risk of flooding elsewhere".

This condition is consistent with similar conditions imposed on developments by the EA, such as the current suggested EA conditions for this project (applicable to the CCC , DBERR or combined applications):

- *CONDITION: No development approved by this permission shall be commenced until a scheme for the provision and implementation of compensatory flood storage works has been approved by the Local Planning Authority. The works shall be constructed and completed in accordance with the approved plans unless otherwise agreed in writing by the Local Planning Authority.*

- *CONDITION: No development approved by this permission shall be commenced until a scheme for the provision and implementation of a surface water regulation system has been approved by the Local Planning Authority. The scheme shall be completed in accordance with the approved plans.*

To provide substantiation to these suggested conditions, the EA have stated:

"The proposed development would lead to an increased rate of surface water run-off. In accordance with PPS25; surface water should be attenuated with the limiting

discharge being the mean annual discharge from the existing undeveloped site. All discharges above this up to the 1 in 100 years design event would need to be attenuated. The amount requiring attenuation should be increased following the guidance in Table B2 of PPS 25 to allow for climate change. The proposals indicate the use of sustainable drainage systems, which are acceptable in principle to the Environment Agency. We would therefore recommend that the following planning condition is imposed."

These conditions are extremely likely to be applied to any other development in Cheshire in excess of 1ha in area (a size determined by the EA as the lowest practical site size where runoff flows would be assessed in this manner). As such each site would need to constrain its own surface water generation as well as cater for its flood risk and not exacerbate the flood risk to others. The aim of these policies and conditions is to mitigate against possible cumulative impacts.

A list of development sites and allocations is provided in Table 1.4 in Section 1. Of these developments only those in close proximity to this site are considered as having the potential to contribute to both flooding and pollution impacts cumulatively.

In addition to the development at the Quinn Glass plant, two broad development allocations have been identified close to the site which require consideration, these being the remaining allocation within which the Quinn Glass development is located and an allocation adjacent to its eastern boundary (classified for business use).

The proposed Ince RRP development, Quinn Glass and the development allocations are close to the Ince Marshes flood zone and both discharge surface water into the ditch system that is drained by the Ince Marshes pumping station. As a result uncontrolled surface water discharges for one or other of the sites could influence the other.

The planned mitigation for the RRP site would minimise its affect on the surrounding area by providing flood compensation volumes in excess of that required for the site. In addition, the site would be protected from other sources of flooding and contamination by the raising of floor levels and storage areas to a level above predicted floodwaters.

7.6 Mitigation Measures

7.6.1 Construction Mitigation Measures – All applications

During construction, the quality of both surface water and groundwater would be protected through the implementation of Management Plans to issues such as refuelling of plant, fuel storage, etc., building upon the mitigation provided in this ES. These measures are applicable to each of the plots separately as well as the site overall (or any combination of plots).

A project specific Surface Water Management Plan would be developed for the project including measures such as:

- All onsite diesel storage tanks to be placed on hard standing ground within the construction compound. To reduce the risk of pollution via tank leakage, a double skinned tank container would either be used, or the tank would be double bunded with a capacity of 110% of the maximum stored volume as per the Control of Pollution (Oil Storage) Regulations 2001.

- Drip trays would be used under compressors, pumps, motors, redundant plant and during re-fuelling. These would be emptied and cleaned regularly especially after rainfall.
- Diesel bowsers would be double skinned and equipped with spill control kits.
- Control measures for controlling silt run-off to streams.
- All fuel storage and refuelling to be carried out at a minimum of 30m from watercourses.

Further information on mitigation measures is provided in Section 6.5.

There would be several construction compounds and each would be located away from all watercourses minimising the risk of contamination. Extreme care would be taken when using concrete in foundations close to watercourses and in areas of excavation close to groundwater.

Emergency management procedures would be incorporated within the overall facilities management plan to cater for emergency events.

The drainage network to the site would be constructed at an early stage. This would enable early control of discharges and management of accidental spillages.

Any waste storage and temporary storage of materials would be located on the higher parts of the site to minimise the potential for silt runoff resulting from flooding.

A surface water monitoring programme of watercourses located on and around the site would be established and watercourses would be monitored before, during and on completion of construction works. This would indicate if the development was impacting on surface water quality.

Dredging arisings are to be transported to the receiving site under controlled waste handling conditions. The transportation is likely to be directly via the dredger barge and thus would not involve overland transport that could bring the material into contact with more sensitive watercourses.

The Emergency Management Procedures would set out requirements in the event of an accidental release to ground. This would consider the likely migration pathways for pollutants, which based on geological investigation undertaken, is as follows:

Following a spillage, the pollutant would firstly migrate vertically downwards to the shallow groundwater table. The low permeability clayey alluvial deposits may offer some protection to the underlying deep aquifer. The pollutant would be anticipated to migrate horizontally in the groundwater flow direction towards the Manchester Ship Canal and Mersey Estuary and also vertically downwards into the deeper aquifer. If a significant thickness of low permeability clay exists beneath the site, this may be sufficient to protect the deeper aquifer within the sandstone. The rate of pollutant migration vertically and laterally would be dependant upon the number and orientation of permeable horizons present.

7.6.2 Site Design & Operation Mitigation

7.6.2.1 All Applications

Much of the operational mitigation would be similar to that described in the construction and design sections above with the additional emergency management systems for dealing with accidental spillages from the liquid storage areas. Measures would include bunding these areas, and procedures for waste transfer, such as sealed containers and covered wagons. These procedures are designed to minimise the potential for linkage between the spillage and the surrounding watercourses.

The drainage scheme for the site would incorporate a number of features to protect the environment from operational hazards. These measures would be applicable to each of the plots separately as well as the site overall (or any combination of plots).

All potential contaminated activities would be subject to safeguards as described in the relevant EA PPG. These include the installation of petrol interceptors on all areas that drain vehicle parking, as well as the washdown and garage facilities. All process water and water from storage areas which is likely to contain significant pollution is to be passed to the site water treatment plant.

Runoff from roof areas is considered a clean water source with minimal requirements for treatment prior to discharge. Due to the large portion of roof area it is intended to separate the flows from roads and roofs prior to discharge into the surrounding watercourses. This would have the added benefit of reducing the size of interceptors.

Outfall levels into the surrounding ditches would be close to or at the invert of the minor ditches. Flap valves are to be installed to minimise the potential for flood waters to re-enter the on-site drainage system and flush out the contents of petrol interceptors and silt traps. To accommodate runoff within the site during an event when the flap valves are closed, the internal pipework on-site would be upsized to provide additional storage volumes.

The drainage system would be designed to minimise the risk of back flooding during severe storm events where ground water or surface water could enter the foul system. Sealed covers to manholes and pumping stations would be installed. Any foul pumping facilities will be located at higher elevations to increase the level of protection from flooding.

Foul drainage would discharge either to public sewer or to sealed containment tank (for collection by road tanker and subsequent discharge to public sewer).

Any sealed containment tank or pumping station to be used for foul drainage would be located at higher elevation to protect it from flooding, and would also be designed to minimise the potential for leakage or spillage during maintenance or emptying. A kerbed area forming a bund is to be incorporated into the access for this facility.

All petrol interceptors would be fitted with isolation valves such that sections could be isolated if potentially polluting materials reach the surface water drainage system.

A maintenance schedule for all the on-site mitigation features would be employed to monitor the condition of silt traps, catchpits and petrol interceptors and arrange for each of these to be cleaned out when required. In addition the operation of flap valves and isolation valves would be checked at regular intervals.

7.6.2.2 DBERR Section 36 Electricity Act Application

For the RDF plant, the water abstraction from the canal and discharge of excess cooling waters would be kept to an operational minimum.

As described above in Section 7.5.9, although a large amount of water is transferred in and out of the canal for use by the power station the quantity is significantly less than the 11,160 m^3/h (3.1m^3/sec) that is the base flow within the canal. Both abstraction and discharge would be subject to consent from the Environment Agency

7.6.3 Flood Risk

7.6.3.1 All Applications

All buildings are to be constructed with a minimum finished floor level of 5.063m AOD. This provides a 600mm freeboard above the predicted 1 in 200 year tidal flood event in 2067 (the design lifetime of the development).

All main access roads and strategic pedestrian links are to have a finished surface level of 4.763m AOD to maintain clearance above floodwaters for the lifetime of the development and provide a safe means of access.

In the event of a major flood some parts of the site would be at risk of flooding from waters within the on-site drainage. All interceptors and below ground foul drainage pipework would be fitted with sealed covers to prevent leakage.

Flood storage compensation volumes as detailed in Tables 7.3, 7.5 and 7.7 are to be provided as part of the SUDS wetland scheme.

Where the existing levels are above the predicted flood level this facility would provide compensation storage as well as storage for the lesser rainfall events. Due to the topography there is limited land to the south and west that could be used, as existing ground levels are below flood levels, however there is ample compensation provided elsewhere on the site, which would be utilised.

The design of the SUDS would mirror the existing ditch network and would include linear features providing habitat for water vole etc. Figure 7.11 shows a schematic view of the system in relation to flood water levels and the base water level controlled by the Ince Marshes pumping station.

The two applications (CCC and DBERR) both require parts of the South East and North West SUDS Areas. These provide 19,850m^2 of compensation and would be constructed for either application.

7.6.4 Watercourses and Groundwater

Each application would require the diversion of some of the existing minor ditches and the infilling of a number of smaller field ditches within the site. New boundary ditches and swales are to be created around each plot designed to function as required for land drainage but also incorporate ecological features. These would be designed to improve species diversity within the ditch network to provide positive wildlife gains in the medium to long term. Detailed design of the wetland habitat would be further developed in consultation with Natural England, Cheshire County Council, Cheshire Wildlife Trust and the Environment Agency and would include a planting schedule that reflects the local species composition whilst increasing biodiversity with appropriately selected species. This is discussed further in Section 10 - Ecology.

Groundwater monitoring wells would be installed prior to construction of the site and a monitoring programme established throughout construction and afterwards. Analytical results and observations would indicate if the development is impacting the quality of the groundwater.

7.6.4.1 CCC Application

This application would require crossing of the Western Boundary Drain, which would be bridged or culverted to allow three access roads to cross it. In addition, several smaller field boundary drains that are situated beneath the road and rail link would also be crossed and the West Central Drain would be crossed at two locations.

To allow construction of the site, there would be a loss of approximately 4800m of poor quality, mainly dry ditches across the site, although these would be replaced with a greater number of watercourses (estimated to be 5700m in the mitigation areas and 10,900m elsewhere around the site) designed to provide both drainage and improved ecological habitats. It must be noted that the 'main drains' that are present would remain and therefore ditch loss would be limited to field boundary drains most of which only seasonally hold water and are noted to be lacking in bank vegetation through heavy shading by existing scrub.

7.6.4.2 DBERR Application

For this application the West Central Drain would also be crossed at two locations. In addition, several smaller field boundary drains that would be situated beneath the road and rail link would also be crossed.

In terms of the surrounding network, approximately 1,450m of poor quality, mainly dry ditches across the site, although these would be replaced with a greater number of watercourses (estimated to be 800m in the mitigation areas and 1,535m elsewhere around the site).

7.6.4.3 Combined Application

This application would require the works as described above for the CCC and DBERR Applications. No additional mitigation is required.

7.6.5 Building Design

The site would utilise rainwater harvesting systems within or around the buildings on each plot for landscaping, wheelwashes and other washdown facilities thus reducing the mains water demand for the site. This is detailed in Section 2.9.1.

7.7 Summary of Residual Impacts

7.7.1 Assessment of Significance

The assessment of significance of impact involves the assessment of the baseline data and the use of professional judgement. The assessment criteria detailed in Tables 7.11 to 7.15 have been used and an assessment has been made on magnitude of the residual impact combined with receptor sensitivity to determine the significance of the impact.

7.7.1.1 Magnitude of Impact

Table 7.11: Magnitude of Impact - Hydrology

Magnitude	Description
Large	The proposals could result in a significant change in terms of flooding, surface water drainage, hydrology or hydrogeology, which may result in hardship.
Medium	The proposals could result in changes to flooding, surface water drainage, hydrology or hydrogeology, which cause inconvenience.
Small	The proposals could occasionally cause a minor flooding, surface water drainage, hydrology or hydrogeology change in the short term.
Negligible	No effect on flooding, surface water drainage, hydrology or hydrogeology above normal.

Table 7.12: Magnitude of Impact - Water Quality

Magnitude	Description
Large	Irreversible or long-term change well outside the range of natural variation where recovery could be protracted (>10years) to a large area or an area remote from the development. Potential health hazard.
Medium	A change outside the bounds of natural variation to a large area or an area remote from the development, which would recover over a medium period of time (5-10 years).
Small	A change within the bounds of natural variation to an area in close proximity to the site, which would recover over a short period of time (1-5 yrs).
Negligible	A change well within the bounds of natural variation. No effect detectable or recovery within a very short timescale (< 1 year).

7.7.1.2 Sensitivity of Receptors

Table 7.13: Receptor Sensitivity - Hydrology

Receptor Sensitivity	Description
High	Low lying land, groundwater, local drainage network, Ince Marshes Pumping Station.
Medium	Manchester Ship Canal, wider drainage network.
Low	Mersey estuary.
Negligible	Areas not sensitive to water related changes.

Table 7.14: Receptor Sensitivity - Water Quality

Receptor Sensitivity	Example of Receptor
High	Designated sites such as RIGS or National Park.
Medium	Biological and chemical water quality within rivers and streams. Surface water (flow patterns).
Low	Soils (i.e. impact from traffic movement).
Negligible	Impermeable geological strata.

7.7.1.3 Potential Significance

Consideration of the two sets of criteria generates the following generic definitions of potential effects.

Table 7.15: Significance - Hydrology

Significance	Description
Very Significant	Major change to flooding, surface water drainage, hydrology or hydrogeology that greatly affect the immediate low lying land, groundwater, local drainage network, Canal, Ince Marshes Pumping Station or the Mersey estuary, and are potentially irreversible.
Significant	Change to flooding, surface water drainage, hydrology or hydrogeology that affect the immediate low lying land, groundwater, local drainage network, Canal, Ince Marshes Pumping Station or the Mersey estuary and are potentially irreversible.
Moderate	Minor or temporary changes to flooding, surface water drainage, hydrology or hydrogeology that affect the immediate low lying land, groundwater, local drainage network, Canal, Ince Marshes Pumping Station or the Mersey estuary.
Slight	Minor or temporary short term changes to flooding, surface water drainage, hydrology or hydrogeology that affect the immediate low lying land, groundwater, local drainage network, Canal, Ince Marshes Pumping Station or the Mersey estuary.
None	No detectable effect on flooding, surface water drainage, hydrology or hydrogeology.

The definitions of significance for impacts on water quality follow the guidance given in Figure 1.2.

7.7.2 Residual Impacts Summary

The development has a number of mitigation measures that reduce its affect on the water environment. The residual effects, i.e. those likely to remain following adoption of mitigation measures, are summarised below.

The major impact is to the existing watercourses immediately around and on the proposed site, some of which would be removed or diverted. However, the proposals include reinstatement and the construction of additional wetland areas that not only replace the flood storage volumes but also would add increased ecological variety and the opportunity to enhance the wildlife habitat around the site.

The following tables summarise the residual impacts for the CCC and DBERR Applications and the Entire Site. As can be seen the majority of residual impacts are similar for each of the applications and the two in combination.

Table 7.16: Residual Impacts - CCC Application

Key Issue	Magnitude	Receptor Sensitivity	Significance
During Construction			
Silt runoff	Small	Medium	Moderate (-ive) temporary
Spillages from refuelling operations	Small	Medium	Moderate (-ive) temporary would result in temporary isolation of part of drainage network
Strengthening works to canal side – dredging and piling works	Medium	Low	Moderate (-ive) temporary with suitable method statements in place
During Operation			
Increase of surface water runoff from paved areas	Small	Medium	Slight (-ive) total flood storage capacity remains unchanged
Loss of conveyance within ditch network	Small	High	Moderate (+ive) as ditches replaced and extended
Backwash of flood waters onto site	Small	Medium	Moderate (-ive) as flap valves and on-site storage is utilised
Water quality within watercourses	Small	Medium	Moderate (-ive) as petrol interceptors and catchpits are utilised. Maintenance would need to be carried out
Crossing and culverting of watercourses	Small	Medium	Moderate (-ive) as bridges used where possible
Location of buildings within identified flood zone	Small	Medium	Slight (-ive) total flood storage capacity remains unchanged

Table 7.17: Residual Impacts - DBERR Application

Key Issue	Magnitude	Receptor Sensitivity	Significance
During Construction			
Silt runoff	Small	Medium	Moderate (-ive) temporary
Spillages from refuelling operations	Small	Medium	Moderate (-ive) temporary would result in temporary isolation of part of drainage network
Strengthening works to canal side – dredging and piling works	Medium	Low	Moderate (-ive) temporary with suitable method statements in place
During Operation			
Increase of surface water runoff from paved areas	Small	Medium	Slight (-ive) total flood storage capacity remains unchanged
Loss of conveyance within ditch network	Small	High	Moderate (+ive) as ditches replaced and extended
Backwash of flood waters onto site	Small	Medium	Moderate (-ive) as flap valves and on-site storage is utilised
Water quality within watercourses	Small	Medium	Moderate (-ive) as petrol interceptors and catchpits are utilised and water treated at on-site plant. Maintenance would need to be carried out
Crossing and culverting of watercourses	Small	Medium	Slight to Moderate (-ive) as bridges used where possible
Location of buildings within identified flood zone	Small	Low	Slight (-ive) total flood storage capacity remains unchanged
Discharge of cooling waters into canal	Small	Low	Slight (-ive) volumes and rates are small in comparison to canal flows
Abstraction of waters from canal	Small	Low	Slight (-ive) volumes and rates are small in comparison to canal flows

Table 7.18: Residual Impacts - Entire Site

Key Issue	Magnitude	Receptor Sensitivity	Significance
During Construction			
Silt runoff	Small	Medium	Moderate (-ive) temporary
Spillages from refuelling operations	Small	Medium	Moderate (-ive) temporary would result in temporary isolation of part of drainage network
Strengthening works to canal side – dredging and piling works	Medium	Low	Moderate (-ive) temporary with suitable method statements in place
During Operation			
Increase of surface water runoff from paved areas	Small	Medium	Slight (-ive) total flood storage capacity remains unchanged
Loss of conveyance within ditch network	Small	High	Moderate (+ive) as ditches replaced and extended
Backwash of flood waters onto site	Small	Medium	Moderate (-ive) as flap valves and on-site storage is utilised
Water quality within watercourses	Small	Medium	Moderate (-ive) as petrol interceptors and catchpits are utilised and water treated at on-site plant. Maintenance would need to be carried out
Crossing and culverting of watercourses	Small	Medium	Moderate (-ive) as bridges used where possible
Location of buildings within identified flood zone	Small	Medium	Slight (-ive) total flood storage capacity remains unchanged
Discharge of cooling waters into canal	Small	Low	Slight (-ive) volumes and rates are small in comparison to canal flows
Abstraction of waters from canal	Small	Low	Slight (-ive) volumes and rates are small in comparison to canal flows

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