

12.0 FLOOD RISK, HYDROLOGY & DRAINAGE

Introduction

- 12.1 This Chapter of the Environmental Statement (ES) assesses the likely significant effects of the Proposed Development in terms of its impact on the flood risk, hydrology and drainage both at the Site and in the immediate area and is supported by **Appendix 12.1**. It should be noted that many of the issues relating to the hydrogeology underlying the Site are also considered in Chapter 17: Geology due to the considerable overlap between the two subject areas.
- 12.2 The Chapter identifies key water resources and sensitivities, and addresses the potentially significant direct and indirect impacts of the Proposed Development on these resources. Consideration of impacts is made in the context of existing Site conditions, during construction works and once the Proposed Development is complete. The need for mitigation measures is addressed and potential residual impacts are identified.
- 12.3 Direct consultation with external parties undertaken as part of the Environmental Impact Assessment (EIA) process, includes the following:
- Commissioning of a Landmark Envirocheck® Report 30050538_1_1;
 - Environment Agency (EA);
 - Ryedale District Council (RDC); and
 - Thornton Internal Drainage Board (TIDB).
- 12.4 A site walkover survey was undertaken on the 26 November 2009 and a variety of data sources were consulted such as published maps and relevant authorities.

Planning Policy Context

- 12.5 ***The Water Resources Act 1991 and The Water Act 2003***: The Water Resources Act 1991 sets out the relevant statutory regulatory controls that provide protection to water bodies and water resources. The Water Resources Act 1991 has recently been modernised by the introduction of The Water Act (2003). The Act governs the control of water abstraction, discharge to water bodies, water impoundment, conservation and drought provision. This Act has changed six key areas of the former Act. Of relevance to the Proposed Development is the need to obtain a license for the dewatering of engineering works, which was previously exempt, to make sure that it is managed

appropriately and that any impact on the environment can be dealt with. The Act is supplemented by:

- The Environment Act 1995 which established the Environment Agency (EA); and
- The Environmental Protection Act 1990, which provides for integrated pollution control.

12.6 A number of specific Regulations have also been implemented to enact the statutory law as set out above. These Regulations include:

- Water Resources (Environmental Impact Assessment) (England and Wales) Regulations 2003;
- The Groundwater Regulations 1998; and
- The Anti-Pollution Works Regulations 1999.

12.7 ***Planning Policy Statement 25: Development and Flood Risk:*** Planning Policy Statement 25 (PPS25): Development and Flood Risk 2006 sets out a sequential risk-based approach in determining the suitability of land for development in flood risk areas. PPS25 provides guidance to Developers, Local Planning Authorities (LPAs) and the EA in relation to the obligations surrounding the identification of flood risk for consideration during land-use planning in England.

12.8 The policy aims to discourage inappropriate development in areas at risk of flooding and to ensure that where development does occur, flood risks have been taken into account and appropriate measures put in place. PPS25 draws on the Department of Food and Rural Affairs (Defra) revised predictions for climate change.

12.9 ***Draft National Policy Statement for Energy:*** The policy states that where a project is likely to have adverse effects on the water environment, an impact assessment should be undertaken as part of the ES. The policy aims to minimise the adverse effects of a development during construction, operation and decommissioning phases.

12.10 New development should avoid areas at risk of flooding and be directed away from areas at high risk. This document states that development proposals should be resilient to the future increased risk of flooding that is anticipated to be caused by climate change and any flood risk assessment should account for this.

12.11 A Flood Risk Assessment will be required for those developments located in Flood Zones

2, 3 and in Zone 1 if it exceeds 1 hectare in size. It may also be required in areas smaller than 1 hectare but at risk of flooding from other sources (e.g. surface water) or where a statutory body has indicated that there may be drainage problems.

12.12 **The Yorkshire and Humber Plan:** The Yorkshire and Humber Plan, published in May 2008 is the current Regional Spatial Strategy to 2026. The Plan contains the following policies relating to water resources and flood risk:

12.13 **Policy YH1 Overall Approach and Key Spatial Priorities** – a main aim of the Yorkshire and Humber Plan is to avoid increasing flood risk and manage land and river catchments in order to mitigate flood events.

12.14 **Policy YH2 Climate Change and Resource Use** – Plans and strategies should help to meet targets set out in the Regional Economic Strategy by, amongst other things, encouraging water efficient buildings and minimising resource demands from development, and help provide successful adaptation to the predicted impacts of climate change by minimising threats and impacts of increased flood risk, increased storminess, increased pressure on water resources, supply and drainage systems.

12.15 **Policy ENV1 Development and Flood Risk** – The Region will manage flood risk proactively by reducing the causes of flooding to existing and future development, especially in tidal areas, and avoid development in high flood risk areas where possible. Allocation of areas for development will follow a sequential approach and will be in the lowest risk sites appropriate for the development (identified by Strategic Flood Risk Assessments).

12.16 Flood management will be required to:

- facilitate development in cities where there is little development land available outside high flood risk zones, provided the sequential approach has been used to inform decisions regarding flood risk;
- provide flood storage, habitat creation and managed realignment around river corridors as required; and
- provide positive land management for flood alleviation.

12.17 **Policy ENV2 Water Resources** – The region will safeguard water resources and encourage water efficiency.

- 12.18 **Policy ENV3** Water Quality - The region will maintain high standards of water quality. Plans and strategies should: prevent development that could pollute surface and underground water resources especially in Source Protection Zones and close to above ground water resources of reservoirs and some rivers; and provide for adequate sewerage infrastructure and treatment capacity and promote more sustainable waste water treatment methods.
- 12.19 **North Yorkshire County Council Mineral Local Plan:** North Yorkshire County Council is preparing a Minerals and Waste Development Framework to replace the Council's current Mineral and Waste Local Plans. Policy 4/10 of the "saved" policies of the Mineral Local Plan requires that proposals will only be granted permission if they do not cause unacceptable impact of surface or ground water resources.
- 12.20 **North York Moors National Park Authority Core Strategy:** The North York Moors National Park Authority Core Strategy states that the impacts of climate change on the National Park will be mitigated by avoiding development in flood risk areas, facilitating flood protection provision and improve flood storage (Core Policy D – Climate Change). Development Policy 2 Flood Risk states that development will only be permitted with the sequential approach as per PPS25, where it will not lead to increased flood risk in other areas and where (if required) a Flood Risk Assessment has been carried out.
- 12.21 **Ryedale Local Plan:** At present the Development Plan for Ryedale consists of the Regional Spatial Strategy (The Yorkshire and Humber Plan) together with saved policies from the Ryedale Local Plan and the North Yorkshire Mineral Local Plan. The Ryedale Core Strategy is anticipated to be submitted to the Planning Inspectorate in autumn 2010.
- 12.22 The Local Plan was adopted in March 2002. Policy U3 (Surface Water Runoff) states that a development must not create additional surface water run-off. Those developments that increase the risk of flooding must include appropriate attenuation or mitigation measures, including restoration of the floodplain. The policy also states that Council will strongly support the use of sustainable drainage systems.

Relevant Pollution Prevention Guidelines

- 12.23 **Environment Agency Pollution Prevention Guidance Notes:** The EA Pollution Prevention Guidance Notes provide advice on statutory responsibilities and good environmental practice. The Guidance Notes of particular relevance to the Proposed

Development include:

- Pollution Prevention Guidelines Note 1 (PPG1) – General Guide to the Prevention of Pollution, provides an introduction to the prevention of pollution from a variety of sources.
- Pollution Prevention Guidelines Note 2 (PPG2) - Above Ground Oil Storage Tanks offers advice on storage options, equipment and its maintenance and how to deal with spills.
- Pollution Prevention Guidelines Note 3 (PPG3) – Use and Design of Oil Separators in Surface Water Drainage Systems, provides guidance on when oil separators are appropriate and what size and type of separator are required.
- Pollution Prevention Guidelines Note 4 (PPG4) – Disposal of Sewage where no Mains Drainage is available, offers advice if connection to the local sewage network is not possible and offers guidance on alternative means of wastewater disposal.
- Pollution Prevention Guidelines Note 5 (PPG5) – Works in, near or liable to affect watercourses provides guidance on general precautions to take when working in the vicinity of a watercourse, along with more specific measures to take to prevent contamination and to minimise any impacts.
- Pollution Prevention Guidelines Note 6 (PPG6) – Working at construction or demolition sites repeats much of what PPG5 presents but concentrates specifically on the situations likely to occur at demolition and construction sites.
- Pollution Prevention Guidelines Note 7 (PPG7) – Refuelling Activities provides information on the correct delivery, storage and dispensing of fuel to help reduce the risk of pollution.
- Pollution Prevention Guidelines Note 21 (PPG21) - Pollution Incident Response Planning, advice for those developing site specific pollution incident response plans to help prevent and mitigate damage to the environment caused by accidents such as spillage and fire.

12.24 ***Construction Industry Research and Information Association (CIRIA)***

Guidance: C532 'Control of Water Pollution from Construction Sites: Guidance for Consultants and Contractors' (Ref. 12-23) brings together the above guidance but goes into more detail with regard to sources of water on construction sites, pollutants and pathways in addition to providing guidance on planning for the type and location of suitable control measures.

12.25 5C697 'The SUDS Manual' (Ref. 12-24) provides best practice guidance on the planning,

design, construction, operation and maintenance of SUDS to facilitate their effective implementation within developments. This supersedes a number of previously issued guidance including C521.

Assessment Methodology and Significance Criteria

12.26 This section presents the general methodology used to assess the potential impact of the development on the hydrology, hydrogeology and water resources of the area. The following tasks were undertaken in order to complete the assessment:

- Consultation with statutory and non-statutory bodies to identify the interests and concerns regarding the water environment;
- Desktop study to obtain baseline and historical data;
- Field surveys to ascertain baseline conditions;
- Identification of the potential impacts from the development and assessment of their significance based on the magnitude of the potential impact and the sensitivity of the receiving environment; and
- Identification of options for mitigation of potential impacts in accordance with relevant legislation, policies and guidance.

12.27 An initial desk based study was conducted comprising a desk-based review of the site, which included the collation of information from the following sources:

- Ordnance Survey Explorer OL27, North York Moors, Eastern Area, 1:25,000 (Ref. 12-25);
- EA Interactive Flood Risk Maps (Ref. 12-26);
- Liaisons with EA; and
- National Rivers Authority, Groundwater Vulnerability 1:100,000 Map Series, Sheet 09, North East Yorkshire (Ref 12-27);

Significance Criteria

12.28 A qualitative (and quantitative where possible) assessment of potential and residual impacts has been carried out.

12.29 In the absence of national guidance on the assessment of impacts on the water environment and ground conditions and in line with current best practice, the determination of significance has broadly been based upon the methodology of

assessing the impacts of transportation and transport infrastructure on the water environment detailed in the Department of Transport's 'Transport Analysis Guidance' TAG UNIT 3.3.11. This document brings together the 'New Approach to Transport Appraisal (NATA)' methodology and the 'Guidance on the Methodology for Multi-Modal Studies (GOMMMS)' methodology for assessing impacts on the water environment. It is believed that by adopting this approach potential concerns raised by consultees will have been addressed.

- 12.30 This method for assigning significance allocates a level of importance (Low to Very High), to the water resources based on a number of attributes such as water supply, biodiversity, transport and dilution of waste products, recreation, conveyance, etc. Following this, the magnitude of the impact is estimated based on the assessor's knowledge of the development and taking into account the application of appropriate available mitigation measures. Finally, comparison of the importance of the resource against the potential magnitude of the impact results in an overall assessment of significance. The GOMMMS methodology has recently been expanded by Mustow, Burgess and Walker (2005) to further standardise this approach, making it less open to the subjectiveness of the assessor.
- 12.31 This assessment addresses the direct effects of construction and operation on the Proposed Development, in addition to the indirect and cumulative effects. It also assesses whether these effects are short, medium and long-term, permanent, temporary, beneficial or adverse where relevant.
- 12.32 On the basis of guidance provided in these source documents, the criteria used for determining the potential magnitude of the impact, as relates to the impacts of the development, is presented in **Table 12.1**. The importance of the resource according to the characteristics used in the GOMMMS methodology is outlined in **Table 12.2**. The EA has recently revised ecological water quality classifications and groundwater vulnerability classifications. Table 12.2 has been amended to include these changes, while retaining the corresponding importance levels.

Table 12.1: Criteria for determining impact magnitude (adopted from GOMMMS Vol 2, table 4.17)

Magnitude	Criteria	Example
Major	Results in loss of attribute	Loss of EC designated Salmonid fishery Change in GQA grade of river reach Compromised employment source Loss of flood storage/increased flood risk Pollution of potable source of abstraction
Moderate	Results in impact on integrity of attribute or loss of part of attribute	Loss in productivity of a fishery Contribution of a significant proportion of the effluent in the receiving river, but insufficient to change its GQA grade Reduction in the economic value of the feature
Minor	Results in minor impact on attribute	Measurable change in attribute, but of limited size and/or proportion
Negligible	Results in an impact on attribute but of insufficient magnitude to affect the use /integrity	Discharges to watercourse but no significant loss in quality, fishery productivity or biodiversity No significant impact on the economic value of the feature No increase in flood risk

Table 12.2 Methodology for Determining Importance Level (adopted from GOMMS Vol 2, table 4.15)

Feature	Attribute/ Service	Indicator Of Quality	Measure	Grading	Importance Level
River	Water Supply	Chemical Water Quality	EA's Chemical General Assessment (GOA)	A B C-D E-F	Very High High Medium Low
		Industrial/ agricultural abstractions	Location and volume of abstraction	All abstractions within 2 km downstream >1000m ³ /day 500-1000 m ³ /day 50-499m ³ /day <50m ³ /day	Very high High Medium Low
		Drinking water supply	Classification defined within the Surface Waters (Abstraction for Drinking Water) (Classification) Regulations 1996 No. 3001	Classification: DW1 or DW2 within critical travel time for pollution downstream DW3 within critical travel time downstream Not designated	Very High High Medium-Low
	Biodiversity	Biological Water Quality	EA's Biological GOA	A B C-D E-F	Very High High Medium Low

Feature	Attribute/ Service	Indicator Of Quality	Measure	Grading	Importance Level
			WFD RBMP Ecological Classification	High Good Moderate Poor - Bad	Very High High Medium Low
			Fisheries Quality	Fisheries status as defined within the Freshwater Fish Directive 78/659/ 78/659/	Designated salmon fishery Designated cyprinid fishery Undesignated fishery Not a fishery
	Transport and dilution of waste products	Surface water/ effluent discharges	Type of discharges with reference to the EC Dangerous substances Directive (78/659/EEC and Daughter Directives))	All discharges within 2km up or downstream: List I discharge List II discharge Other discharge/ no discharge	Very High-High Medium Medium-low
	Recreation	Riverside access	Presence/ absence of route and importance	National trail. Cycleway/ other route Regional Trail Definitive footpath/bridleway No route	Very High High Medium Low

Feature	Attribute/ Service	Indicator Of Quality	Measure	Grading	Importance Level
		Presence of clubs/ recreation use	Presence/ absence	Club/ recreation use present No club/ recreation use	Very High-High- Medium Low
	Conveyance of flow and material	Presence of watercourse	Size of watercourse	Main river >10m wide Main river <10m wide Ordinary watercourse >5m wide Other	Very High-High Medium Medium Low
Floodplain	Flood Defence	Importance in relation to flood defence	Status of floodplain area	Designated washland Active floodplain Existing defended area Does not flood	Very High-High High-Medium Medium Low
			Return period	>1 in 25 years <1 in 25 years <1 in 100 years <1 in 200 years	Very High High Medium Low
Ground- water	Water Supply	Industrial/ agricultural abstractions	Location and volume of abstraction	All abstraction points within zone of influence of development >1000m ³ /day 50-1000m ³ /day 50-499 m ³ /day <50 m ³ /day	Very High High Medium Low

Feature	Attribute/ Service	Indicator Of Quality	Measure	Grading	Importance Level
		Drinking water supply	Presence of potable public supply or private water supply within zone of influence of development	Public supply Private water supply >10m ³ /day or serves >50 people Other public water supply No supply	Very High High Medium Low
		Groundwater vulnerability	Source Protection Status	Within Zone 1, 2 or 3 of a Source Protection Zone Not within a Source Protection Zone	Very High-High Medium-Low
			Classification of aquifer vulnerability	Principal Aquifer with H, I or U soils Secondary Aquifer with H soils Principal Aquifer with H soils Secondary Aquifer with I soils Secondary Aquifer with L soils or Unproductive Strata	Very High High Medium Medium Low

Feature	Attribute/ Service	Indicator Of Quality	Measure	Grading	Importance Level
	Conveyance of flood flows	Acceptance potential of flood flows	Soil type/ groundwater table levels	Gravels with low water table (>1mm below infiltration point) Sands with low water table. All soil types with high water table Clay	Very High High Medium Low

12.33 **Table 12.3** presents the significance of an effect, based on consideration of the magnitude of an impact, the nature of that impact and importance of the attribute. For the purposes of the EIA regulations, a moderate or major impact is considered to correspond with a 'significant' effect.

Table 12.3 Criteria for determining significance (adopted from GOMMMS Vol 2, section of table 4.18)

Magnitude of Impact	Importance of Attribute			
	Very High	High	Medium	Low
Major	Very Significant	Highly Significant	Significant	Low Significance
Moderate	Highly Significant	Significant	Low Significance	Insignificant
Minor	Significant	Low Significance	Insignificant	Insignificant
Negligible	Low Significance	Insignificant	Insignificant	Insignificant

Baseline Conditions

Surface Water Resources

12.34 There are no watercourses crossed by the pipeline route or in the immediate vicinity of the Hurrell Lane Gas Processing Facility. The nearest watercourse to the Hurrell Lane site, Thornton Beck, runs about 1.2km to the west of the Site. Troutsdale Beck runs approximately 400m to the north of the Ebberston Well site. Friar Dike, Allerston Beck, Ebberston Beck and Welldale Beck flow to the south of the pipeline, as shown in **Figure 12.1**, and drains to the River Derwent. A network of land drains flow into these watercourses and are also highlighted in Figure 12.1.

12.35 Land drains run along the Hurrell Lane Gas Processing Facility site's western and southern boundaries, as shown in **Figure 12.2**. Hurrell Lane Drain starts about 800m to the north of the site and runs along the western boundary of the site in a southerly direction. New Ings Drain starts about midway along the southern boundary of the site, and flows in an easterly direction.

12.36 The pipeline route crosses the Eastfield Drain about 1 km to the north of the Hurrell Lane Gas Processing Facility site. According to OS background mapping, the crossing would be a short distance from the start of the drain, estimated at about 100m.

Water Quality

- 12.37 There are several small watercourses close to the site as detailed above. In 2007 the EA altered the way they assess the status of water bodies as a result of the requirements of the Water Framework Directive (WFD). There are now two classifications, Ecological and Chemical. These classifications have been assessed as part of the River Basin Management Plan (RBMP) for the Humber River Basin District **Figures 12.3 and 12.4**, taken from the EA website, show that Thornton Beck, running through Thornton-le-Dale, and Troutsdale Beck, are classified as being of poor Ecological Status. According to the RBMP, these watercourses do not have a chemical classification. Ebberston Beck, Allerston Beck, Welldale Beck and Friar Dike are classified as being of moderate Ecological Status, with Welldale Beck, Allerston Beck and Friar Dike also achieving a pass for Chemical Quality, whilst the others remain unclassified.
- 12.38 The RBMP for the Humber River Basin District aims to improve the ecological and chemical quality of surface water bodies, by which the site is located. The objectives the WFD are as follows:
- is for 14% of surface waters will improve by at least one biological, chemical or physical element by 2015;
 - by 2015, 19% of surface waters will be at good ecological status; and
 - by 2015, at least 29% of assessed waters will be at good or better biological quality.
- 12.39 The Proposed Development site is located within the Derwent Catchment. This catchment is a very rural catchment with grazing moorland in the uplands and large areas of designated conservation sites. Issues such as physical modification due to flood protection and land drainage, along with point source discharges for water industry sewage works and trade affect the water quality in a number of rivers in the catchment.
- 12.40 Consultation with the EA provided the following response with regards to water quality:

“Under the Water Framework Directive, Thornton Beck falls within waterbody GB104027067950 ‘Thornton/Dalby/Staindale from Source to the Syme’. This waterbody has an overall ecological status of poor and the failing element under the WFD is Fish. There is

currently no predicted improvement in the status of this waterbody by 2015”.

- 12.41 The EA also provided water quality data for their sample point at Thornton Beck (referred to as Dalby Beck by the EA) located immediately upstream of Ellerburn Trout Farm. The chemical analysis showed that this stretch of Thornton Beck is classified with a GOA_HI Class A for 2008 (see Table 12.2).
- 12.42 As reported in Landmark Envirocheck® Report there has been 3 recorded incidents of pollution to controlled waters in the surrounding area. All of these have been identified as minor incidents involving pollutants from fish farms and mud, clay or soil from farming and occurred between 1993 and 1998.
- 12.43 Based on the low frequency and severity of pollution incidents in the vicinity of the site, there is likely to be limited deterioration of water quality from polluting activities in the area.
- 12.44 Based on the information above, the surface water quality is considered to be of **very high importance**.

Abstractions and Discharges

- 12.45 There are currently 14 surface water abstraction licenses in operation at sites around the Proposed Development, including abstractions for aquaculture, general agriculture, Flamingo Land Ltd and the North York Moors National Park Authority. The total surface water abstracted, according to the EA's records, is 75,648,349 cubic meters per year.
- 12.46 In addition, RDC listed a number of private water supplies situated in the area of the Ryedale Gas Project. **Table 12.4** below identifies these abstractions.

Table 12.4 Private Water Supplies

Supply Name	Supply Reference	Type	Easting	Northing
Allerston Village	A2/1/1C	Spring	487700	483100
Little Garth	F8/1/1F	Spring	489500	483200
Ebberston Hall	F8/2/1E	Spring	489500	483500
White House Cottage	F8/4/1F	Spring	490400	487600
Warren House Farm	A2/7/1F	Borehole	487400	484600
California Farm	W3/07/1E	Borehole	481500	481200
Hazel Hall Farm	F8/08/1E	Spring	491300	482700
Broad Head Farm	A2/10/1F	Spring	490300	488100
Pheasant Hill	F8/10/1F	Borehole	488990	485360
Low Park Farm	F8/11/1F	Spring	489550	483340
Highfield Grange	W3/12/1E	Borehole	482900	483300
Givendale Head Farm	F8/7/24	Spring	489800	487700
Jingleby Thorn Farm	A2/08/24	Spring	489300	489500
High Rigg Farm	W3/14/25	Borehole	486350	486950
Charity Farm	W3/08/25	Borehole	484500	480800
Willow Grange	W3/11/25	Borehole	484900	480400

12.47 The EA did not identify any discharges to surface water within the vicinity of the Site, however, four discharge consents were highlighted in the Envirocheck® Report; one from the Forestry Commission Office for sewage disposal, discharged to Troutdale Beck (NGR 490800, 487500); one for mixed farming use at NGR 485100, 482100; a third from a domestic property at NGR 486350, 483050 discharging to a land drain leading to Friar Dyke; and a final consent for sewage disposal works discharging to a land drain draining to Friar Dyke at NGR 486300, 483000.

12.48 Based on the volume of water abstracted in the vicinity of the site, surface water abstractions and discharges are considered to be of **very high importance**.

Fisheries

12.49 Thornton Beck is classified as a very good salmonid fishery. There are also Grayling, Chub and Dace in the area. However, it is not used by a fishing club or syndicate, only landowners and their guests. There are commercial fisheries in the vicinity of the site.

12.50 Based on the above information, Fisheries are considered to be of **very high importance**.

Flood Risk

12.51 The proposed pipeline route and Hurrell Lane Gas Processing Facility site lie in Flood Zone 1, the zone of lowest flood risk as illustrated in **Figure 12.5**. There are land

drains next to the Hurrell Lane site. These serve small catchment areas upstream of it. Flood risk from other sources was also assessed as low. Overall, the Proposed Development is considered to be at low risk of flooding from all sources.

12.52 A full Flood Risk Assessment (FRA) has been undertaken by URS for the development site, with a summary provided in the following section. Refer to Appendix 12.1 of this ES for a copy of the full FRA.

12.53 Based on the information above, flood risk at the Site is considered to be of **low importance**.

12.54 In summary a number of different elements of the local watercourses have been assessed. Using the principals laid out in Table 12.2 the following importance designations can be allocated:

- Surface Water Quality – Very High Importance;
- Abstractions and Discharges – Very High Importance;
- Fisheries Quality – Very High Importance; and
- Flood Risk– Low Importance.

12.55 Based on the above designations the surface water in the region is considered overall to be of **Very High Importance**.

Groundwater

Hydrogeology and Groundwater Vulnerability

12.56 Chapter 17 contains a full review of the geology of the area. A review of data provided by the EA shows that the Site is underlain by the Corallian Limestone Aquifer, which is a Principal Aquifer with soils of high to intermediate leaching potential. The EA state that:

“Drift cover is mainly thin or absent in the proposed route and so, the Corallian Limestone Principal Aquifer is close to the surface and is vulnerable. The aquifer is dominated by flow through solutionally enlarged fractures and fissures and is recharged rapidly via sinkholes. Groundwater levels are high at the boundary

between the Corallian Limestone and the Ampthill Clay and Kimmeridge Clay formation and springs are commonplace”.

- 12.57 The boundary between the clay formations and the Corallian Limestone lies immediately north of the A170, therefore the Hurrell Lane Gas Processing Facility is situated on ground classified as Unproductive Strata by the EA. The proposed pipeline therefore crosses the geological boundary and therefore may encounter high groundwater levels at this point.
- 12.58 Based on the information above, the groundwater vulnerability is considered to be of **very high importance**.

Groundwater Quality

- 12.59 According to the RBMP, the Derwent Vale of Pickering Corallian Limestone aquifer is currently designated as “poor” with regards to both the quantitative and qualitative status. The Hurrell Lane Gas Processing Facility is approximately 1 km southeast of Source Protection Zone 3 (Total Catchment) of the Pickering public supply borehole.
- 12.60 Currently, according to the RBMP, 89% of groundwater bodies in the Humber River Basin District are achieving good quantitative status and 33% are achieving good chemical status. A number of groundwater bodies currently fail to achieve good status due to historic mining in the west on the coal measures, unsustainable abstractions, and diffuse pollutants, such as nitrate and pesticides.
- 12.61 Based on the above information, groundwater quality is considered to be of **medium to low importance**.

Abstractions and Discharges

- 12.62 The EA identify 12 groundwater abstractions within the zone of influence of the Site. The abstractions include water from Cemex UK Materials Ltd, Yorkshire Water Services supplying the public water supply, and general agriculture. Groundwater is abstracted from the Principal aquifer, for an estimated 3,469,167 cubic meters per year.
- 12.63 In addition, RDC identified a number of private water supplies in the vicinity of the Site, which are listed in Table 12.4.

12.64 The EA or Envirocheck® Report did not identify any discharge consents within the vicinity of the Site.

12.65 Based on in the information above, the groundwater is considered to be of **very high importance** with regards to groundwater abstractions.

Groundwater Summary and Importance

12.66 Based on the above information the following designations of importance can be made regarding the groundwater resource:

- Groundwater Vulnerability – Very High Importance
- Groundwater Quality – Medium to Low Importance
- Groundwater Abstractions – Very High Importance

12.67 Since the site overlays a Principal aquifer that is potentially very vulnerable, and there are large volumes of abstractions, including for use as public drinking water as well as for commercial uses within the area, then groundwater is considered to be of **Very High Importance**.

Water Supply and Sewerage Network

12.68 Yorkshire Water Services Ltd (YWS) have provided asset plans for their water supply and sewerage infrastructure in the area. This shows that a water supply pipeline is crossed at one location along the route of the proposed development. Also, a rising main is present near to the proposed Hurrell Lane Gas Processing Facility. The vast majority of the surrounding area is undeveloped, and not served by the YWS infrastructure.

12.69 Given the low levels of YWS infrastructure use and presence, water supply and the sewerage network are considered to be of **Low Importance**.

Summary of Resource Classification

12.70 **Table 12.5** summarises the importance assigned to the various water resources discussed above.

Table 12.5 Importance of Water Resources

Water Resources/Attribute	Importance
Surface Water Quality	Very High
Pollution	High
Surface Water Abstractions and Discharges	Very High
Fisheries	Very High
Flood Risk	Low
Groundwater Vulnerability	Very High
Groundwater Quality	Medium to Low
Groundwater Abstractions	Very High
Yorkshire Water Services Water Supply and Sewage Network	Low

Construction Impacts and Mitigation Measures

Demolition and Construction Phase

- 12.71 The potential sources, pathways and receptors in the context of water resources for the Site preparation and the construction phase of the Proposed Development are presented in **Table 12.6**.

Table 12.6 Potential Sources, Pathways and Receptors for Consideration during the Site Preparation & Construction Phases

Sources
Site preparation and construction materials
Localised soil and groundwater contamination in Made Ground and underlying strata
Off-site soil and groundwater contamination migrating on-Site
Increase in water demand and waste water discharge
Pathways
Surface water runoff and erosion
Groundwater dewatering activities.
Creation of direct contact pathways to ground and surface water
Existing buried obstructions and services
Legacy drainage infrastructure
Migration of groundwater
Receptors
Water quality of local surface water drainage systems
Groundwater

Upstream water supplies, downstream Sewage Treatment Works

12.72 Pollution sources arising from construction activities that could impact surface and groundwater comprise the following:

- suspended sediments;
- oils and hydrocarbons;
- concrete, cement products and waterproofing chemicals;
- disturbance of contaminated land;
- disturbance of the existing drainage system;
- disturbance to groundwater; and
- preferential pathways for groundwater and pollutant migration.

12.73 Other impacts associated with construction phase comprise:

- additional water supply; and
- additional wastewater generation.

Suspended Sediments

12.74 Potential sources of suspended sediments on demolition/construction sites include excavations, exposed ground and stockpiles, plant and wheel washing, dust and mud on site access roads and de-watering. The major pathway for suspended sediments to reach controlled water bodies is through runoff during rainfall events or when areas are being washed down.

12.75 In watercourses, excessive levels of sediment can result in the suffocation of fish, smothering of plants, reduction in light levels and quality of surface water abstractions. Any organic matter contained within the sediment will increase the Biological Oxygen Demand (BOD) of the water and result in a lowering of dissolved oxygen (DO). If the Site is contaminated, sediments may also contain toxic particles such as heavy metals, which may also impact directly on flora and fauna.

12.76 From observations made during the site visit, and inspection of Ordnance Survey (OS) mapping for the pipeline route, the pipeline route crosses Eastfield Drain, some 100m from its start. The proposed Gas Processing site at Hurrell Lane is bordered by land drains at its southern and western extents. Given the absence of major watercourses along the pipeline route or its immediate vicinity, it is estimated that the release of

potentially polluted suspended sediments will have a **minor adverse impact** on its water quality.

12.77 A number of construction site management measures will be employed to prevent the release of suspended sediments. These comprise:

- Cut-off ditches or geotextile silt-fences installed around excavations or exposed ground and stockpiles
- Properly contained wheel wash facilities will be used where required, to isolate sediment-rich runoff and direct it to containment areas or the local land drainage network;
- Earth movement will be controlled to reduce the risk of construction silt combining with run-off from undisturbed parts of the Site; and
- Silty water abstracted during excavations will be discharged to settlement tanks. Settled runoff can then be used for non-potable uses onsite, such as vehicle washdown and dust suppression. Excess water will be discharged to the adjacent surface water drainage system, or land drains near the Hurrell Lane site. An abstraction licence and discharge consent detailing volumes and rates of discharge will need to be agreed with the EA prior to the commencement of works.

12.78 Adoption of these measures will minimise the potential for uncontrolled release of sediment into active drainage systems and should, therefore, result in a **negligible impact** on the drainage system and surface waters and thus is of **low significance**.

Oils and Hydrocarbons

12.79 Sources of oils and hydrocarbons on construction sites include storage tanks, plant and machinery, spillage and leakage at refuelling areas and vandalism. Oils and hydrocarbons can have a long-term effect on the water quality of controlled waters and can result in the poisoning of fish, the creation of oily surface films on water and a reduction in the quality of industrial and potable abstractions. Oils also bind to sediments, strata and organisms and can form emulsions that float on the water surface and, upon breakdown, the action of microbes can lower the DO content of the water. Oils can also cause a reduction in quality of local groundwater.

12.80 Measures will be taken to protect controlled waters and local drainage networks from the release of oils and hydrocarbons, which would otherwise have a **moderate**

adverse impact which would be a **highly significant impact** on surface water resources in the vicinity of the Site. These measures comprise:

- Oils and hydrocarbons will be stored in designated locations with specific measures to prevent leakage and release of their contents, including the siting of the storage area away from drainage system and on an impermeable base with an impermeable bund that has no outflow and is of adequate capacity to contain 120% of the contents. Valves and trigger guns will be protected from vandalism and kept locked when not in use;
- Wherever possible, plant and machinery will be kept away from controlled waters and will have drip trays installed beneath oil tanks/engines/gearboxes/hydraulics, which will be checked and emptied regularly via a licensed waste disposal operator. Refuelling and delivery areas will be located away from surface water drains; and
- An Emergency Spillage Action Plan will be produced, which Site staff will have read and understood. On-site provisions will be made to contain a serious spill or leak through the use of booms, bunding and absorbent material.

12.81 With these control measures, potential impacts associated with the release of oil and fuel during construction works are likely to be **negligible** and therefore of **low significance**.

12.82 Implementation of the above measures does not, however, exclude the possibility of an accidental spillage of oils and fuels, the impact of which is dependent upon the volume lost to ground. Although an emergency spillage plan would be designed and implemented through the construction programme to minimise the impact of such an event, accidental spillages still have the potential to result in a **moderate adverse impact**, which could be **significant**.

Concrete, Cement Products and Waterproofing Chemicals

12.83 Concrete and cement products are highly alkaline and their release into controlled waters could have a **moderate adverse**, albeit short-term, effect on flora and fauna and on water quality in general, and therefore cause a **significant impact**. On-site concrete and mortar mixing and the washing down of mixing areas results in large volumes of contaminated wastewater, which can end up in the surface waters and drainage systems. A number of precautions will be taken on site to reduce potential for impact. These include:

- The majority of concrete used can be purchased pre-mixed and delivered from an off-site source, thereby negating the need to mix concrete on-site and reducing the creation of alkaline waste water;
- Wherever possible, the mixing and handling of wet concrete will be undertaken in designated areas, away from surface water drains; and
- A designated area will be used for any washing down or equipment cleaning associated with concrete or cementing processes and facilities provided to remove sediment prior to disposal into the surface water drainage system.

12.84 With these control measures, the impacts associated with concrete and cement products are considered likely to be **negligible** and thus of **low significance**.

Disturbance of Contaminated Land

12.85 The pipeline route and the Hurrell Lane Gas Processing Facility lie on previously undeveloped land. It is likely however, that there may be contaminants residing in the underlying soil and groundwater due to historical uses at the Ebberston Well site, and at road crossings. However, from the small size of areas where previous use or ground disturbance is expected, the risk to groundwater resources from this contamination is considered to be low.

12.86 In the event that further contamination is discovered, work should stop immediately and measures be taken to prevent further disturbance and mobilisation of contaminants, until the contamination has been assessed, treated in-situ or removed for off-site disposal.

12.87 Stockpiling of possible contaminated excavated materials and appropriate management, such as positioning away from any drainage systems and subsequent covering to prevent runoff or infiltration of contaminants into the ground, would minimise the risk of pollution of water bodies.

12.88 Contaminants present within any made ground underneath the Site may be treated prior to development by:

- Removing, treating or isolating any contamination hotspots under hardstanding material; and
- Providing a clean subsoil or topsoil capping or covering layer in landscaped areas.

12.89 The above measures would reduce the risk of soil or groundwater pollution of controlled waters to a **negligible**, and therefore, **low significance** level.

Disturbance of Existing Drainage Network

12.90 As the pipeline route and the Hurrell Lane Gas Processing Facility site lie on previously undeveloped land, it is considered unlikely that there buried drainage infrastructure will be encountered. There is risk, however, that the pipeline may cross sewers connecting villages in the area. YWS asset plans were obtained during this assessment, and they show a sewer rising main along New Ings Lane, the southern boundary to the Hurrell Lane Gas Processing Facility site. Also a water pipeline runs along the A170 road. The sewer is outside the development redline boundary, and the water main is crossed by the pipeline route at one location. Therefore the risk of disturbance to the YW infrastructure is low. However, damage or disturbance to unidentified drainage networks during construction activities could result in the uncontrolled discharge of both surface water and foul water, which could result in a **significant, major adverse impact** to both groundwater and surface water.

12.91 A number of measures will be implemented on site to prevent the release of these contaminants. These comprise:

- All existing utilities will be identified and marked prior to works commencing;
- Any damage to the drainage network will be immediately repaired;
- Exposed disused drainage piping (such as abandoned overflows) will be isolated from surface water run off and decommissioned; and
- An Emergency Action Plan will be produced to ensure spillages and leakages are immediately contained.

12.92 The measures described above are intended to reduce the number of situations whereby pollutants may arise, and to restrict their passage to Controlled Waters. With these control measures potential impacts to the existing drainage network are considered **negligible** and **insignificant**.

Disturbance to Groundwater

12.93 Consideration should be given to encountering shallow groundwater, known to be high, particularly at the boundary between the Corralian Limestone and Clay formations, during construction works. In particular, works relating to excavations to install the

pipeline, and for structure foundations at the Hurrell Lane Gas Processing Facility. Exposure of groundwater can provide a direct pathway for surface contaminants, such as oils and fuels, to enter controlled waters and excavations can also temporarily alter groundwater levels. The works have the potential to cause a **moderate adverse**, and therefore **significant impact**.

12.94 The following measures would be considered for controlling groundwater during excavations:

- Where complete cut-off is provided, then groundwater can be controlled on excavation using normal pumping equipment. If partial cut-off is considered, dewatering systems using sump trenches or well points directing groundwater from the excavation can be used instead;
- Measures such as cut-off trenches will be put in place to prevent potentially polluted runoff from within the Site entering the excavation; and
- Water arising from excavations will need to be disposed of to the nearby surface water drainage system (subject to an EAW issued discharge license) if uncontaminated and following the removal of silt via settlement ponds or alternative measures.
- The use of no-dig techniques, such as auger drilling, pipe jacking and directional drilling will reduce the extent of excavations and requirements for dewatering

12.95 Incorporation of these measures during construction will ensure an impact of **minor adverse** magnitude on groundwater, which will be of **low significance**.

Water Supply

12.96 There will be a need for water supply to construction staff ablutions and catering facilities, and for construction activities such as concrete mixing and dust suppression.

12.97 The main site establishment, including offices, would be located directly off the A170 adjacent to the pipeline storage area near the site of the Hurrell Lane Gas Processing Facility. Water requirements for the site offices during the construction phase will be met through mains water, subject to agreement with YWS.

12.98 The pipeline route and the Hurrell Lane Gas Processing Facility are currently unoccupied and, therefore, have no water requirement. It is estimated that there will be up to 150 staff during the construction period. Therefore there will be a temporary increase in

the demand for water as a result of the construction phase of the development.

- 12.99 The use of water efficient fixtures and fittings in temporary office facilities and the re-use of water, and use of stored site runoff and water obtained from dewatering of excavations would help to minimise demand from the public water supply. The use of ready mixed concrete would also help to minimise water consumption. This will result in a temporary, **minor adverse impact**, of **low significance** on the supply network.

Wastewater Generation

- 12.100 The presence of construction and site facilities will result in the generation of foul wastewater from construction activities and offices, which must be kept separate from surface water runoff. The volume of wastewater produced is expected to be similar to potable water use at the contractor's facilities during construction. The amount of waste water produced, and therefore, wastewater produced, can however be reduced by the use of water-efficient fixtures and fittings and the re-use of water in construction activities where applicable. Foul water will be collected through portable toilets across the construction site. The portable toilets will be emptied, as required, by tanker for disposal and treatment at a sewage treatment works, subject to YWS agreement.
- 12.101 Eventual disposal from the tanker, of foul water collected across the construction site, can be controlled, if required, to take into account any capacity problems in the public wastewater collection and treatment infrastructure. It is anticipated therefore, that the impact on the sewer network and wastewater treatment facilities will be a temporary, **minor adverse impact** and **insignificant**.

Preferential Pathways

- 12.102 A buried pipeline may potentially create a pathway for shallow groundwater and contaminants that may be present in the Made Ground to migrate to other areas. The potential for existing ground contamination is considered low, as except for the Ebberston Wellsite and the A170 road crossing, the pipeline route is on land previously undisturbed. The impact of the preferential pathways would thus be expected to be **minor**.
- 12.103 In order to reduce the movement of contamination via these pathways, or disturbance of the local shallow groundwater systems, careful attention to backfilling the pipeline trench, the installation of clay plugs and the design of land drainage schemes around the pipeline to ensure that pre-existing patterns are maintained.

12.104 The adoption of these measures will reduce the residual impact from preferential pathways to **negligible** and therefore of **low significance**.

Operational Impacts and Mitigation

12.105 The potential sources, pathways and receptors in the context of water resources for the Completed Development are presented in **Table 12.7**.

Table 12.7 Potential Sources, Pathways and Receptors for Consideration during the Site Operational Phase

Sources
Storage of fuels and plant
Contamination from condensate discharges and pipeline leakages
Residual localised soil and groundwater contamination in Made Ground and underlying strata
Increased demand for water utilities
Pathways
Creation of direct contact pathways to ground and surface water
Site layout and topography (hardstanding, surface water drains)
Lateral migration of groundwater
Structure foundations
Water supply and sewage infrastructure.
Receptors
Land drains and local surface water systems
Shallow groundwater
Deep groundwater
Buildings and property, including foundations and underground services

12.106 The operational phase of the Proposed Development poses less risk of impacts to the environment compared to the construction phase. Impacts on water resources from the built environment relate to the following areas:

- Impacts on flood risk and drainage;
- Pollution; and
- Water supply and wastewater generation;

Flood Risk and Drainage

12.107 The FRA presented in Appendix 12.1, indicates that the Proposed Development would remain at low risk of flooding from fluvial and other sources. As a result of the development, the rate of surface water runoff from the built development would increase, potentially increasing the risk of flooding to other areas downstream. The Site however, is surrounded by agricultural fields and increases in flood risk are likely to be of **moderate** impact and thus **insignificant**. There is need however, to mitigate flood risk from the increased surface water runoff, to ensure it does not lead to increases in flood risk to other areas. Surface water runoff from the Hurrell Lane Gas Processing Facility site would be limited to the 1 in 1 greenfield rate of 1.4l/s/ha. In order to achieve that, up to 990m³ of attenuation storage would be provided on site, to limit the runoff to the greenfield rate. The attenuation storage would be provided through a combination of swales along the site roadway and access track, and a pond. A separate process area drainage system is proposed. Both the surface water and process water drainage systems would have separate interceptor pits to catch condensate and to allow appropriate testing before discharge to the storage pond.

12.108 With these measures in place, the flood risk and drainage at the Site is considered to be of **negligible** impact and **insignificant**

Water Supply

12.109 The facilities proposed for the Site will require a supply of mains water. Potable water will be required for messing facilities, showers, safety showers, cleaning and general use for the gas plant. This water will also be required for the initial fill, and subsequent top up, of firewater storage, boiler system and cooling water system. It is estimated that there will normally be 5 persons on site during the day shift. Based on this, the water demand is expected to be small. The Proposed Development may result in a **minor adverse impact** on mains water resources in the area.

12.110 The use of water efficient fixtures and fittings for the office facilities would help to minimise demand from the public water supply. This will result in a **negligible adverse impact**, of **low significance** on the supply network.

Wastewater Generation

12.111 An administration building would form part of the Hurrell Lane Gas Processing Facility. The presence of staff at the Site will also lead to generation of foul drainage. If not

managed properly, foul drainage could lead to **major adverse impact** to surface and ground water in the area.

12.112 It is proposed that foul drainage will be discharged to a fully contained tank on site. The tank will retain all foul water produced. When full, the tank will be emptied by a third party contractor for disposal and treatment at a sewage treatment works, subject to YW agreement. Given the low numbers of staff on site, this option is considered practicable and will ensure discharge of untreated sewage is avoided, resulting in **minor adverse impact** to the public sewer system and treatment facilities, and **insignificant**.

Contamination from In-situ Materials

12.113 Damp-proof membranes will be used for the construction of building foundations. Consequently the buildings' underground structure and drainage network, which will be built to the requisite British Standards and which will lie within the damp proof membrane, will not be exposed to underground strata or groundwater and will not therefore be able to potentially contaminate underground water resources. As a result, a **negligible impact** is likely with **insignificant** effects on shallow groundwater quality expected.

Pollution

12.114 Typical sources of pollution from the Proposed Development would be oil leaks and petrol spillages from parking facilities, which may cause polluted runoff from the Hurrell Lane Gas Processing Facility and Ebberston Wellsite.

12.115 During testing, no liquids, i.e. water or condensate, were produced, and the prediction is that this will remain the case during the early years of production. However, most wells in this area and formation do eventually produce liquids as the well depletes, therefore the design will make provision for liquids treatment and handling in the future. The proposed solution is to separate gas and liquids at the well site, and then to transfer them via separate pipelines to the main site where separation of water from the condensate can take place. Produced liquids will be separated into condensate and water streams at the Hurrell Lane Gas Processing Facility, and stored on site. Leakages or spillages of the condensate may result in pollution of the surface and ground water.

12.116 The release of oils and chemicals in this way is anticipated to have a negligible to **minor adverse impact** on the water environment as the quantities are likely to be

relatively small and dilution will be available within the environment.

12.117 The main pathway for these pollutants to impact the groundwater environment is via infiltration through soft landscaped areas. Any areas used for parking at the Hurrell Lane Gas Processing Facility and Ebberston Well site should be covered by hardstanding with sufficient surface water drainage to direct any oil or petrol leaks to the surface water drainage system.

12.118 Condensate will be stored in a dedicated storage tank. Condensate will be taken off-site via road tanker (by others) and sold as feedstock for further processing in a refinery. Additionally, the design of the pipelines will incorporate such measures as corrosion protection by cathodic protection monitoring to identify possible leaks.

12.119 With the measures above, a **negligible** pollution impact is likely, which will be of **low significance** to the underlying groundwater.

Firewater containment

12.120 Because of the nature of the operations at the Hurrell Lane Gas Processing Facility, there is risk of a fire occurring. The design of the Facility includes provision for fire fighting. Surface water runoff from fire fighting has potential to cause pollution to the local surface water system if it drains into the surrounding drains or to the groundwater. If firewater is released, together with other polluting chemicals stored on site, such as diesel, this could result in **major adverse** impacts to the receiving water environment.

12.121 The design of the drainage systems at the Site will include containment systems for firewater. Diesel and other chemicals will be stored in designated locations with specific measures to prevent leakage and release of their contents, including the siting of the storage area away from drainage system and on an impermeable base with an impermeable bund that has no outflow and is of adequate capacity to contain 120% of the contents. In addition to the primary containment through bunds, the attenuation storage designed for surface water runoff will include shut-off valves or penstocks which can be used to prevent any discharges to the land drains and retain surface water within the Site. The retained water can then be discharged to the land drains, if approval is obtained from the EA, or if the level of contamination is not acceptable, tankered off-site for disposal at the local sewage works, with approval of the YWS. With these measures, surface runoff generated during a fire event will have a **negligible** impact and thus is of **low significance**.

Residual Impact Assessment and Conclusions

12.122 The impact of the Proposed Development on water resources has been assessed through the identification of baseline environmental quality and the potential sources, magnitudes and significance of any impacts. The assessment has been based on professional judgement, data and reviews of relevant literature, policies and legislation.

12.123 No significant impacts on water resources are expected to occur throughout the construction and operational phases, provided that standard mitigation measures are applied as discussed above. **Table 12.8** summarises the residual impacts on water resources.

Table 12.8 Summary of Residual Impacts Water Resources

Description	Geographic Scale	Residual Impact	Significance
Construction Phase			
Impact associated with the release of suspended sediment during the demolition and construction phase	Local	Negligible	Low
Use and storage of hydrocarbon fuels and other chemicals on Site during the demolition and construction programme	Local	Negligible – Minor Adverse	Low to Significant
Use of concrete and cement products during construction	Local	Negligible	Low
Disturbance of undiscovered areas of contamination during demolition and construction	Local	Negligible	Low
Disturbance of existing drainage network	Local	Negligible	Insignificant
Disturbance to groundwater during excavations	Local	Minor	Low
Water supply	District	Minor	Low
Wastewater generation	District	Minor	Insignificant
Disturbance of preferential pathways	Local	Negligible	Low
Operational Phase			
Impact on flood risk once the Proposed Development is complete	Local	Negligible	Insignificant
Water supply	District	Negligible	Low
Wastewater generation	District	Minor	Insignificant

Description	Geographic Scale	Residual Impact	Significance
Contamination from in-situ materials	Local	Negligible	Insignificant
Pollution	Local	Negligible	Low