10. Water

10.1. Introduction

This chapter describes the existing surface water and groundwater regime likely to be encountered beneath and in the general vicinity of the proposed development. It also addresses the potential impact of the proposed development on hydrology (i.e. surface water) and hydrogeology (i.e. groundwater) together with the mitigation measures that will be employed to eliminate or reduce any potential impacts. A detailed description of the proposed residential development is presented in Chapter 2 – Project Description of the EIAR.

10.1. Methodology

The following scope of works was undertaken by Atkins in order to complete this assessment: -

I. Desk-based study including review of available historical information;

II. Site Walkover Survey carried out by a Senior Atkins Hydrogeologist on the 12th June 2018;

III. Geotechnical investigation works undertaken by Geotechnical Environmental Services Ltd. (GES) between 11th and 14th June 2018. 20no. trial pits were excavated by a 13T tracked excavator. 5no. boreholes were drilled to a target depth using a Geoprobe 6620DT drill rig; 3no. selected boreholes (BH1, BH2 and BH4) were then converted to groundwater monitoring wells and screened across subsoils and the top of highly weathered bedrock (gravelly clay underlain by greywacke bedrock). Drilling and installation works were supervised by a Senior Atkins Hydrogeologist on 12th and 13th of June 2018. Shallow boreholes / monitoring wells were positioned in order to obtain representative baseline data. BH1 was located in the north western portion of the Site, BH2 was located in the south western portion and BH4 was located in the north eastern portion.

IV. Baseline groundwater level monitoring carried out by GES between 19th and 28th June 2018 at 3no. groundwater monitoring wells (BH1, BH2, and BH4). All shallow monitoring wells were observed to be effectively dry during each monitoring event.

The purpose of the desk-based task was to characterise the current hydrological and hydrogeological setting of the Site. Relevant background information was compiled, specifically from the following data sources;

- Environmental Protection Agency (EPA) web mapping (consulted June 2019);
- Geological Survey of Ireland (GSI) Datasets Public Viewer and Groundwater web mapping (consulted June 2019);
- GSI '*Louth Ground Water Body (GWB): Summary of Initial Characterisation'* (GSI, 2004);
- Office of Public Works National Flood Hazard mapping web Site (consulted June 2019);
- Ordinance Survey of Ireland (OSI) web mapping to assess the surface topography and landforms (consulted June 2019);
- National Parks and Wildlife Service (NPWS) Map Viewer (consulted June 2019);
- Water Framework Directive (WFD) Ireland web mapping (consulted June 2019);
- '*Proposed Strategic Housing Development at Haggardstown, Blackrock, Dundalk, Co. Louth: Flood Risk Assessment'* Report prepared by Finn Design Partnership (2019).
- *'Proposed Residential Development Lands at Blackrock, Dundalk: Combined Preliminary (PRA) and Generic Quantitative Risk Assessment (GQRA)*' Report prepared by Cove Environmental Consulting (2018).

The information obtained during the walkover survey and the geotechnical investigation was supplemented by data gathered during the desk-based review of all available relevant Site-specific and regional data. This assessment has been completed in accordance with relevant best practice guidance from the Institute of Geologists of Ireland (IGI) *'Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements'* (IGI, 2013). This assessment has also been prepared with regard to the guidelines prepared by the Environmental Protection Agency outlined in '*Revised Guidelines on the Information to be contained in Environmental Impact Statements*' published in 2015, '*Advice Notes on Current Practice (in the*

Preparation of Environmental Impact Statements)' published in 2015, and also '*Guidelines on the Information to be contained in Environmental Impact Assessment Reports – Draft*' published in August 2017.

Separately, a Flood Risk Assessment (FRA) has been prepared by Finn Design Partnership in accordance with the following guidance document; '*The Planning System and Flood Risk Management – Guidelines for Planning Authorities*' DOEHLG 2009, and comprised the following key phases: -

- **Stage 1: Flood Risk Identification** - to identify whether there may be any flooding or surface water management issues related to the proposed development that may warrant further investigation; and,
- **Stage 2: Initial Flood Risk Assessment** - to confirm sources of flooding that may affect the proposed development, to appraise the adequacy of existing information and to scope the extent of the risk of flooding.

10.2. Receiving Environment

10.2.1. Flood Risk Assessment

Finn Design Partnership has prepared a Flood Risk Assessment (FRA) to accompany the Planning Application for the proposed development (hereafter referred to as the Site). This FRA is presented in full in Appendix H. Based on the findings of this Site-specific FRA the following conclusions have been made;

- The following potential sources of flooding have been screened out during the initial Stage 1 assessment;
  - **Fluvial flooding**; Fluvial Flooding is not relevant to this location, given that there are no streams or rivers passing through or near the Site and in considering the size of the adjacent estuary.
  - **Pluvial or surface water flooding**; Given the topography of the Site and the fact the surrounding areas are relatively flat and to a large extent fall away from the Site, pluvial flooding is not seen as a risk for the development.
  - **Groundwater flooding**: The development will be serviced by surface water network that discharges into the Dundalk Bay Estuary following on-Site attenuation/infiltration and treatment. Site levels around the dwellings have been designed so that sufficient falls exist which will ensure that storm water discharges by gravity to gulley's and drainage channels prior to connecting to the attenuation system for the development.
  - **Potential Blockage of proposed surface water network**; Based on hydraulic modelling carried out by Finn Design Partnership (using MicroDrainage computer modelling software) the potential scenario of restricted flow by 50% of the allowable runoff rate was modelled and the results fed into the overall drainage design. To fully mitigate for a potential flood event of 50% blockage to the HydroBrake the attenuation/infiltration basin has been oversized to provide additional capacity within the structure. This additional storage will safeguard the proposed development and neighbouring properties in the immediate vicinity of the attenuation/infiltration basin. This approach will provide sufficient protection to the proposed development by preventing flood waters getting to a level where they create a risk for the new dwellings. Finish floor levels for all new dwellings within the vicinity of the attenuation/infiltration structure will ensure that there will be at least 500 mm of freeboard between the maximum top water level in the attenuation/infiltration basin and the floor level of any adjacent dwellings. These measures will safeguard the proposed development from potential flood risk associated with blockage within the proposed surface water network.

- The initial Stage 1 assessment concludes the following '*In the context of the 'Planning System and Flood Risk Management Guidelines, DOEHLG, 2009' this initial flood risk assessment has determined that a large portion of the development site (in excess of 98% of the site area) does not fall within Flood Zone 'A' and Flood Zone 'B' and therefore no further consideration is required for this area of the development site. There is that area of the site that is immediately west of the R172 where the proposed new entrance to the development will be constructed that will be subject to tidal/coastal flooding during extreme events. In accordance with the 'Planning System & Flood Risk Management Guidelines, DOEGLG, 2009' this flood risk assessment has*

determined that this area of the proposed development site may fall within Flood Zone 'A' and Flood Zone' B'. In accordance with the 'Planning System & Flood Risk Management Guidelines, DOEGLG, 2009' development proposals for this part of the site are subject to the requirements of 'The Justification Test.'

- Accordingly, a Stage 2 (Scoping Stage) FRA was completed by Finn Design Partnership. The key findings of this Stage 2 assessment, which included detailed hydraulic modelling for the two main proposed storm water discharge locations (i.e. existing northern drainage channel which drains to Dundalk Bay, and the existing eastern drainage channel which drains to the existing wetlands area immediately east of the Site) are as follows;
  - The minor increases in flood levels associated with discharging the greenfield runoff rate to the existing open channel on the periphery of the Dundalk Bay Estuary are imperceptible and immeasurable and would not result in an adverse impact to the existing hydrological regime or result in an increased flood risk to adjacent properties.
  - There are no negative impacts of discharging attenuated flows to the wetland area that is located to the West of the R172 nor constructing the proposed new access roadway through the same area.
  - On the information that is available, it is concluded that the eastern portion of the site where the new entrance and a section of the service roadway will be constructed is susceptible to coastal flooding under extreme conditions. In this case it is deemed that the site is located within a Flood Zone A as defined in the Flood Risk Management Guidelines. Therefore, a justification test is required to check that the development satisfies all of the criteria applicable in terms of flood risk management. It is considered that the information sources are of sufficient quality to make a conclusion on the extent and level of any flooding without the need to advance to a more detailed Stage 3 Assessment for this element of the assessment.

- In summary, taking account of the results of the FRA (including application of the justification test) the following conclusions (with respect to the potential risk of flooding arising from, and/ or impacting the proposed development and adjacent lands) have been made (Finn Design Partnership, 2019):
  - It has been demonstrated that the proposed development satisfies all of the criteria of the Justification Test for Development Management, as per the relevant guidance (DOEHLG 2009).
  - None of the proposed dwellings will be at risk from flooding, as all finish floor levels will be significantly above the highest predicted level for the most extreme coastal flood event.
  - The minor increases in flood levels associated with discharging the greenfield runoff rate to the existing open channel on the periphery of the Dundalk Bay Estuary are imperceptible and immeasurable and would not result in an adverse impact to the existing hydrological regime or result in an increased flood risk to adjacent properties. This is clearly evident in the results of the Site-specific hydraulic model developed by IE Consulting (refer to Appendix E of the FRA (Finn Design Partnership, 2019) included in Appendix H of this EIAR) and presented in Figure 10.1.
  - The proposed measure to raise the level of the R172 carriageway on either side of the proposed new entrance to the site and where the new entrance and service roadway will tie in with such levels will mean that access will be available to and from the site at all times albeit that vehicles may have to pass through a section of the public roadway and service roadway that will be under a maximum depth of 110 mm of water in the case of a 0.1% or 1 in 1000 coastal flood event.
  - The proposed development does not represent an unacceptable flooding risk, nor shall it exacerbate flooding in the immediate vicinity or wider area.
  - The proposed development is therefore deemed to be in compliance with both '*The Planning System and Flood Risk Management – Guidelines for Planning Authorities*' (DOEHLG, 2009) and Louth County Development Plan with respect to flood risk.

A number of design recommendations are included in the FRA report, which have informed the final drainage design proposed as part of this residential development. The residual risk of flooding arising from or to the proposed development is therefore considered to be negligible and does not warrant further evaluation as part of this impact assessment.

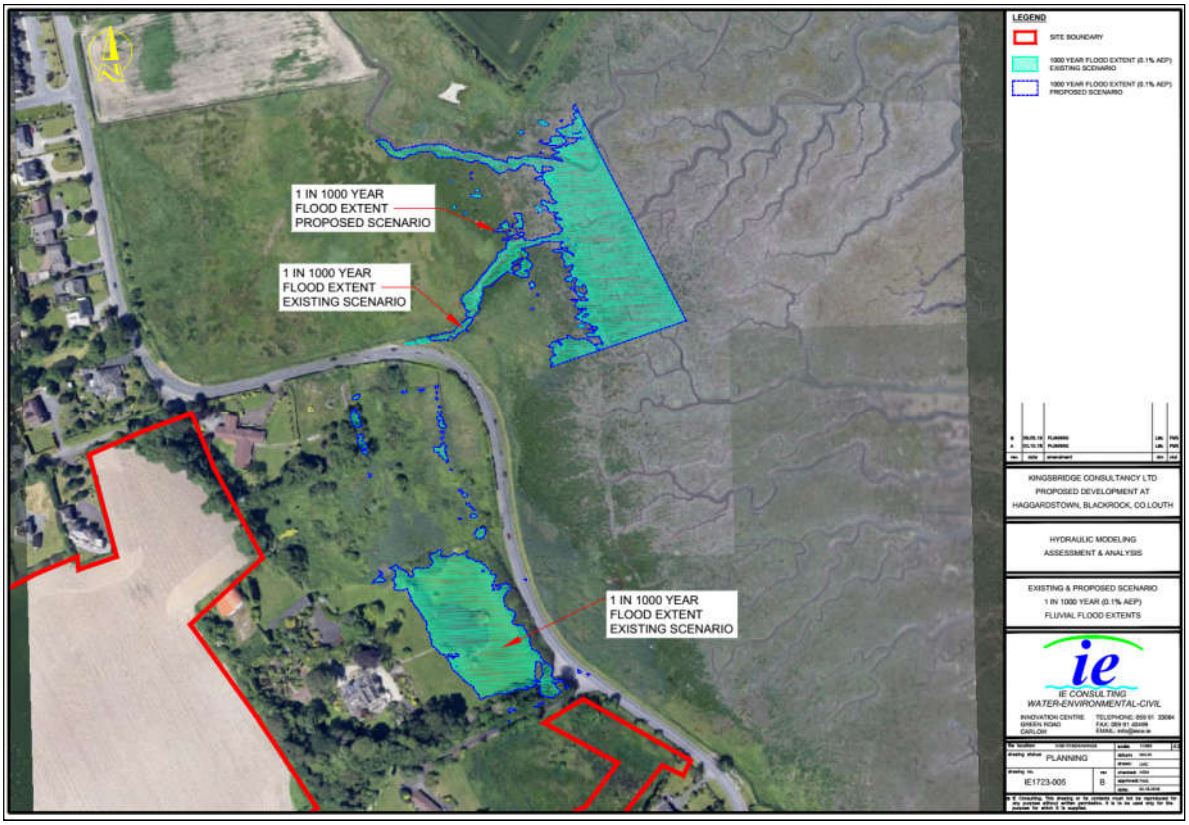

Figure 10.1 - Existing & Proposed Scenario 1 In 1000 Year (0.1% AEP) Fluvial Flood Extents (Source: IE Consulting, 2019)

10.2.1.1. Drainage Design and Climate Change

Drainage infrastructure beneath the proposed development and associated attenuation area have been designed to take account of potential changes in rainfall run-off rates associated with climate change (i.e. additional 10% increase in rainfall over the design life of the development (100 years)).

Finish floor levels of all proposed dwellings along with the vast majority of Site infrastructure will be well above the maximum predicted flood level (3.94 m AOD). As previously detailed, all habitable dwellings together with the proposed crèche will be protected from tidal flood risk in both the current climate and future climate scenarios. Therefore, the potential impact of climate change on the proposed development with regards to drainage design is imperceptible.

10.2.2. Hydrology

10.2.2.1. Surface Water Drainage

There are no reported surface water features within the proposed development, and none were identified during the Site walkover survey. Currently rainfall runoff across the Site would appear to drain directly to ground. Regional total rainfall is 960.4 mm/yr (based on the 30-year mean recorded at the Clones Station, Co. Monaghan during the period 1978–2007) (Met Eireann, 2019). Effective rainfall (or precipitation) is equal to the difference between total rainfall and actual evapotranspiration and is estimated to be 337mm/yr in the vicinity of the proposed development (GSI, 2019). Effective rainfall will be partitioned between overland flow / surface water run-off, and infiltration to ground. Based on a recharge cap of 100mm/yr which has been applied to the bedrock aquifer by the GSI (2019) as a result of the low permeability till (derived chiefly from Lower Palaeozoic rocks) beneath the proposed development, it is estimated that 237mm/yr of effective rainfall therefore occurs as overland flow / surface water run-off. However, given the absence of any onsite drainage or surface water features, overland flow is considered to percolate to ground in more permeable areas of the proposed development, for example in the low-lying eastern portion of the Site, and may flow in discrete permeable zones immediately beneath the subsurface, prior to discharge to Dundalk Bay.

Dundalk Bay is located immediately east of the proposed development, on the eastern side of the existing R172 (Blackrock Rd.). Dundalk Bay is a Special Area of Conservation (SAC) and proposed

Natural Heritage Area (pNHA) (Site Code: 000455), and Special Protected Area for birds (SPA) (Site Code: 004026). Dundalk Bay is a designated Site due to the presence of protected birds, habitats and flora and fauna species, which are listed under Annex I and Annex II of the European Birds Directive (2009/147/EC) and Habitats Directive (92/43/EEC). Examples of protected habitats and species present in Dundalk Bay include Estuaries, Tidal Mudflats and Sandflats, Perennial Vegetation of Stony Banks, Salicornia Mud, Atlantic Salt Meadows, Mediterranean Salt Meadows, Great Crested Grebe, Greylag Goose, Light-bellied Brent Goose, Shelduck, Teal, Mallard, Pintail, Common Scoter, Redbreasted Merganser, Oystercatcher, Ringed Plover, Golden Plover, Grey Plover, Lapwing, Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Black-headed Gull, Common Gull and Herring Gull.

Dundalk Bay is a very large open, shallow sea bay with extensive saltmarshes and intertidal sand/mudflats, extending some 16 km from Castletown River on the Cooley Peninsula in the north, to Annagassan/Salterstown in the south. The bay encompasses the mouths and estuaries of the Rivers Dee, Glyde, Fane, Castletown and Flurry. The Site is of international importance because it regularly supports an assemblage of over 20,000 wintering waterbirds including Light-bellied Brent Goose, Knot, Black-tailed Godwit, and Bar-tailed Godwit (NPWS, 2011). Dundalk Bay has also been identified by the GSI as an area of Geological Heritage, as detailed further in Chapter 9 - Land, Soils and Geology.

The portion of Dundalk Bay located immediately east of the Site is not easily accessible, due to tidal fluctuations and the presence of mudflats; therefore, it is highly unlikely that this section of the bay is used for bathing or amenity purposes.

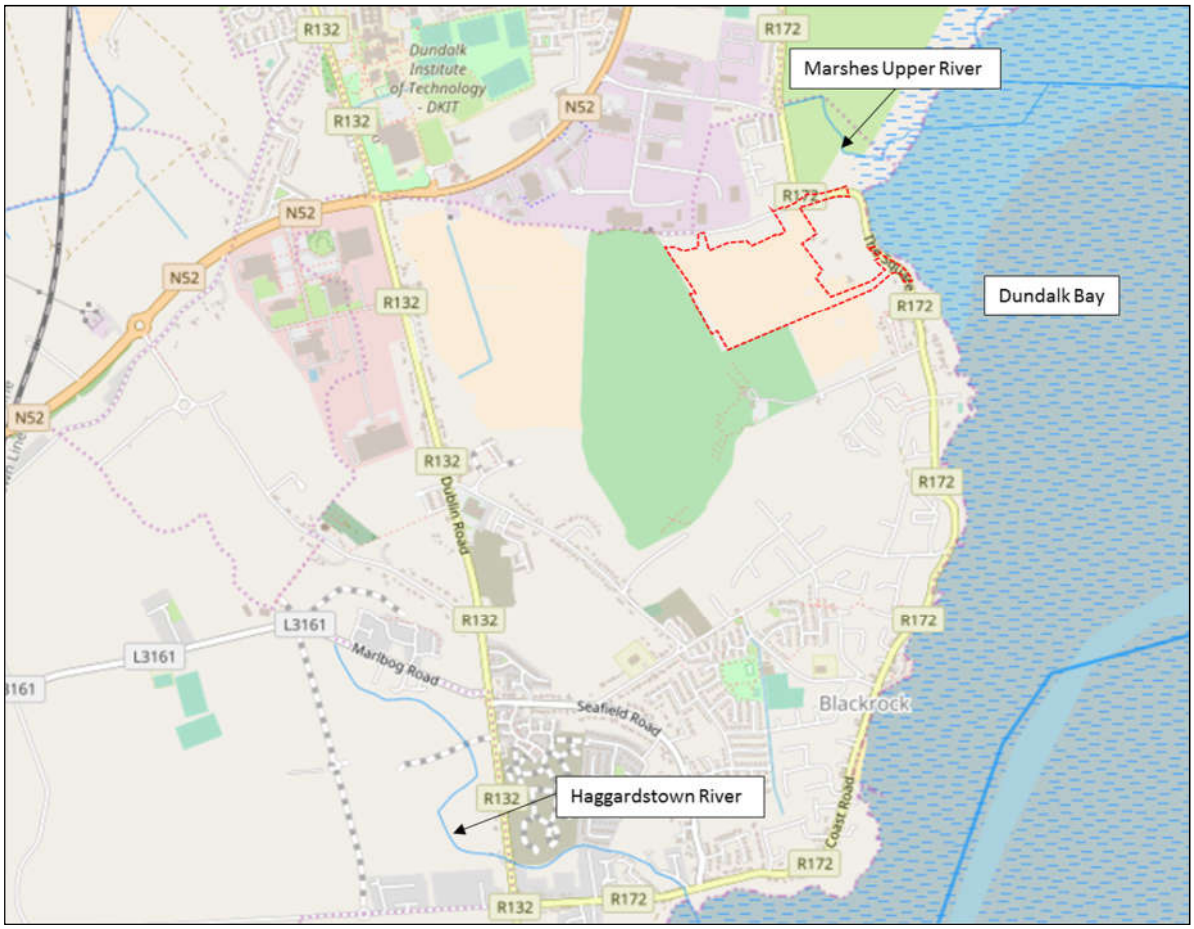

Figure 10.2 - Key Hydrological features in vicinity of Proposed Development (Source: EPA, 2019)

The Haggardstown River, the Marshes Upper River and an unnamed drainage ditch are the only watercourses identified within c. 2km of the proposed development (EPA, 2019), as presented in Figure 10.2. The Haggardstown River rises in Haynestown area c. 1.8km south-west of the proposed development and flows in a general south westerly direction for c. 2.3km before discharging to

Dundalk Bay SAC / SPA (EPA, 2019). The Marshes Upper River rises to ground (possibly culverted) immediately east of the R172, c. 0.5km north of the proposed development, and flows in an easterly and southerly direction before discharging to Dundalk Bay SAC / SPA (EPA, 2019). An unnamed ditch is located c. 0.7km west of the proposed development; however, this drain does not discharge to the proposed development Site. None of the identified surface water courses (Haggardstown River, Marshes Upper River, unnamed drainage ditch) within a 2km radius of the proposed development are hydraulically connected to the proposed development Site.

On a local scale, there are two existing minor drainage channels located offsite. The 'northern drainage channel' is located approximately 30m north east of the Site boundary, and discharges to Dundalk Bay SAC / SPA. The 'eastern drainage channel' is located adjacent to the proposed Site entrance, east of the main Site, and discharges to an existing wetlands area, prior to discharging to Dundalk Bay SAC / SPA. Refer to Figure 10.3.

Figure 10.3 - Local Offsite Drainage Channels and Wetland Areas Located Downgradient of the Site.

Based on the results of the desk-based review and Site walkover survey there is no evidence of a direct hydrological link between the proposed development and Dundalk Bay SAC/ SPA. However, an indirect link is likely via. shallow groundwater flow in an easterly direction from the Site, and subsequent diffuse groundwater discharge to the existing northern and eastern drainage channels and wetland areas (located north and east of the Site) which ultimately drain to Dundalk Bay SAC/ SPA.

10.2.2.2. Surface Water Quality

There is no data available regarding surface water quality in the vicinity of the Site due to the lack of any pertinent surface water features. Neither the Haggardstown River, nor the Marshes Upper River have been assigned a water quality status in accordance with the River Waterbody Water Framework Directive (WFD) for the period 2010 to 2015. The Inner Dundalk Bay (transitional waterbody) is reported to have '*Moderate Status'* for the monitoring period 2010 to 2015 (EPA, 2019). The overall objective of the WFD is therefore to '*Restore'* the good ecological status for the Inner Dundalk Bay by 2021.

10.2.3. Hydrogeology

10.2.3.1. Aquifer Characteristics

The GSI provides a methodology for aquifer classification based on resource value (regionally important, locally important and poor) and vulnerability (extreme, high, moderate or low). Resource value refers to the scale and production potential of the aquifer whilst vulnerability refers to the ease with which groundwater may be contaminated by human activities (vulnerability classification is primarily based on the permeability and thickness of subsoils), as presented in Table 10.1.

Table 10.1 - Groundwater Vulnerability Rating Table (Source: GSI, 1999)

Vulnerability Rating	Hydrogeological Conditions				
	Subsoil Permeability (Type) and Thickness			Unsaturated Zone	Karst Features
	High permeability (sand/gravel)	Moderate permeability (e.g. Sandy subsoil)	Low permeability (e.g. Clayey subsoil, clay, peat)	(Sand/gravel aquifers only)	(<30 m radius)
Extreme (E)	0 - 3.0m	0 - 3.0m	0 - 3.0m	0 - 3.0m	-
High (H)	>3.0m	3.0 - 10.0m	3.0 - 5.0m	>3.0m	N/A
Moderate (M)	N/A	>10.0m	5.0 - 10.0m	N/A	N/A
Low (L)	N/A	N/A	>10.0m	N/A	N/A

Notes: (1) N/A = not applicable.
(2) Precise permeability values cannot be given at present.
(3) Release point of contaminants is assumed to be 1-2 m below ground surface.

Bedrock underlying the vicinity of the Site and its surrounding area comprises calcareous red-mica greywacke of the Clontail Formation as discussed in detail in Chapter 9 - Land, Soils and Geology. The bedrock aquifer within the vicinity of the Site is classified as '*Pl'*, a Poor Aquifer which is generally unproductive except for local zones (GSI, 2019). Refer to Figure 10.4.

There are no gravel aquifers underlaying the Site; however, the Dundalk Gravels Aquifer, which covers an area of c. 5km, is located c. 0.6km north, and the Dromiskin Gravel Aquifer, which covers an area of c. 8.47km, is located c. 2.2km south of the proposed development (GSI, 2019). Both gravel aquifers are classified as '*Lg'*, a Locally Important Gravel Aquifer (GSI, 2019). Refer to Figure 10.4. There are no geological structures (including faults or unconformities) present in the vicinity of the proposed development (GSI, 2019).

According to GSI, 2019, the groundwater vulnerability beneath the general vicinity of the proposed development, is classified as '*Extreme',* with localised portions of *'rock at or near surface'* indicating that bedrock is expected to be extremely shallow in the vicinity (within approximately 3m), and accordingly would be vulnerable to potential contamination. Refer to Figure 10.5. This classification was verified by Site-specific geological records obtained during the geotechnical investigation works.

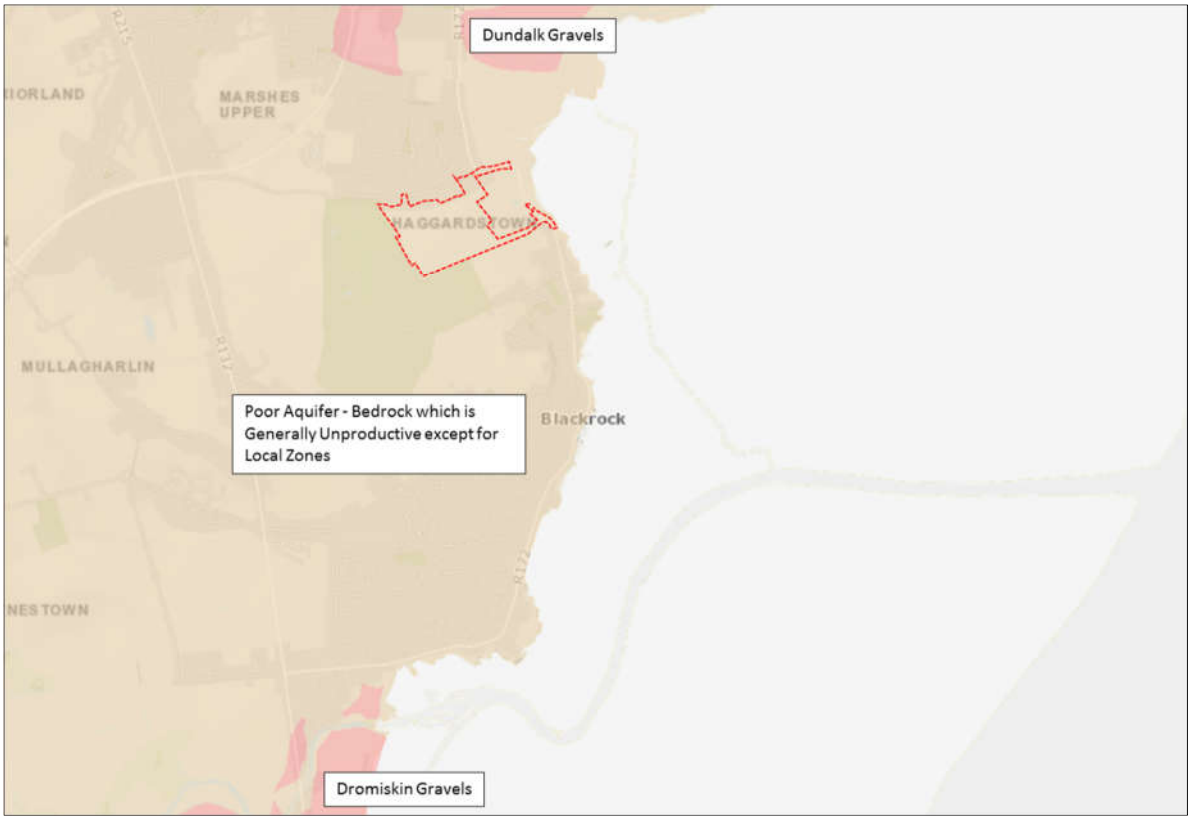

Figure 10.4 - Regional Aquifer Classification (Bedrock and Gravel Aquifers) (Source: GSI, 2019)

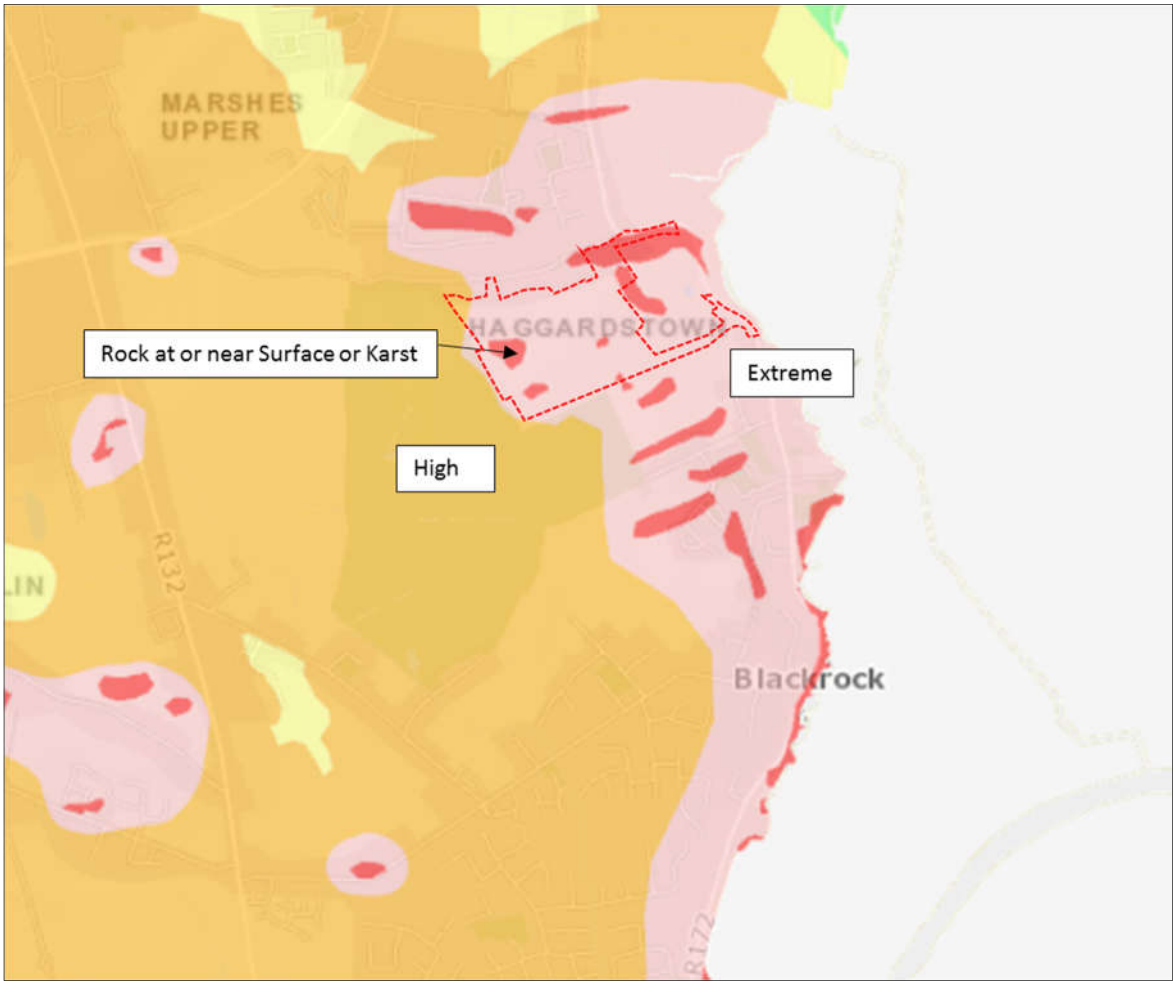

Figure 10.5 - Regional Groundwater Vulnerability Rating (Source: GSI, 2019)

Groundwater beneath the general vicinity of the proposed development Site forms part of the Louth Groundwater Body (GWB). According to the GSI (2004) most groundwater within this GWB (which has a reported area of 1,621 km^2) flows within the upper broken and weathered bedrock zone (typically less than 3m thick), within a zone of interconnected fissuring 10-15 m thick (mainly <10 m), and within a zone of isolated poorly connected fissuring typically less than 150m. Regional groundwater levels generally range from 0-10 m below ground level. Flow paths are likely to be short (30-300 m) with groundwater discharging rapidly to the streams crossing the aquifer, and to small springs and seepages. Overall, the flow direction within this GWB is expected to be to the east, as determined by the topography (GSI, 2004).

There are no karst features within a 10km radius of the proposed development (GSI, 2019); accordingly, the potential for karst connectivity, and groundwater flow via. conduit pathways does not warrant consideration as part of this assessment. Based on the geological setting of the receiving environment there is no potential for karst features (such as fractures or epikarst) to be present beneath the Site.

10.2.3.2. Groundwater Levels and Flow Direction

3no. perched water monitoring wells (BH1, BH2, BH4) were installed to a maximum depth of 4.37m across the Site within shallow subsoils and highly weathered greywacke bedrock. 3no. monitoring events were undertaken on 19th, 25th, and 28th June 2018. Monitoring well locations are presented in Figure 10.6.

Figure 10.6 - Location of Disused Onsite Groundwater Supply Well and Shallow Groundwater Monitoring Wells Installed Onsite.

All 3no. shallow wells were reported to be effectively dry during each event; however, it is noted that the monitoring events coincided with a particularly dry summer where drought conditions were reported throughout the country. An existing groundwater supply well is also located in the north western corner of the proposed development Site (location presented in Figure 10.6). Access was provided to this well during the monitoring programme. The well, which is located within an existing

pump house, has a total depth in excess of 30m (maximum depth of dip meter). A groundwater level of 1.49m below ground level (mbgl) was recorded on 28th June 2018. The well is disused and will not be recommissioned as part of the proposed development. No borehole logs or well installation details are recorded; however, based on available information it appears that this is a historic well which has not been used for some time, and is likely installed within the bedrock aquifer beneath the Site.

Inferred groundwater flow is expected to follow topography in a general easterly / north easterly direction towards Dundalk Bay SAC/ SPA, as presented in Figure 10.7. Given the noted absence of surface watercourses within the proposed development, it is likely that rainfall run-off percolates vertically and flows beneath the shallow subsurface, as previously outlined, recharging the bedrock aquifer in localised areas. Shallow groundwater flowing beneath the proposed development is subsequently likely to discharge directly via. groundwater flow pathways, and indirectly via. surface water / drainage ditch pathways to Dundalk Bay SAC/ SPA.

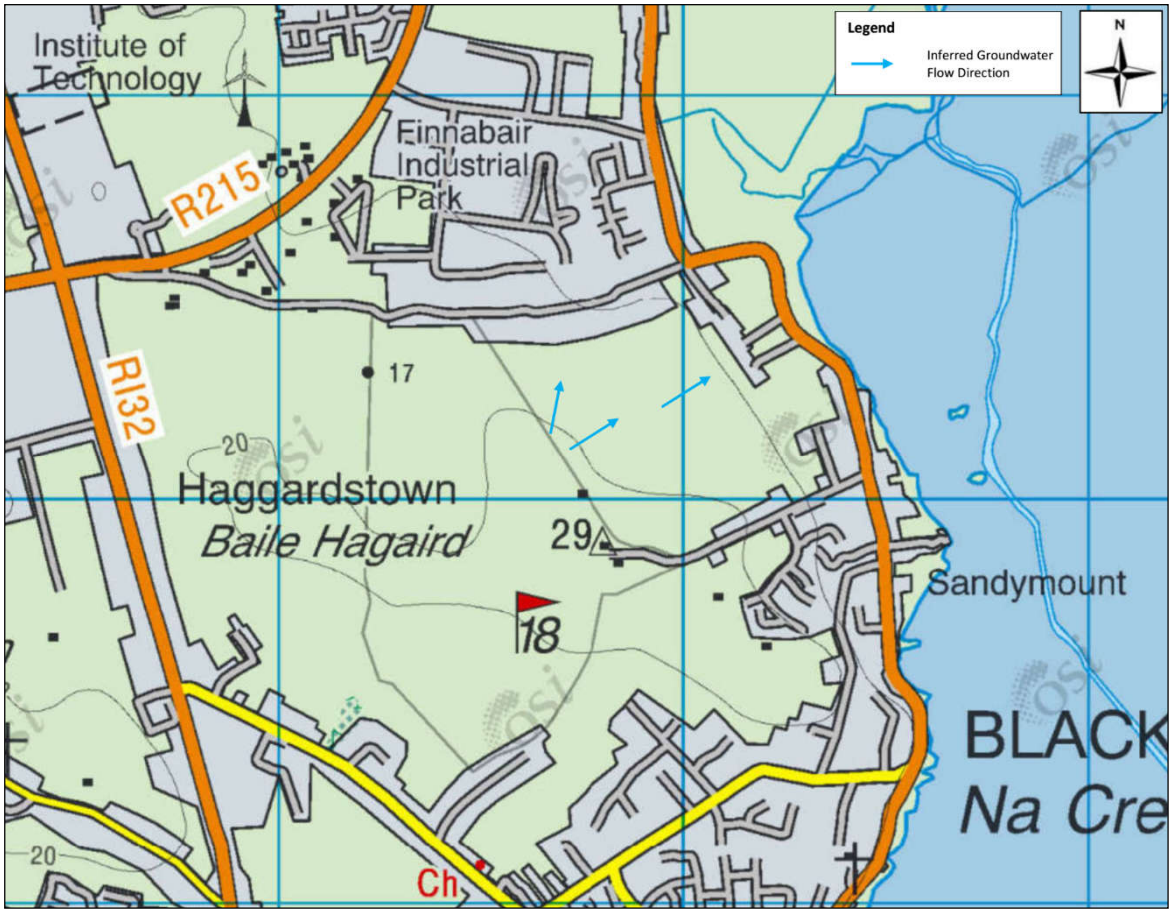

Figure 10.7 - Inferred Groundwater Flow Direction (Source: GSI, 2019)

10.2.3.3. Groundwater Use & Available Resource

A search of the GSI groundwater well database was conducted to identify registered wells within the general area of the Site. There are 25no. registered wells within 2km (Figure 10.8) and the following uses are reported;

- Unknown / Other – 24 no.; and,
- Industrial –1 no.

Well yields within the vicinity of the Site are reported by the GSI (2004) to be variable. The closest reported well to the Site is located c. 0.6km south of the Site. The use of this well has not been recorded by the GSI or is unknown. 3no. wells (one of which is a groundwater abstraction well for industrial use) are also located c.0. 8km north west of the Site which are reportedly used by Carrolls Ltd. However, the P.J. Carroll factory ceased operation in 2008, and these wells are located up-hydraulic gradient of the Site.

There are no reported drinking water supplies or Public Supply Source Protection Areas within a 2km radius of the Site; the nearest designated public supply source protection zone is the Ballymakenny Source Protection Area located c. 25km south, just north of Drogheda.

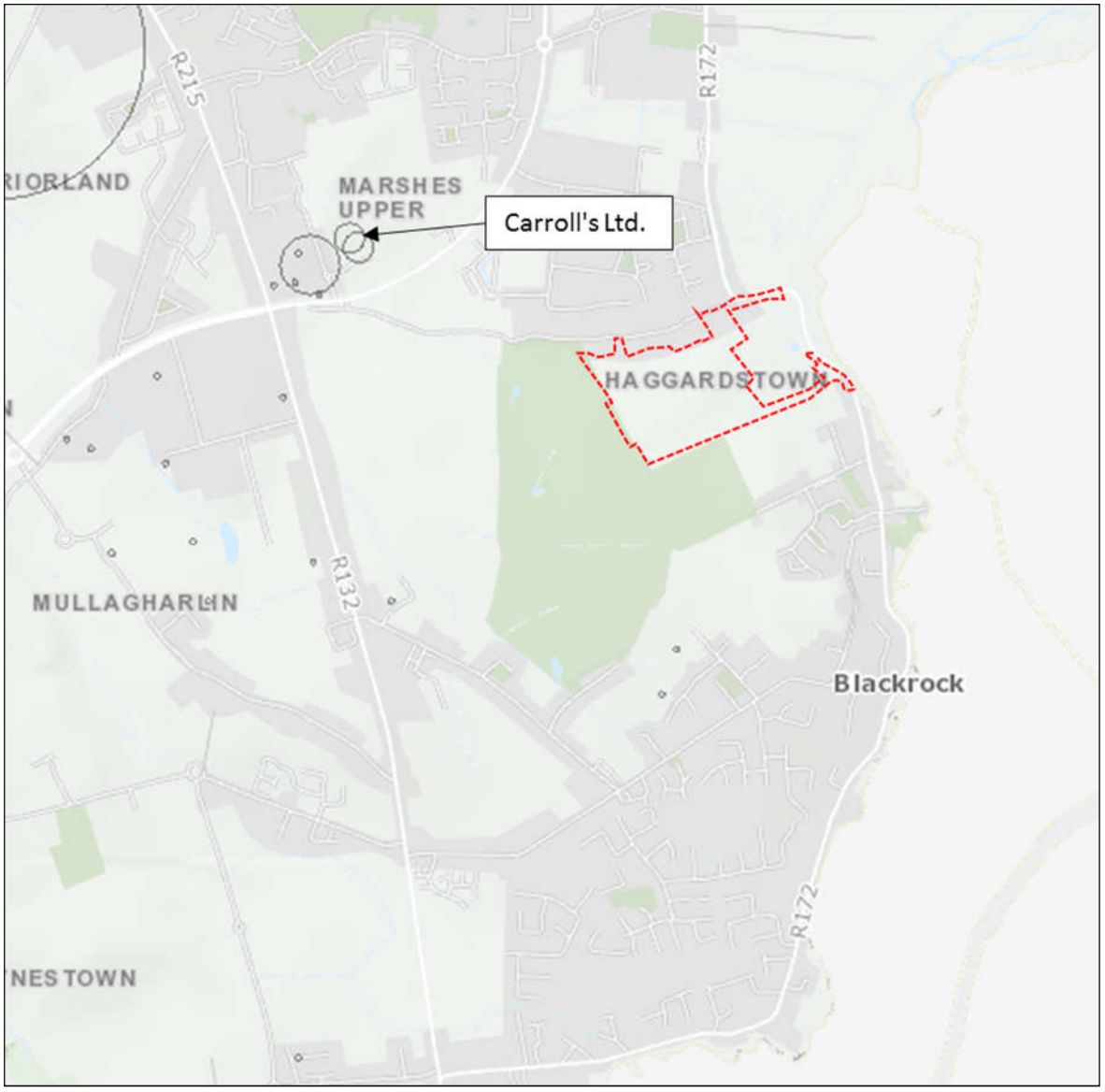

Figure 10.8 - Registered Groundwater Wells in the vicinity of the Site (Source: GSI, 2019)

10.2.3.4. Groundwater Quality

The European Communities Environmental Objectives (Groundwater) Regulations, (S.I. 9 of 2010) came into effect on 27th January 2010. The aim of the Regulations is to achieve the environmental objectives established for groundwater by Article 4 (1) (b) of the Water Framework Directive (2000/60/EC). The 2010 Regulations set down groundwater quality standards for nitrate (50mg/L) and active substances in pesticides in Schedule 4 and also established threshold values for pollutants or indicators of pollutants in Schedule 5. Under these regulations the EPA shall also assign a status of '*Good*' or '*Poor*' to those bodies of groundwater where available data and knowledge allows.

Regional groundwater quality within the general vicinity of the Site, is of '*Good Status*' for the 2010 to 2015 period. The overall objective of the Water Framework Directive for the Louth GWB is to '*Protect*' the current good status. A key component of groundwater classification is the assessment of the impact of pollution on the groundwater body. The groundwater status classification process accounts for the ecological needs of the relevant rivers, lakes and terrestrial ecosystems that depend on contributions from groundwater.

Preparations for the second cycle (2015-2021) River Basin Management Plans are currently underway. According to the EPA (2018) the key change will be that for this cycle the Eastern, South Eastern, South Western, Western and Shannon River Basin Districts will be merged to form one national River Basin District. This cycle is led by the local authorities at regional level. The second cycle River Basin Management Plan 2018-2021 was published by the Department of Housing, Planning and Local Government (DoHPLG) in April 2018. The Site is located within the Newry, Fane, Glyde and Dee Catchment (Code: 06). This catchment includes the area drained by the Newry, Fane, Glyde and Dee rivers and by all streams entering tidal water between Murlough Upper and The Haven, Co. Louth, draining a total area of 2,125km². The largest urban centre in the catchment is Dundalk. The total population of the catchment (in the RoI) is approximately 115,900. The catchment assessment is currently being completed by the EPA.

10.3. Potential Impact of the Proposed Development

10.3.1. Hydrogeological Conceptual Site Model

In addition to flood risk, the following criteria are typically applied when evaluating potential impacts to the water environment: -

- Impacts to surface water / groundwater quality; and,
- Impacts to surface water flows / groundwater resources.

In terms of groundwater resources, no significant impact is anticipated arising from the proposed development based on the following facts: -

- There are no reported public supply wells within the vicinity of the Site. Based on GSI (2019) records the closest reported groundwater abstraction well (Carrolls Ltd.) is located c. 0.8km from the Site. However, due to the nature, scale and location of the proposed development, any offsite groundwater abstraction wells are unlikely to be impacted by the proposed development.
- There will be no significant change to rainfall recharge rates at the proposed development. Storm water generated from the proposed development will be conveyed through new storm water drainage networks which have been designed in accordance with the Greater Dublin Strategic Design Study and based on SuDS principles. Storm water will be attenuated at greenfield run-off rates prior to discharge to either the proposed outfall location at the existing open channel north east of the Site (which drains naturally to Dundalk SAC /SPA), or to the second discharge point to the proposed outfall location immediately west of the proposed main access road onto the R172 (which will drain to the existing wetlands in this area). The proposed storm water discharge system has been designed to broadly follow the existing topographic levels and characteristics of the current natural drainage catchment regime. This will minimise any impacts to existing rainfall recharge rates at the Site (and accordingly groundwater levels beneath the Site) as a result of the proposed development.
- Maximum excavation depths are anticipated to range between approximately 5m (for utilities and services) and 7m (for the proposed wastewater pumping station that will be located within the eastern portion of the Site). Based on encountered Site-specific geological records, and Site topography, some dewatering may be required during the construction phase, albeit in a localised area of the Site, primarily along the lower lying eastern portion of the Site. However, given the fact that the Site is underlain by a Poor Aquifer which is generally unproductive except for local zones, and taking account of the localised nature of potential dewatering, Site development works and associated excavation, no groundwater quantity / groundwater level impacts are anticipated to regional groundwater resources, or any groundwater dependant terrestrial ecosystems (GWDTEs) in the vicinity of the proposed development (including offsite wetland areas).
- No groundwater abstraction is proposed during the operational phase. Irish water has confirmed that the existing water network will have sufficient capacity to meet peak operational water requirements of 290.25m^3 per day[12] from the proposed development. Based on proposed excavation depths in the vicinity of Apartment Blocks A and B, excavation into c. 0.5m of bedrock will be required; however, groundwater is unlikely to be encountered. Therefore, based on encountered ground conditions in this area, permanent dewatering of both underground car parks is unlikely to be required during the operational phase.

[12] Calculated as follows: [(500*3*150 l/d)+(1*120*60l/d)]*1.25 = 290,250l/d or 290.25m3/d (Source: Water Supply Requirements Calculation dated 20/04/18 by Finn Design Partnership)

Therefore, given the nature of the proposed development there will be no impact to regional or local groundwater resources, or water level impacts to any GWDTE in the vicinity of the proposed development (including offsite wetlands). Accordingly, potential impacts on groundwater resources or groundwater levels to do not warrant further consideration.

In assessing potential water quality impacts, the EPA advocates a 'risk-based approach', and states that '*the principal aim in dealing with contaminated land and groundwater related issues is to secure the protection of human health, water bodies (including groundwater) and the wider environment'* (EPA, 2013). In accordance with this risk-based approach a preliminary Source-Pathway-Receptor (SPR) model has been derived for the Site.

Four key receptors (in terms of surface water /groundwater quality) have been identified as follows;

- Bedrock aquifer beneath the Site (a Poor Aquifer which is generally unproductive except for local zones);
- Local drainage channels downgradient / east of the Site (including both the northern and eastern drainage channels) (via. surface water and groundwater pathways);
- Existing wetlands located downgradient / east of the Site (via. surface water and groundwater pathways), and,
- Transitional Waters, namely Dundalk Bay SAC/ SPA (via. surface water and groundwater pathways).

The focus of this assessment will therefore be on potential groundwater quality and surface water quality impacts, along with surface water flow impacts that may be associated with the proposed development. A preliminary Hydrogeological Conceptual Site Model (CSM) has been derived for the Site (based on all available information obtained during the Site walkover survey, desk based literature review and Site specific geological and monitoring records). This model, presented in Figure 10.9, represents the current conceptual understanding of surface water / groundwater processes and interactions in the vicinity of the Site.

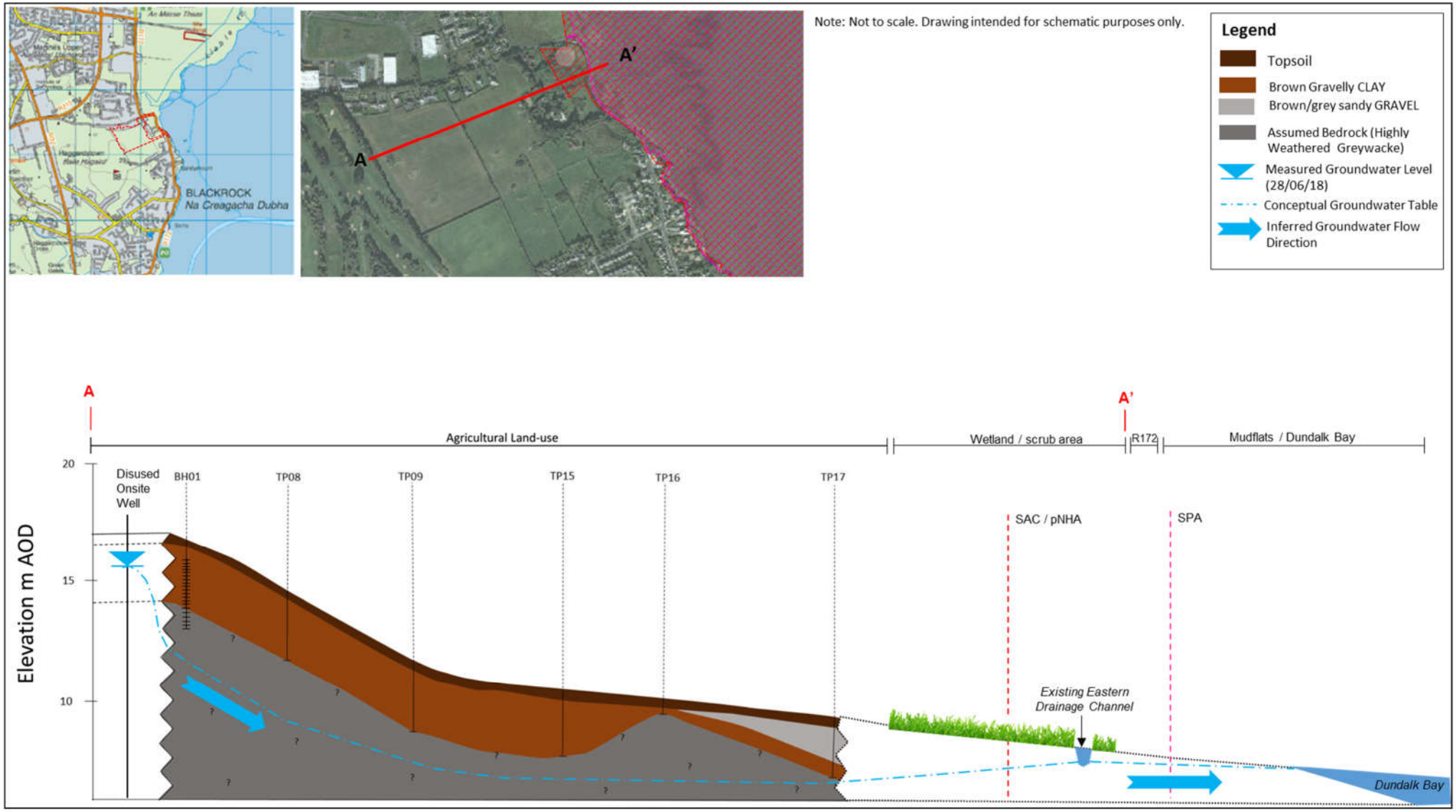

Figure 10.9 - Hydrogeological Conceptual Site Model

10.3.2. Characteristics of the Proposed Development

The project involves the development of 483no. residential units, comprising the following:

- 258no. houses (41no. five bedroom 3-storey units, 20no. four bedroom 3-storey units, 80no. four bedroom 2-storey units, 1no. four bedroom 1-storey unit, and 116no. three bedroom 2-storey units);
- 213no. apartments (64no. one bedroom units and 149no. two bedroom units);
- 12no. Duplex Units (6no. two bedroom below duplexes and 6no. three bedroom duplexes);
- Construction of the access road and priority junction with right turning lane off the R172 (Dundalk to Blackrock Roadway);
- Crèche (677 sqm);
- Provision of car parking spaces (824no.) (including underground car parking (64no.) at Apartment Block A and Apartment Block B), and bicycle parking spaces (512no.);
- All associated landscaping and Site development works;
- Storm water drainage system via. 4no. catchment areas, with interception storage and treatment of runoff within the SuDS features, via. permeable paving, swales, filter drains, silt traps and oil separators, and 2no. culverts to be located offsite along existing drainage channels;
- Foul sewerage pumping station with rising main to connect to the public gravity mains at stand-off manhole located at the N52 junction with the Crowne Plaza Hotel/ DKIT entrance; and,
- Potable water supply (300 mm/200 mm diameter pipeline) extending from the existing 700 mm diameter pipeline extending along Bóthar Maol before passing through the Site and connecting into the existing mains located along the R172 at the northern end of Blackrock village (near the Site entrance).

10.3.2.1. Storm Water Drainage Design

The proposed drainage system (consisting of 225 mm, 300 mm, 450 mm, 525 mm, 675 mm and 750 mm diameter pipeline) has been designed based on 4no. separate catchment areas (network 1 to 4), as presented in Drawing Ref: 1703-Eng-110 to Drawing Ref: 1703-Eng-119 (refer to Appendices B and C of the Engineering Services Report submitted with this application) and summarised as follows;

- **Network 1 and 2** - Storm water from each of the two large catchment areas (network 1 and 2) will pass through a silt trap (minimum volume of 4.5m^3) and hydrocarbon interceptor (Kingspan Klargester Class 1 bypass separator) before being attenuated in a proposed infiltration basin which will be located within the eastern portion of the Site. Attenuated flows will then be discharged under allowable greenfield runoff rates to an existing open channel (northern channel) within the estuary of Dundalk Bay, as follows:
  - A drainage pipeline (375mm diameter) will be installed to convey flow from the infiltration basin to discharge into a 1000mm wide (750mm high) box culvert. The maximum allowable design flow from the infiltration basin is 80.60 litres per second (l/s) which has been calculated by reducing the overall allowable runoff rate of 105.9 lts/sec, that has been calculated for that part of the Site where the residential units and creche will be constructed, by 25.3 l/s to take account of the fact that the flows from network 3 are not attenuated.
  - This culvert will extend to the end of the existing open northern channel and will be laid so that there will be a minimum of 150mm minimum depth of water in the culvert at all times.
  - Flow control measures will be installed to ensure the velocity of water exiting the culvert at all times will not exceed 0.465 l/s.
  - A new head wall will be constructed at the outlet of the box culvert.
  - The energy of the discharge will be further dissipated through the installation of a riprap apron (2m long and 0.25m deep) at the outlet of the culvert by laying 100mm broken stone across this zone.
  - These design measures will ensure that Dundalk Bay SAC/ SPA is protected against any potential erosion which could result at the discharge point.
  - All proposed storm water drainage works will be carried out above the relevant high water mark (high tide), and therefore do not require a foreshore licence.

- **Network 3 -** Storm water from this minor catchment area in the north-eastern portion of the proposed development (network 3 designed to accommodate run-off from 20no. properties and

an internal road network that serves the units) will join the drainage pipeline from the infiltration basin, before passing through a silt trap (minimum volume of 2.5m^3) and hydrocarbon interceptor (Kingspan Klargester Class 1 bypass separator) immediately prior to discharge from the north-eastern Site boundary. These minor volumes of additional storm water will discharge to the existing open northern channel prior to discharge to Dundalk Bay SAC/ SPA, as outlined in detail above. Flow control measures for all 20no. units have been incorporated into the drainage design where the overall allowable runoff rate of 105.0 lts/sec that has been calculated for that part of the development Site has been reduced to take account of the arrangement where the flows from this networks are not attenuated.

- **Network 4 -** Storm water from a minor catchment area along the south-eastern boundary of the proposed development (network 4, designed to accommodate run-off from the main internal access road to the development) will also be attenuated prior to passing through a silt trap (minimum volume of 2.5m^3) and hydrocarbon interceptor (Kingspan Klargester Class 1 bypass separator). A second allowable runoff rate of 2.1 l/s has been calculated for this area of the Site where the attenuated flows will be retained in oversized pipes before discharging to the existing open eastern channel via. a new head wall which will be constructed at the outlet from the drainage pipe, prior to discharge to the existing wetlands in this area (which form part of the Dundalk Bay SAC / SPA). Flows are expected to be negligible as modelled within the Flood Risk Assessment (Finn Design Partnership, 2019) included in Appendix H of this EIAR).

SuDs Measures

SuDs techniques to be applied within the development include the following;

- As the Site is currently in agricultural use the proposal for the storm water design is to mimic the existing runoff. Therefore, the proposed drainage system will result in minimal change to the existing hydrological regime across the Site. The following systems are proposed;
  - Attenuation storage will be provided to ensure that there is adequate attenuation storage for limited discharge volumes. Attenuation will be provided for events up to and including a 1% AEP rainfall event. A 500 mm freeboard will be maintained from the lowest Finish Floor Level (FFL) of the dwellings within the vicinity of the structure to the top water level of the infiltration basin.
  - A discharge rate of 50.40 l/s has been calculated for the Site; this rate is used to calculate the allowable runoff for the 1 in 30 and 1 in 100 yr events by applying the relevant growth factors. Discharges will however be limited to ensure that, as a minimum, discharge rates are maintained below the greenfield runoff rate (2.873 l/s/ha, for soil type 2).
  - Infiltration of storm water runoff to ground will be facilitated via. permeable paving used for duplex/apartment car parking. Further opportunities will be provided for infiltration to ground via. the installation of piping under permeable paving areas which will connect to adjoining swales along the edge of the parking areas. The design of the swale network (both dry and wet) will provide further opportunities for storm water runoff to infiltrate into and within the landscaped area in the central portion of the Site.
  - A silt trap, and hydrocarbon interceptor (Kingspan Klargester Class 1 bypass separator) will be provided for the treatment of all storm water runoff from the Site prior to discharge to either the infiltration basin / the northern channel or the eastern channel, as detailed previously.

- The above design measures evolved based on Site-specific ground conditions (Site investigation data provided by Geotechnical Environmental Services Ltd (GES), and relevant best practice guidance including the SuDS Manual (CIRIA (2007)).

- As the drainage network for the proposed development will be constructed to a '*taking in charge*' standard, the range of SuDS features available are somewhat restricted. However, the following key elements have informed the drainage design;
  - The extents of impermeable areas have been reduced where allowable;
  - Permeable, self-draining areas have been incorporated into landscaped areas;
  - Footpaths and the main access road have been designed in order to direct run-off into the adjacent grass verge or permeable paving (where possible) for infiltration, attenuation and storage.
  - An attenuation storage system will be provided.

- A silt trap and Class 1 petrol/oil separator will be provided before the outfall for each of the 4no. catchment areas (network 1 to 4).

10.3.2.2. Watermain Design

Proposed watermain services (100 - 300mm diameter pipeline), including firewater requirements for the development will be provided. The peak daily domestic water demand (including potable use) for the proposed development is calculated to be 290.25m^3 per day. Irish water has confirmed that the existing water network will have sufficient capacity to meet peak operational water requirements of 290.25m^3/ day from the proposed development.

10.3.2.3. Foul Drainage Design

Proposed foul drainage services (150 – 225mm diameter pipeline) will be provided; all wastewater will discharge via. gravity to the proposed wastewater pumping station along the eastern boundary of the Site, where it will be pumped, via. the proposed rising main, through the Site and extend along Bóthar Maol in a north-westerly direction prior to discharging to the foul mains network and ultimately Dundalk Wastewater Treatment Plant (WWTP) located approximately 4km north-east of the proposed development. Irish water has confirmed that the existing foul network has sufficient capacity to meet the combined wastewater discharge volumes of approximately 225.45m^3/ day from the proposed development, once operational. The proposed onsite waste water pumping station which will be a closed system will be located along the eastern boundary of the Site with capacity for minimum 12-hour emergency storage.

10.3.3. Potential Impacts on Water during Construction phase

There is a potential for degradation in groundwater and surface water quality resulting from potential pollution caused by construction activities e.g. plant, fuel/ chemical spillage etc., particularly during excavations for the proposed residential units (up to four storeys in height), creche, wastewater pumping station, foul services and rising main, storm water drainage system, watermain services, infiltration basin, access road and internal roads. The extent of excavation for service / utility trenches will vary; however, the maximum depth will be approximately 5m. The maximum anticipated depth of onsite excavation will be approximately 7mbgl (to facilitate the proposed wastewater pumping station that will be located within the eastern portion of the Site).

During the construction phase of the proposed development, the following potential impacts on surface water or groundwater quality could occur: -

- Accidental spillages or leaks onsite in the vicinity of exposed groundwater / surface water pose a potential pollution risk as follows;
  - Groundwater levels beneath the proposed development lands range from approximately 1.49mbgl (disused onsite well) in the north-western portion to >4.37mbgl (BH2) in the south-western portion of the Site. Therefore, shallow groundwater is likely to be encountered during any excavation works within the shallow bedrock zone (highly weathered greywacke), specifically in the lower lying eastern portion of the Site. The shallow water table beneath the Site, particularly in any areas where it is intercepted, would be highly vulnerable to water quality impacts through accidental spillages or leaks of oils, fuels, paints or chemicals. This could result in likely moderate adverse temporary impacts directly to the quality of groundwater receptors (bedrock aquifer), and likely slight adverse temporary impacts indirectly (via. groundwater migration) to the quality of surface water receptors (offsite northern and eastern drainage channels), and also to receiving transitional waters (Dundalk Bay) (via. surface water and groundwater pathways).
  - Offsite works, during the construction of the proposed culvert, new headwall, and riprap apron at the northern drainage channel; and the proposed culvert, and new headwall at the eastern drainage channel, could result in surface water quality impacts to these channels, wetland areas and Dundalk Bay SAC / SPA, through accidental spillages or leaks of oils, fuels, paints or chemicals. This could result in likely moderate adverse temporary impacts directly to the quality of these surface water and transitional water receptors (via. surface water pathways).

- General Site activities during the construction phase associated with cement handling and pouring, particularly in the vicinity of the proposed works at the northern and eastern drainage channels, pose a potential pollution risk as follows;

- Offsite works, during the construction of the proposed culvert, new headwall, and riprap apron at the northern drainage channel; and the proposed culvert, and new headwall at the eastern drainage channel, could result in surface water quality impacts to these channels, wetland areas and Dundalk Bay SAC/ SPA, through accidental spillages or leaks of cement. This could result in likely moderate adverse temporary impacts directly to the quality of these receptors (via. surface water pathways).
- Such general Site activities could also result in likely slight adverse temporary impacts (via. groundwater pathways) directly to groundwater quality beneath the Site and indirectly to surface water quality in the downgradient drainage channels, wetland areas and Dundalk Bay SAC/ SPA.

- Inadequate soil / storm water management during the construction phase, specifically in the vicinity of the proposed works at the northern and eastern drainage channels, poses a risk of excess loadings of suspended solids directly to both open channels. This could result in likely moderate adverse temporary impacts directly to the surface water quality of these channels, or to the receiving transitional waters (Dundalk Bay SAC/ SPA) (via. surface water pathway).
- Temporary dewatering will likely be required during excavation in the eastern portion of the Site (where shallow groundwater levels are likely); this may result in excess loadings of suspended solids to a temporary discharge point (presumed to be a temporary onsite soakaway). This could result in likely temporary slight adverse impacts directly to groundwater quality beneath the Site but would not impact surface water quality at the local drainage channels, existing wetlands, or at Dundalk Bay SAC/ SPA.
- Existing subsurface contaminants could pose a potential pollution risk. However, based on the results of the ground investigation and Site-specific soils analytical data (presented in Appendix G of this EIAR (refer to 'Appendix B Lab Analysis' of Appendix 5 'Preliminary Risk Assessment (PRA) And Generic Quantitative Risk Assessment (GQRA) Reports') and discussed in detail within Chapter 9 – Land, Soils and Geology, the potential for groundwater impacts via. excavation and mobilisation of any existing subsurface contaminants is negligible. No groundwater or surface water impacts are expected as a result of current or historic land-use either at the Site or within adjacent lands.

Mitigation measures will be implemented during the construction phase to avoid these potential impacts, and to address any potential water management issues; these are listed below in Section 10.4

10.3.4. Potential Impacts on Water during Operational Phase

During the operational phase of the development, the following potential impacts on surface water or groundwater quality could occur: -

- Groundwater and surface water receptors could be at risk from occasional fuel / oil leaks along the access roads and paved areas. Given that the volumes arising from any such spills / leaks are likely to be very minor and taking account of the localised nature of such events, along with the fact that the Site is underlain by low permeability clay, the potential risk to the underlying bedrock aquifer is negligible and does not warrant further consideration.

  Given the sensitivity of the receiving hydrological environment, this pollution risk could potentially impact the northern and eastern drainage channels, wetlands and transitional waters (Dundalk Bay SAC/ SPA), via. storm water discharge. However, the volumes of fuel or oil potentially spilled / leaked would likely be very minor with localised occurrences, and the storm water drainage system has been designed as follows to treat such volumes (once they are maintained and cleaned in line with the manufacturer's recommendations);
  - The provision of a silt trap and an oil separator on each of the four storm water networks are the primary sources for preventing contamination of the surface water runoff. The silt traps and separators are provided at the end of the networks prior to the discharge to the local drainage channels and wetlands.
  - The oil separators have been designed for the specific outflow from each network where the design criteria is that there is a minimum retention time of 6 minutes to allow immiscible hydrocarbon pollutants, such as oils and petrol to accumulate on the surface of the water and settleable solids to sink to the bottom of the unit.

- Each oil separator will be fitted with an alarm system that will activate when the level of hydrocarbon pollutants reach a pre-determined level where maintenance and cleaning will then be required.

Taking account of the above design measures, the risk posed by occasional fuel / oil leaks along the access roads and paved areas could result in temporary slight adverse impacts to the quality of surface water receptors (offsite northern and eastern drainage channels), wetlands, and receiving transitional waters (Dundalk Bay SAC/ SPA) (via. surface water pathways). Mitigation measures (i.e. maintenance procedures) will be implemented during the operational phase to further address these potential impacts.

- Identified groundwater and surface water receptors could be at risk of quality impacts in the unlikely scenario of an unplanned event (traffic collision, emergency onsite fuel / oil spill, fire water arising from a property fire). The risk of such an event occurring is low given that the majority of traffic into and within the proposed development will be local residents / crèche users, gas will be provided for home heating purposes, and the proposed development will be designed, constructed and maintained in accordance with all relevant statutory building and fire safety requirements. Nonetheless, in the unlikely scenario that any of these unplanned events occur, the following design measures have been incorporated into the storm water drainage system specifically to address this potential risk;
  - Where contaminated surface water runoff enters the network, in all cases it will pass through a silt trap and Class 1 petrol/oil separator. The provision of a silt trap and an oil separator on each of the four storm water networks as detailed previously will treat suspended solids and hydrocarbon pollutants. However, in the case of property fire, larger volumes of potentially contaminated water will enter the storm drainage network before passing through the silt traps and separators. In the case of an emergency onsite fuel / oil spill, significant hydrocarbon volumes could also enter the storm drainage network before passing through the silt traps and separators. Because the silt trap and separator will be unlikely to remove all contaminants in these scenarios, the infiltration basin has been designed to capture 96% of storm water arising from the development (following primary treatment via. silt trap and oil separator). Where such contamination occurs and enters the onsite infiltration basin, all storm water discharge from the infiltration basin to the SAC will cease, via. the use of an emergency penstock valve. Therefore, contaminated water will be retained within the infiltration basin, where it can be temporarily held prior to either offsite removal and treatment, or diversion to the onsite foul sewer pumping station. A second penstock valve will also be fitted on the outlet pipeline (network 3) from the infiltration basin which would be closed while contaminated flows are being diverted to the foul sewerage pumping station. Procedures and checks will be put in place to ensure that the valves are returned to their normal states once the contaminated volume of surface water is removed from the basin and storm drainage network. This will ensure that any contaminated surface water that may arise on the Site can be removed in accordance with all relevant waste management legislation and will be prevented from discharging to the SAC/ SPA.
  - The storm water infiltration basin will have sufficient capacity to hold any contaminated water for a short-term period. The design capacity is 3,690m^3, while required storage volume (maximum 1 in 100 year storm event) is approximately 2,978m^3. Therefore, the infiltration basin has additional spare capacity of approximately 712m^3. The volume of water within the infiltration basin will reflect rainfall events that have taken place over the preceding period and so will vary from time to time. Therefore, in the event that additional capacity is required, the provision of interconnecting pipework between the basin and the onsite pumping station with the penstock valves, provides the opportunity to divert volumes of surface water runoff to the foul sewer network and subsequently to the municipal treatment plant. The provision of the penstock valve on the outlet from the infiltration basin also provides the opportunity to retain the water within the basin from where a decision can be made on how to satisfactorily deal with the incident.

Given the fact that the Site is underlain by low permeability clay, and that any significant loss of contaminants during an unplanned event (traffic collision, emergency onsite fuel / oil spill, fire water arising from a property fire) are likely to be captured within the stormwater system rather than discharge vertically to ground, the potential associated risk to the underlying bedrock aquifer is negligible and does not warrant further consideration.

The risk posed by unplanned events (traffic collision, emergency onsite fuel / oil spill, fire water arising from a property fire) is low. In the unlikely event that such risks would arise, sufficient design measures have been put in place to ensure that any impacts directly to the quality of surface water receptors (offsite northern and eastern drainage channels), wetlands, and receiving transitional waters (Dundalk Bay SAC/ SPA) (via. surface water pathways) are imperceptible. Nonetheless management procedures will be implemented to further reduce this potential risk.

- Identified groundwater and surface water receptors could be at risk of quality impacts in the unlikely scenario of a SuDS failure. SuDS drainage measures have been designed based on Site-specific ground conditions, and relevant best practice guidance including the SuDS Manual (CIRIA, 2007). The following specific design measures will reduce the risk of SuDS failure;
  - Where contaminated surface water runoff enters the network, in all cases it will pass through a silt trap and Class 1 petrol/oil separator. The provision of a silt trap and an oil separator on each of the four storm water networks as detailed previously will remove suspended solids and hydrocarbon pollutants prior to discharge. All units have been sized to accommodate expected flows from each network. If any unit becomes overloaded as a result of unexpected significant contaminant loading, the fitted alarm will immediately activate, and maintenance will be immediately carried out.
  - In the unlikely event of a failure of the silt trap and Class 1 petrol/oil separator, 96% of storm water can be captured for retention within the infiltration basin, or for emergency diversion to the onsite waste water pumping station, as previously detailed. This will ensure that contaminated storm water will be prevented from discharging to the SAC / SPA.

  The risk posed by a SuDS failure has been addressed within the proposed storm water drainage system. Thus, even in a worst case scenario of a SuDS failure, Dundalk Bay SAC/ SPA will be suitably protected from any potential significant water quality impacts. During the operational phase management procedures will be implemented to ensure that the above design measures are fully effective.

- Groundwater and surface water receptors are at risk of becoming contaminated through leakages, spill events, equipment failure or structural failure of the proposed wastewater pumping station, during the operational phase. However, the new pumping station will be designed, constructed and operated in accordance with Irish Waters Code of Practises and Technical Standards (IW-CDS-5030-01 to 04 & IW-TEC-800) and manufacturer recommendations. The potential scenarios of leakages, spill events or structural failure arising are therefore unlikely. In the event of a system failure (e.g. equipment failure) this will trigger an alarm and the relevant authority will be informed of the failure. A back-up pump will automatically kick in. In the event of the failure of the back-up pump, the proposed wastewater pumping station has sufficient capacity for 12-hour emergency storage. Sufficient design measures have been incorporated to address this potential risk. Therefore, taking account of the proposed mitigation measures which will be implemented during the operational phase, this potential risk does not warrant further consideration.

- Groundwater and surface water receptors are at risk of becoming contaminated through routine Site maintenance activity during the operational phase. Maintenance of the residential units, creche, open space / amenity areas, car parking areas, access roads and paved areas, utilities, foul, watermain and storm water drainage system, infiltration basin, pumping station and rising main may result in small quantities of lubricant oils, fuel and chemicals being brought to the Site. In the highly unlikely event of a spill this could result in slight adverse impacts directly to the quality of groundwater receptors, and directly and indirectly (via. groundwater migration) to the quality of surface water receptors. Mitigation measures will be implemented during the operational phase to avoid these potential impacts.

10.3.5. Do-Nothing Scenario

If the proposed residential development is not undertaken the baseline water environment would remain unchanged. Storm water run-off across the Site would continue to discharge to ground (and the underlying aquifer), prior to discharging to the offsite drainage channels, wetlands, and Dundalk Bay SAC/ SPA. Existing baseline surface water and groundwater quality would remain unchanged. The 'do-nothing' scenario would result in neutral impacts with regards to hydrology and hydrogeology.

10.4. Cumulative Impacts

All relevant developments in the immediate environs of the proposed development, which have been approved but are not yet built or operational, have been reviewed as part of this assessment and key developments are summarised below;

- Planning permission has been granted for 137 housing units c. 200m south of the Site to Shannon Homes under planning reference number 17/784. This development is currently under construction.
- There is a planning application submitted for 16 housing units for Michael White immediately north of Bóthar Maol under planning reference number 18/157.
- There is currently planning permission to convert out buildings into a domestic dwelling immediately east of the Site and outline planning permission granted for two domestic houses north of Bóthar Maol under planning reference number 11/462 and 12/213.

Based on the nature of the proposed developments identified above; and taking account of the proposed phasing and nature of this residential development, cumulative impacts on the water environment (i.e. surface water or groundwater) are anticipated to be imperceptible during the construction and operational phases. No potential cumulative flood risks have been identified.

10.5. Mitigation Measures

The mitigation factors and measures for the control of pollution and protection of surface water and groundwater quality are described below.

10.5.1. Construction phase (including enabling decommissioning works)

With regard to groundwater and surface water quality impacts the following mitigation measures are proposed;

- In advance of commencement of the construction phase, the disused existing onsite well, securely located within a pump house in the north-western portion of the Site will be fully decommissioned by an experienced borehole specialist in accordance with relevant guidelines, '*Good practice for decommissioning redundant boreholes and wells'* (UK Environment Agency, 2012). This will ensure that the redundant well is made both safe and structurally stable and will be suitably backfilled or sealed to prevent groundwater pollution and flow of water between different aquifer units.
- The construction management of the Site will take account of the recommendations of the Construction Industry Research and Information Association (CIRIA) guides 'Control of Water Pollution from Construction Sites' and 'Groundwater control - design and practice' to minimise as far as possible the risk of pollution.
- All of the mitigation measures (for the protection of soils and geology) listed in Chapter 9 will be implemented onsite during the construction phase.
- During localised construction works around the northern and eastern drainage channels (to facilitate the installation of the proposed 2no. outfalls / headwalls), any minor volumes of stripped soils should be stockpiled a minimum distance of 10m from each channel and should be appropriately covered. A temporary storm water management system should be implemented by the Contractor.
- Any groundwater temporarily dewatered during the construction of the infiltration basin, wastewater pumping station and any deep building foundations in localised areas in the eastern portion of the Site will be treated via. the installation of a temporary in-situ water treatment system;
  - This system should be designed and sized to ensure that all pumped groundwater water is treated via. a temporary attenuation pond, prior to discharge to a selected onsite location (via. a temporary soakaway).
  - The Contractor will be required to provide a Site-specific dewatering plan, clearly setting out proposed excavation methodology, estimated dewatering rates, details of proposed treatment system, and discharge location.

- In order to prevent any potential surface water / groundwater impacts via. release of hydrocarbon / chemical contaminants the following standard measures will be implemented:
  - Fuels, lubricants and hydraulic fluids for equipment used on the construction Site, as well as any solvents, oils, and paints will be carefully handled to avoid spillage, properly secured

against unauthorised access or vandalism, and provided with spill containment according to best codes of practice;

- Waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the proposed development for disposal or re-cycling;
- Any spillage of fuels, lubricants or hydraulic oils will be immediately contained and the contaminated soil removed from the proposed development and properly disposed of;
- All Site vehicles used will be refuelled in bunded and adequately sealed and covered areas in the construction compound area.
- Strict supervision of contractors will be adhered to in order to ensure that all plant and equipment utilised on-Site is in good working condition. Any equipment not meeting the required standard will not be permitted for use within the Site. This will minimise the risk of groundwater becoming contaminated through Site activity.
- All oil stored on Site for construction vehicles will be kept in a locked and bunded area;
- Generators, pumps and similar plant will be placed on drip-trays to prevent contamination;
- All Site vehicles used will be refuelled in bunded areas;
- All temporary construction fuel tanks will also be located in a suitably bunded area and all tanks will be double skinned. Relevant Material Safety Data Sheets along with oil absorbent materials will be kept on Site in close proximity to any fuel storage tanks or bowsers during proposed Site development works; and,
- All fuel / oil deliveries to on-Site oil storage tanks will be supervised, and records will be kept of delivery dates and volumes.

- In order to prevent any potential surface water / groundwater impacts via. release of cementitious materials the following measures will be implemented:
  - All proposed outfall structures and headwalls along the northern and eastern drains will be precast. Poured concrete will not be used in these sensitive areas.
  - The measures detailed below will be employed where poured concrete is being used on the main Site in the construction process;
    - The production, transport and placement of all cementitious materials will be strictly planned and supervised. Site batching/production of concrete will not be carried out on Site and therefore these aspects will not pose a risk to the waterbodies present, namely any temporarily exposed groundwater, or local drainage channels, wetlands or Dundalk Bay;
    - Shutters will be designed to prevent failure. Grout loss will be prevented from shuttered pours by ensuring that all joints between panels achieve a close fit or that they are sealed;
    - Any spillages will be cleaned up and disposed of correctly;
    - Where concrete is to be placed by means of a skip, the opening gate of the delivery chute will be securely fastened to prevent accidental opening;
    - Where possible, concrete skips, pumps and machine buckets will be prevented from slewing over water when placing concrete; and,
    - Surplus concrete will be returned to batch plant after completion of a pour.

The above mitigation measures will form part of the Outline Construction Environmental Management Plan (CEMP) submitted as part of this planning application, and which will be further developed by the Contractor within the project-specific Detailed CEMP which will be in operation during the construction phase.

10.5.2. Operational Phase

Taking account of the engineering design of the proposed development (which has been duly informed by the receiving environment), the risk of potential water impacts at the proposed development Site are considered lower during the operational phase. However, given the sensitivity of the receiving environment to groundwater and surface water impacts, the following mitigation measures are proposed during the operational phase;

- All of the mitigation measures (for the protection of soils and geology) listed in Chapter 9 will be implemented onsite during the operational phase.
- All plant and equipment utilised onsite during maintenance works should be checked and in good working condition. Any equipment not meeting the required standard will not be permitted for use within the Site;

- Any minor volumes of fuel, oil or chemicals required during routine maintenance works will be brought to and from Site by the maintenance contractor. While temporarily onsite all chemicals will be kept in secure and bunded areas, with relevant Material Safety Data Sheets available onsite. Any fuel / oil tanks temporarily stored on Site will be located in a suitably bunded area and all tanks will be double skinned, with oil / chemical absorbent materials held onsite in close proximity to the tanks;
- In the unlikely event of a fuel / oil or chemical spill / leak during routine maintenance works, emergency spill response measures will be implemented with the aim of limiting the volume spilled and recovering as much of the lost product as possible;
- A detailed Site Management Plan should be put in place for the operational phase of the development. This plan should clearly outline standard operating procedures for each of the following:
  - Maintenance of newly installed storm water drainage system including all newly installed gullies, silt trap and Class 1 petrol/oil separators, infiltration basin, emergency penstock valves, and outfalls. Routine inspections of all silt traps and silt trap and Class 1 petrol/oil separators will minimise the potential risk of equipment failure;
  - Maintenance of newly installed foul drainage system including the newly commissioned waste water pumping station, rising main, pump (and back-up pump), and emergency storage tank;
  - Emergency response in the unlikely event of a major fuel / oil spill onsite;
  - Emergency response in the unlikely event of a major fire at any of the newly constructed properties;
  - Action response in the unlikely event of a deterioration in storm water quality discharging from the Site; and,
  - Waste management.

  The management plan should include all health and safety and environmental management procedures associated with the above tasks and should also identify when routine equipment maintenance and checks will be carried out (as per the relevant manufacturers requirements and industry standards). A nominated person (Site maintenance manager) should be responsible for ensuring that all required equipment maintenance, checks and repairs are carried out as and when required and will keep an up to date maintenance record for the Site. The roles, responsibilities, and contact details for all Site maintenance operators, and emergency services should be contained within the management plan, along with reporting and notification procedures for management, regulators and stakeholders.

  The Site maintenance manager will be responsible for ensuring that, in the unlikely event of either a SuDs failure (e.g. overloading of silt trap and Class 1 petrol/oil separator) or a major onsite contamination incident (e.g. fire water run-off following major property fire) all emergency penstock valves will be immediately closed, resulting in all storm water from the Site being either diverted, or held within the onsite infiltration basin, as per the engineering design. All contaminated water should be disposed of to a suitably licenced offsite waste facility, in accordance with all relevant waste management legislation. This will ensure that there is no risk of any contaminated storm water impacting Dundalk Bay SAC/ SPA. Procedures and checks would have to be put in place to ensure that the valves are returned to their normal states once the contaminated volume of storm water is removed from the basin and storm drainage network.

  Contact details of an alternative Site maintenance contact should be included within the management plan. In the event that the nominated Site maintenance manager is unavailable, this contact will be tasked with the responsibility of ensuring all emergency penstock valves are immediately closed should either a SuDs failure, or major onsite contamination incident occur, and will be responsible for ensuring all contaminated water is appropriately removed and disposed of offsite in accordance with all relevant waste management legislation.

These mitigation measures should form part of a Site-specific Environmental Management Plan (EMP) during the operational phase.

10.6. Residual Impacts

The proposed development will have an imperceptible impact on existing surface water flows in the vicinity of the Site, and to groundwater resources either onsite or offsite. The proposed development will have an imperceptible impact to water levels within the existing downgradient wetlands areas.

Therefore, this development will have an imperceptible impact to existing flows currently discharging to Dundalk Bay SAC/ SPA. No groundwater or surface water impacts are expected as a result of current or historic land-use either at the Site or within adjacent lands. The proposed development will not result in flooding in the immediate vicinity or wider area and does not pose an unacceptable onsite flooding risk.

Taking account of the above mitigation measures, the residual impact to groundwater quality and surface water quality, including receiving transitional waters (Dundalk Bay SAC/ SPA), resulting from potential pollution caused by Site activities e.g. plant, fuel/ chemical spillage etc. or associated with cement handling and pouring during the construction phase is slight adverse and short-term.

The residual impact to surface water quality, including receiving transitional waters (Dundalk Bay SAC/ SPA), resulting from excess loadings of suspended solids, via. inadequate onsite soil / storm water management, during the construction phase is slight adverse and short-term, taking account of the above mitigation measures. Any localised dewatering as required in the eastern portion of the Site, during the construction phase, will be temporary and will pass through a temporary onsite attenuation pond prior to discharge to ground; therefore, dewatering will have no residual adverse impact on surface water quality, including receiving transitional waters (Dundalk Bay SAC/ SPA).

In summary anticipated residual adverse impacts on surface water or groundwater will be short-term and slight adverse, given the mitigation measures proposed during the construction phase of the proposed development.

Taking account of the above mitigation measures, the residual impact to surface water quality including receiving transitional waters (Dundalk Bay SAC/ SPA), resulting from occasional / routine Site maintenance works during the operational phase is slight adverse, temporary and is rarely likely to occur.

The residual impact to surface water quality including receiving transitional waters (Dundalk Bay SAC/ SPA), resulting from occasional fuel / oil leaks along the access roads and paved areas during the operational phase is also slight adverse and temporary, taking account of the above mitigation measures.

The residual impact to groundwater and surface water quality including receiving transitional waters (Dundalk Bay SAC/ SPA) resulting from unplanned events during the operational phase (traffic collision, emergency onsite fuel / oil spill, or fire water arising from a property fire), taking account of the above mitigation measures, is imperceptible and temporary, and rarely likely to occur.

The residual impact to surface water quality including receiving transitional waters (Dundalk Bay SAC/ SPA) resulting from an unexpected SuDS failure during the operational phase is slight adverse and temporary and rarely likely to occur, taking account of the above mitigation measures.

No residual impact to groundwater quality or surface water quality has been identified, arising from potential leakages, spill events, equipment failure or structural failure at the proposed wastewater pumping station.

In summary, anticipated residual adverse impacts on surface water or groundwater will be temporary and slight adverse, given the mitigation measures proposed during the operational phase of the proposed development.

Therefore, taking account of proposed mitigation measures, no significant adverse impacts are anticipated to the receiving water environment arising from the proposed development during the construction or operational phases.

On a regional scale, the proposed development will not affect water quality within Dundalk Bay SAC / SPA and will not affect the current '*Moderate'* ecological status of the Inner Dundalk Bay (transitional waterbody) as required under the European Communities Environmental Objectives (Surface Waters) Regulations, 2009 and as amended 2012. Similarly, the proposed development will not affect the current 'Good' status of the Louth Groundwater Body as required under the European Communities Environmental Objectives (Groundwater) Regulations, 2010 and as amended 2016.

10.6.1. Water and Human Health

Potential human health risks associated with impacts to groundwater and/or surface water arising from the proposed development during the operational phase have been identified as follows;

- Risk of direct contact with contaminated storm water (to onsite maintenance workers) via. potential onsite leaks / spills during routine maintenance, or unplanned events (traffic collision, emergency onsite fuel / oil spill, fire water arising from a property fire or SuDS failure).

Taking account of the baseline environmental setting and proposed mitigation measures during both the construction and operational phases, any human health risks to onsite or offsite receptors as a result of groundwater or surface water impacts will be imperceptible. No human health risks associated with long term exposure to contaminants (via. surface water or groundwater pathways) resulting from the proposed development are anticipated.

10.7. Monitoring Requirements

Routine inspections of all silt traps and Class 1 petrol/oil separators within the proposed development should be carried out as part of the proposed Site management plan, on a quarterly basis. During each inspection, all associated equipment should be checked, and a visual inspection of water quality in the final chamber (post treatment) should be carried out.

Surface water sampling should be carried out at the following locations, on an annual basis and in the event of a major onsite fuel / oil spill or fire:

- Infiltration basin (1no. sample);
- Manhole located in north-eastern corner of the Site (treated storm water prior to offsite discharge to the northern channel and Dundalk Bay SAC/ SPA) (1no. sample); and,
- Manhole located in eastern portion of the Site (treated storm water prior to offsite discharge to the eastern channel, wetlands and Dundalk Bay SAC/ SPA) (1no. sample).

All 3no. samples should be analysed for a representative suite of hydrocarbon parameters, and the results evaluated to assess any potential deterioration in storm water quality arising from the Site. Should any potential issues be identified during this review, appropriate actions will be undertaken, in accordance with the detailed Site management plan.

10.8. Reinstatement

All temporary construction compounds are to be removed upon completion of the construction phase. Such areas are to be reinstated in accordance with the landscape architects plan and engineer's drawings. All construction waste and / or scrapped building materials are to be removed from Site on completion of the construction phase. Oil, fuel etc. storage areas are to be decommissioned on completion of the construction phase. Any remaining liquids are to be removed from Site and disposed of at an appropriate licenced facility.