Chapter 6.0

Water and Hydrology

6.0 Water and Hydrology

6.1 Introduction

This chapter has been prepared by Shane Moriarty, BE of MHL Consulting Engineers and makes use of data provided by JBA Consulting who were commissioned to prepare a Groundwater Seepage Assessment Report for the site to inform the drainage design. Shane is a graduate of Cork Institute of Technology having graduated in 2010 with an Honours Bachelor degree in Sustainable Energy Engineering and an Ordinary Bachelor's degree in Civil, Structural and Environmental Engineering. Shane is currently a Design Engineer with MHL having worked in the United States for eight years as an Engineer for a large natural gas distribution company and a Project Manager in the steel industry.

This chapter comprises of an assessment of the impact of the proposed development in Ballyvolane, Cork, on the surrounding surface water and hydrological environments (including flood risk, surface water drainage, foul drainage, and water supply), as well as identifying proposed mitigation measures to minimise any impacts. Groundwater is assessed separately in Chapter 5 of this EIAR Land and Soils.

6.2 Proposed Development

The proposed development is for seven hundred and fifty-three (753) residential units consisting of sixty-seven (67) detached, two hundred and seventy-eight (278) semi-detached, one hundred and eighty-six (186) terraced, sixty-nine (69) duplex, and one hundred and fifty-three (153) apartment units, along with a local centre including a crèche. The proposed development includes a number of open spaces and play areas including parkland/ a greenway.

The site is to be accessed via a proposed Distributor Road (referenced as NE-U-03 in the current Local Area Plan) which will facilitate access to the remainder of the Urban Expansion Area. A number of local access roads to individual neighbourhoods will be constructed. A comprehensive drainage system, incorporating all roads, is included as part of the overall design.

The proposed surface water drainage system is in accordance with Sustainable Urban Drainage Systems (SUDS) principles and divides the site into seventeen (17) drainage catchments; eight (8) catchments being proposed for infiltration, and nine (9) catchments proposed for attenuation utilising Stormtech Underground Chamber systems with a controlled greenfield run-off rate of 5.0 l/s/ha (Qbar for the site). The attenuated systems will ultimately discharge into the stream located on the west side of Ballyhooly Road.

The scheme includes the proposed grounding of an existing 38KV overhead ESB Networks line which will involve crossing of the watercourse to the west of the site. These works have been discussed with Inland Fisheries Ireland (IFI) and agreed with ESB Networks and will be carried out in accordance with their requirements. It is proposed to use directional drilling to avoid impact on the stream, ref**.** Figure 6.1.

6.3 Methodology

The assessment of the potential impact of the proposed development on the surrounding surface water and hydrological environment was carried out according to the methodology specified in the following:

- EIA Directive 2014/52/EU;
- Environmental Protection Agency (EPA) Guidelines on the Information to be Contained in Environmental Impact Statements (2017);

The assessment included the following activities:

- Site inspection/Walkover
- Review of existing topographical survey data
- Review of existing services drawings (Irish Water, Cork County Council, Cork City Council)
- Site Investigation Report including trial pits, infiltration testing, boreholes (Study carried out by Priority Geotech)
- Review of information available on the Environmental Protection Agency (EPA) online mapping service
- Review of information available on the Geological Survey of Ireland (GSI) online mapping service
- Review of Office of Public Works (OPW) National Flood Hazard Mapping and CFRAM Studies (Catchment Flood Risk Assessment and Management Studies)

The surface water and foul water drainage infrastructure and the water supply infrastructure are in accordance with the requirements of Cork City Council and Irish Water (IW) and the Pre-Connection Enquiry IW Application (water demand and foul drainage discharge).

A number of meetings with Cork City Council Drainage Department have taken place to agree the scope and method of the stormwater drainage solution for the proposed development. Tie-in locations to the existing storm sewer and allowable discharge flow rates as well as preferred type of attenuation tanks have been agreed. The proposed system is in accordance with Sustainable Urban Drainage Systems (SUDS) and has been fully agreed with the Senior Drainage Engineer in Cork City Council.

Pre-planning engagement also occurred with Irish Water on the design of foul water infrastructure; a statement of design compliance has been obtained from Irish Water and is included with this planning application.

The following sources of information were also consulted to establish the baseline environment: -

- Geological Survey of Ireland (GSI) online mapping service:
    - Groundwater wells and springs
    - Karst
    - Drinking water protection areas
    - Groundwater vulnerability, recharge and resources
    - Quaternary sediments
    - Bedrock geology

- Ordnance Survey Ireland (OSI) mapping
    - Environmental Protection Agency (EPA) interactive mapping and water quality data:
    - Water quality monitoring locations
    - WFD water body risk
    - WFD water body status
    - River Q values 1971-2016
    - Protected areas

- GeoHive (http://map.geohive.ie/mapviewer.html)
    - Topography
    - Land use
    - Historic land use
- Met Eireann – met.ie
- Office of Public Works (OPW) National Flood Hazard Mapping and CFRAM Studies (Catchment Flood Risk and Management Studies)
- Irish Water and Cork County Council Records
- Priority Geotechnical Ltd., 2017, 2019. Borehole logs.
- MHL & Associates Ltd., 2019. Longview Estates Development – Overall road design plan.
- Fetter, C.W. 2001. Applied Hydrogeology. 4th Edition, Prentice Hall.
- JBA Consulting, 2019. Groundwater Seepage Assessment Report (Appendix 6.1)

6.4 Receiving Environment (Baseline Scenario)

6.4.1 Regional Hydrology and Water Quality

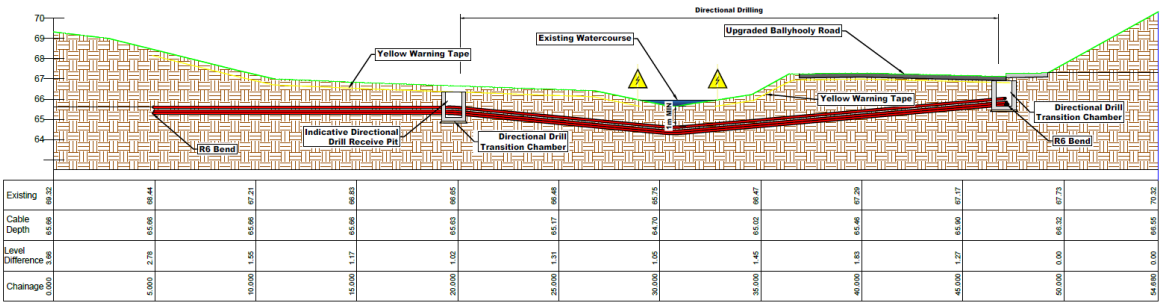
The site lies within Hydrometric Area 19, the EPA Classification for catchments flowing into the River Lee, Cork Harbour and Youghal Bay. The site lies between Water Framework Directive (WFD) River Sub Basins Glennamought Trib Bride_010 and Bride (Cork City) 020 and is within the South Western River Basin District (IESW). The Transitional Water Quality 2010-2012 had the Lee (Cork) Estuary Lower at an Intermediate Status.

6.4.2 Local Hydrology and Water Quality

Watercourses are mapped in Figure 6.2 below. The River Bride lies 1km west of the site and flows south to join the River Lee in Cork. The Lee Estuary is a designated Water Framework Directive (WFD) transitional water body (IE_SW_060_0950), with an ecological status of Moderate, and deemed to be At Risk. There are no water quality Q values in the transitional portion of the River Lee.

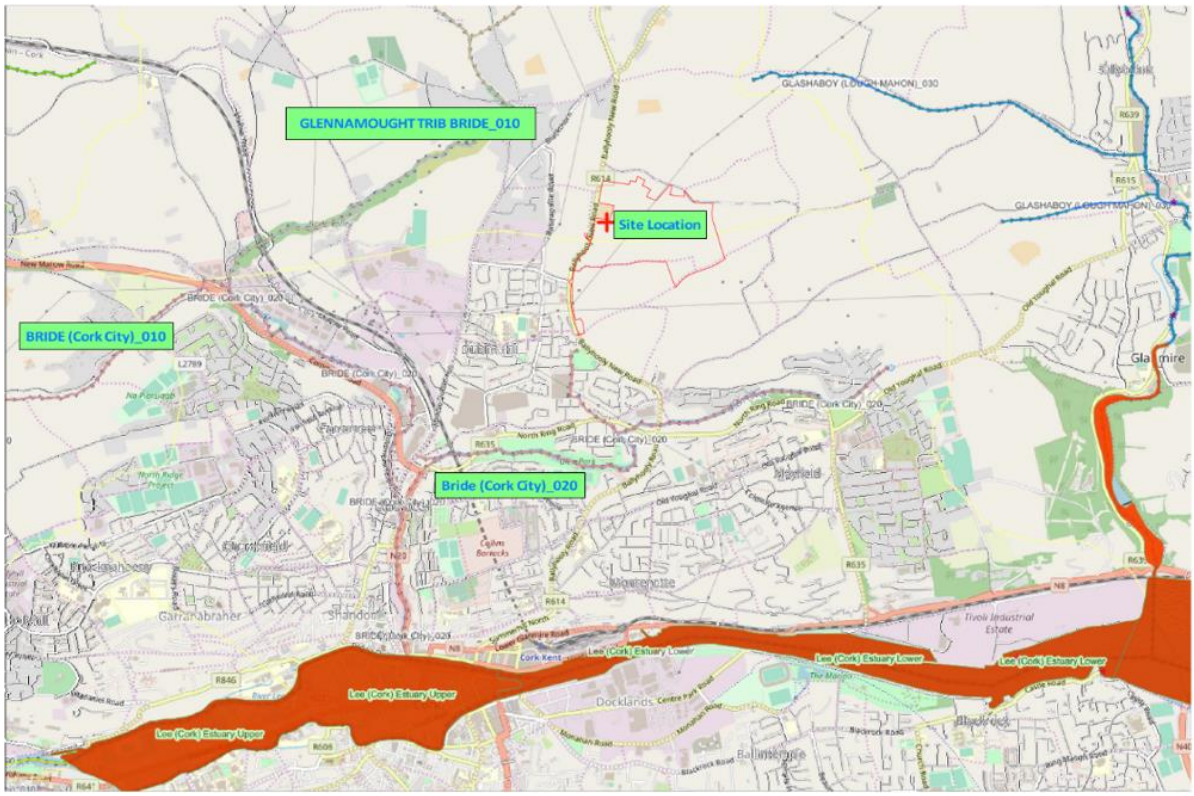
The River Bride is not designated as a river water body and, therefore, does not currently have a WFD status.

Figure 6.1 Section Showing 38KV crossing of stream



Section A-A

Figure 6.2 Site Location and Watercourses



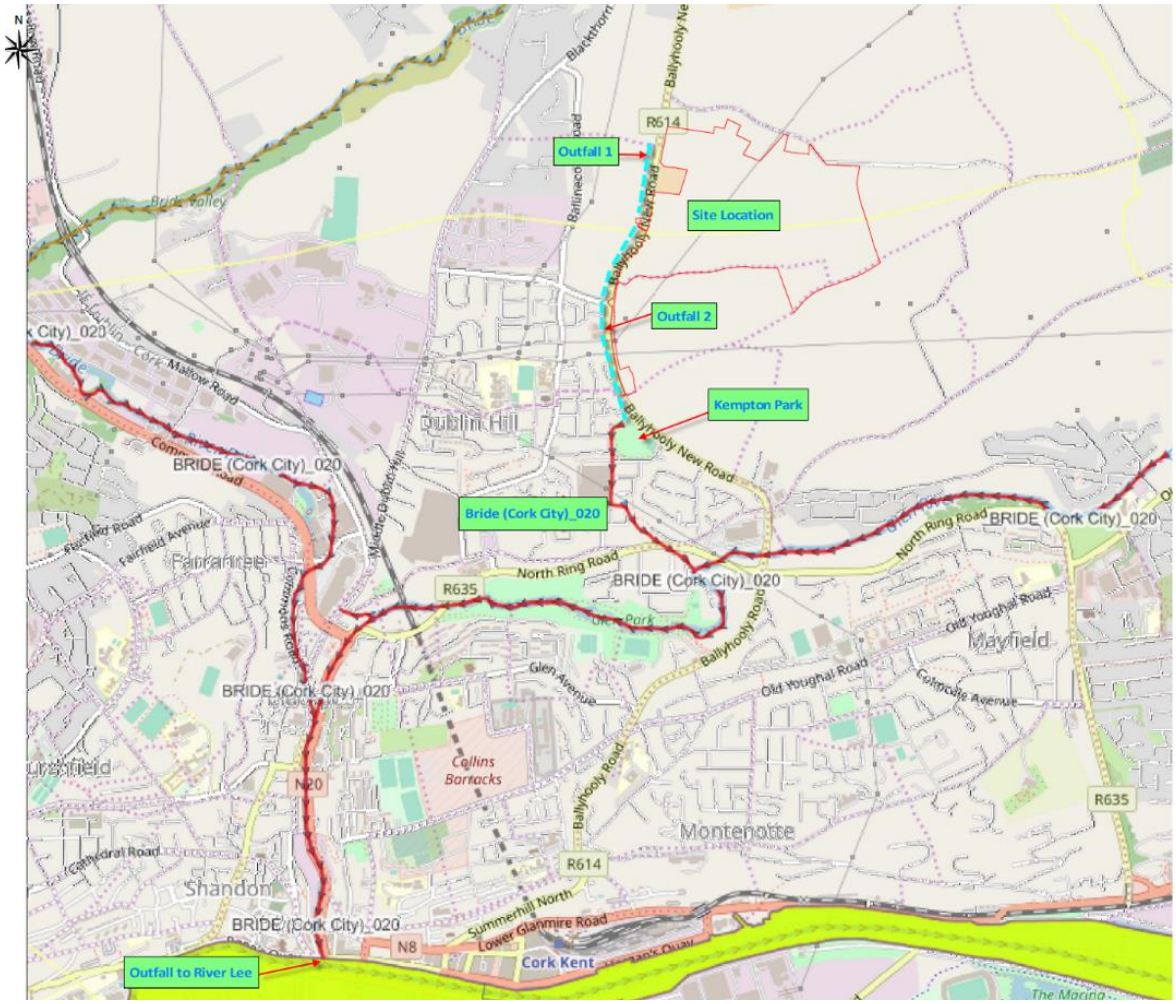
The site rises east to west from the Ballyhooly Road, from approx. 65m OD on the west side, to approx.130m OD in the east. Beyond the site to the west, ground elevations continue to fall in a southerly direction. A survey of the proposed site indicates that elevations vary from: 61m OD in the south west corner of the site; ~75m OD in the north west corner of the site; 125m OD in the north east corner of the site; and ~128m OD in the south east corner of the site.

Currently, an existing watercourse runs north to south on the western side of Ballyhooly Road. This serves as an outfall for surface water falling on the public road and new housing to the north (Dublin Pike[1]). This watercourse is culverted over a portion of its length from the Kilbarry Link Road (Labelled Lower Dublin Hill on the EPA Mapping) south to Kempton Park where it is designated by the EPA as Bride (Cork City) _020, links with the Glen River and ultimately is culverted under the N20 Blackpool Bypass out-falling to the River Lee on Camden Quay, refer to Figure 6.3 Watercourses.

As the site falls naturally from the east to the west, it is proposed to construct two surface water outfalls (Outfall 1 and Outfall 2) to the watercourse running on the western side of Ballyhooly Road. Outfall 1, which is to serve Neighbourhood 4, will facilitate recharging of this tributary during periods of low flow.

[1] Cork County Council Application Ref 17/6781 - Construction of 74 no. residential units comprising 23 no. detached 4-bed dwellings, 44 no. semi-detached dwellings of which 28 no. are 4-bed dwellings and 16 no. are 3-bed dwellings, and 7 no. townhouses of which 6 no. are 3-bed dwellings and 1 no. is a 2-bed dwelling and all associated site development works, foul and storm drainage including attenuation tank, and landscaping and amenity area. The proposed development incorporates 1 no. new access from the L2980 (Dublin Pike) and 1 no. new access from the Ballincollie Road with individual accesses to 13 of the units also from the Ballincollie Road.

Figure 6.3 Watercourse Mapping (*Source EPA*)



The majority of the site will discharge to Outfall 2, specifically located downstream of an existing culvert under the Kilbarry Link Road. Through a combination of attenuation, infiltration and other SuDS measures the controlled flow from the site will be to an agreed Qbar rate of on average 5.0 l/s/ha.

SuDS measures proposed are as follows:

- Discharge Rate to be limited to QBAR for all rainfall events up to and including the 100-year storm event.
- Attenuation Storage to be provided up to the 100-year storm event allowing for 20% climate change.
- Hydrocarbon interceptor and silt chambers to be used upstream of each attenuation tank.
- Provision of infiltration soakpits for areas where the ‘f’ values are suitable.
- Provision of interception storage by means of open swales along road edges.
- Provision of permeable paving in public areas and to form ‘home-zones’.
- Provision of tree-pits at suitable locations along roads and within the Park area.
- Green roofs for Apartment Blocks in Neighbourhood 6.

6.4.3 Hydrogeology

GSI's Groundwater Data Viewer indicates that the site is underlain predominantly by bedrock comprising Devonian mudstones and sandstones and classifies the underlying aquifers as 'Locally Important Aquifer' (Figure 6.4), that is generally only moderately productive in local zones.

Although underlain by till, the hydrogeological setting is deemed to be Extreme permeability subsoil across much of the site due to the thin depth of till. The Geological Survey of Ireland states that groundwater vulnerability is a term used to represent the natural ground characteristics that determine the ease with which groundwater may be contaminated by human activities, (Figure 6.5).

There are no mapped karst features or historic springs in the vicinity of the site.

The residential sites to the north are served by bored wells with GSI data available for some. The average depth of the borehole is recorded as 35m with rock encountered at 4.6m and a Yield cubic metres per day of 27.3. This is classed as a 'Poor' yield but sufficient for domestic use.

Figure 6.4 Aquifer Resources

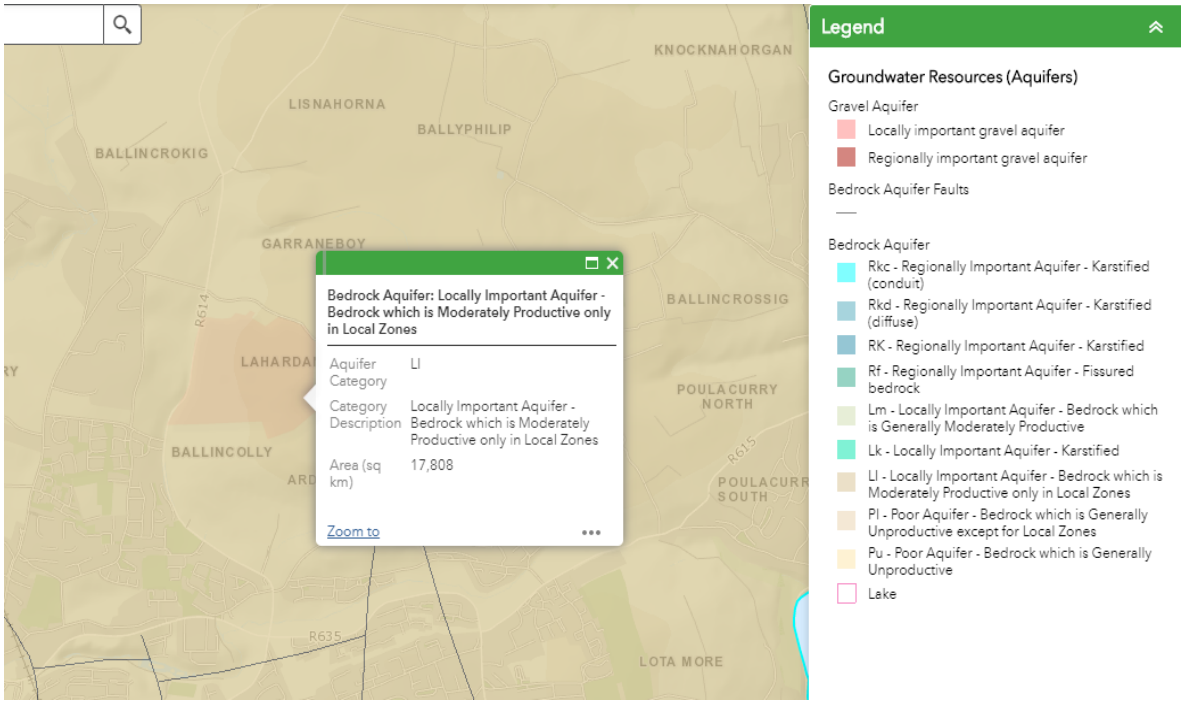
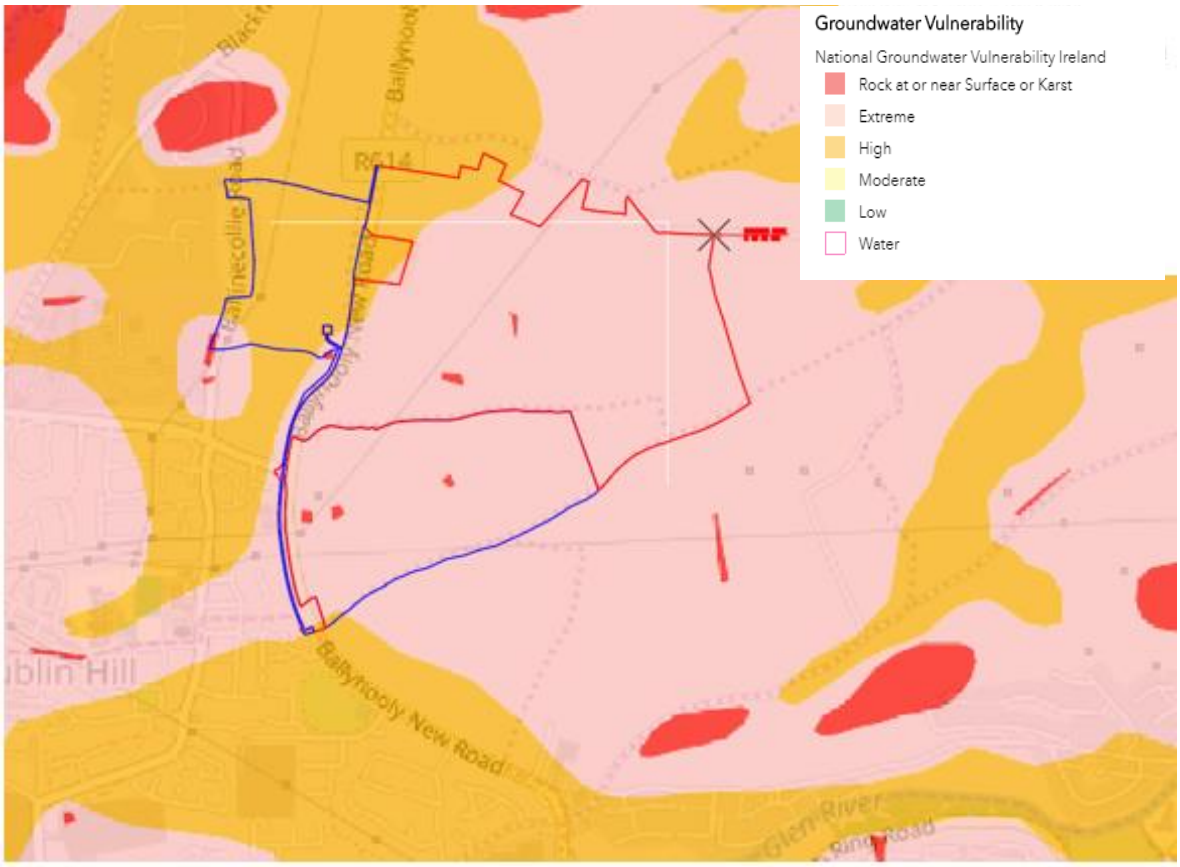


Figure 6.5 Aquifer Vulnerability



The regional groundwater flow direction will mimic that of topography and catchment drainage; flowing south west to the River Bride. Water was struck in the 2019 boreholes at various depths, ranging from 1.0-4.5 m below ground level (Ref. Table 6.1). An approximate groundwater level contour map produced from this initial site investigation data indicates that the overall gradient of the water table mimics that of the site's topography.

Since February 2019, water levels have generally fallen and become steady from March to April, this is in-line with seasonal variations and rainfall occurrences. In the south west part of the site, where most of the areas of cut are proposed, water levels have fallen by ~3m in RC01/RC02 (2019) (Ref. Fig 6.6 for Site Investigation locations), but have risen by 0.5 m in RC03 (2019). In borehole RC03 (2019), the thickest sandy gravelly clay observed across the site (4.3 m) was encountered suggesting that the water table here is a perched one within the superficial deposits. A perched water table is readily recharged by rainfall events thus explaining the rise in the water table level at RC03.

In boreholes RC01/RC02 bedrock was much closer to the ground surface, with the fallen water levels suggesting that the upper bedrock is not particularly water-bearing. Nonetheless, it may be the case that localised perched groundwater lenses exist within the more permeable horizons of the superficial deposits and may have limited lateral extent. In cut areas these groundwater lenses will be removed as part of the excavation and will not add to the quantum of groundwater seepage being taken into the storm sewer network.

The only other borehole where water levels have risen is RC09, located in the north west at the lowest elevation towards the river valley, where water levels are now close to ground surface. In this borehole, no bedrock was encountered, and the water level is likely to be that

perched in permeable gravel deposits.

From Table 6.1 below, those areas which are more likely to experience groundwater seepage include the areas indicated in the south west by boreholes RC01, RC02 and RC04, where the indicative groundwater level may be above the new elevations for the proposed development platforms.

Table 6.1 Rotary Core Summary

Borehole ID (2019)	Ground Level (m OD)	Average GWL (m OD)	Proposed FFL (m OD)
RC01	75.07	71.05	71
RC02	85.61	82.71	81.28
RC03	80.99	77.14	77.25
RC04	97.04	92.91	92.59
RC05	111.05	108	109.12
RC06	65.82	63.02	67.11
RC07	74.03	71.03	75.028
RC08	88.82	87.32	91.64
RC09	70.77	70.09	n/k

Falling head tests were carried out on boreholes RC04/RC05/RC07 (2019) (Priority Geotechnical, 2019) (Appendix 5.1). These boreholes are all screened in the bedrock and so are measuring bedrock groundwater. The permeability values obtained were:

• RC04 - 3.91*10-6 m/s (0.337 m/d);
• RC05 - 4.99*10-6 m/s (0.43 m/d); and
• RC07 - 8.89*10-5 m/s (7.68 m/d).

The average of these values is 3.26*10-5 m/s (2.8 m/d). These are moderate permeability values, typical of mudstone/sandstones with fractured elements. Pure sandstones would typically have a permeability value of an order of magnitude greater.

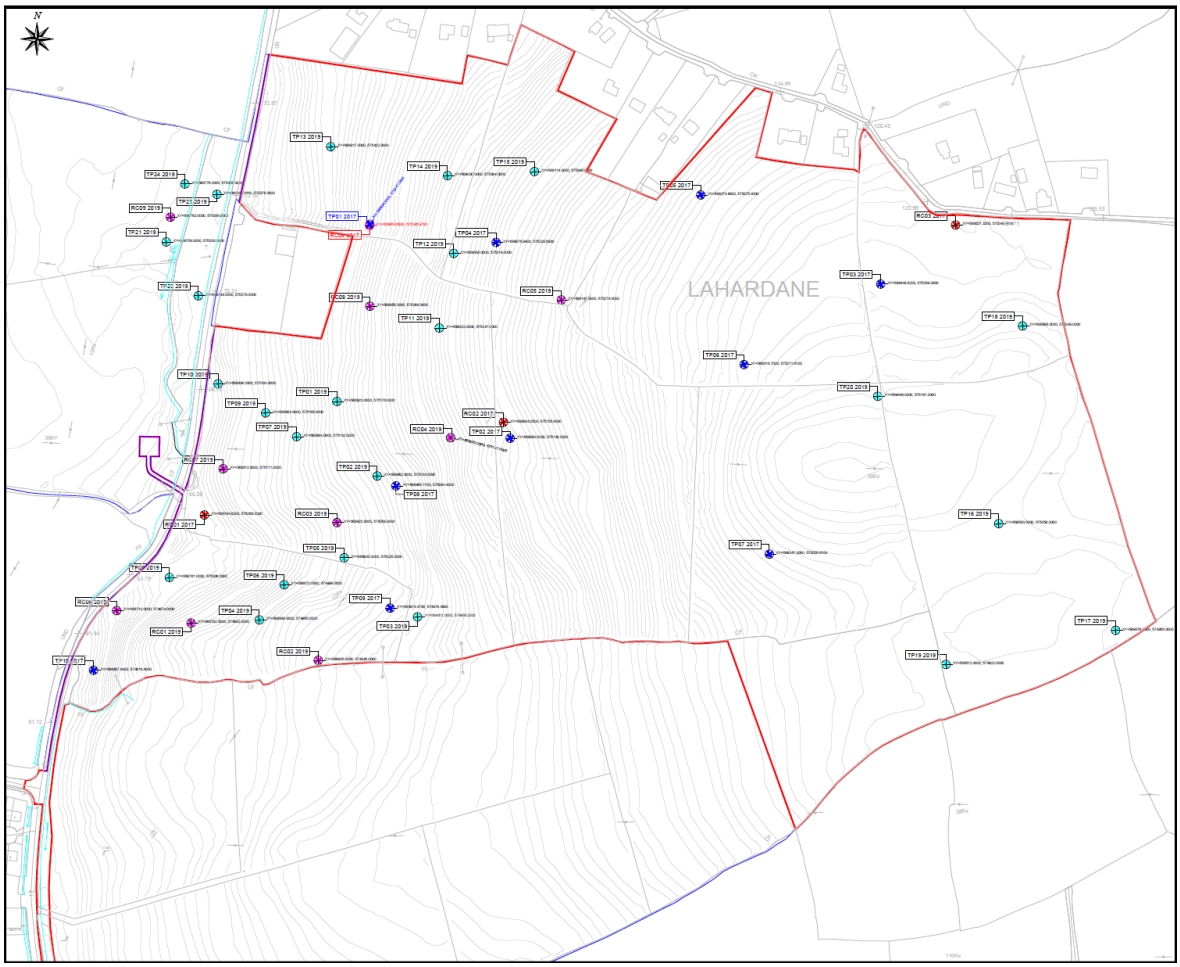
RC04/RC05 boreholes had ~1.5 m of superficial deposits overlying fractured bedrock to ~7m bgl, whilst borehole RC07 was shallower (4.5m) with more superficial deposits (2.5 m) and two sets of fractures were also observed within the underlying bedrock. As such, the order of magnitude difference perhaps relates to the greater thickness of superficial deposits.

Unconsolidated deposits with conductivity values in the order of 10-4 to 10-3 m/d are deemed to be Very Low to Low, and representative of massive clays and silt/clay/sand mixtures. As such, the overall permeability of the upper superficial deposits is likely to reflect

the dominance of the gravelly clay substrate and supports the hypothesis that those deposits which may contain groundwater are not laterally extensive, and support only limited perched aquifers.

JBA Consulting have interpreted the available data and a seepage rate of **0.002 l/s per meter run** of sewer, within cut areas which are below the measured groundwater table, is included for in the storm water drainage design. A drainage drawing indicating the runs that are impacted by groundwater seepage flows is included in the overall application and in Appendix 6.2 of this report.

Figure 6.6 Site investigation locations



The site investigation from 2017 (in appendix 5.1) comprised of ten (10) trial pits which were excavated from 4.0 to 7.0m below ground level (bgl), and four (4) boreholes which were drilled from 5.0 to 8.3m bgl. The 2019 investigation comprised of twenty-four (24) trial pits which were excavated from 1.8 to 3.5 m bgl, and nine (9) boreholes which were drilled between 3.0 and 9.5m bgl.

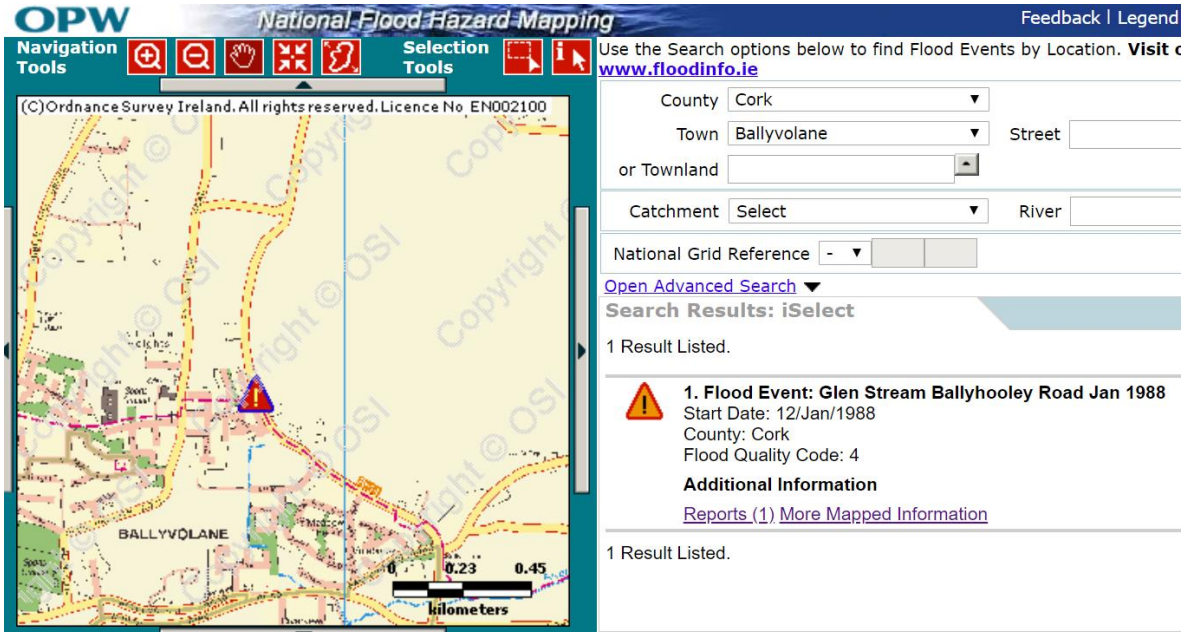
6.4.4 Flood Risk

6.4.4.1 OPW Flood Hazard Mapping

The Office of Public Works (OPW) Flood Hazard Mapping website holds a record of historic flood events. A review of this database indicated that there are no records of flooding incidents at the site of the proposed development.

One report of a past flood event, from January 1988, remarks of flooding having occurred further south on Ballyhooly Road near Mervue Lawn due to a partial blockage of Glen Stream. No other report is recorded in the database for the local area.

Figure 6.7 Flood Event Location - 1988

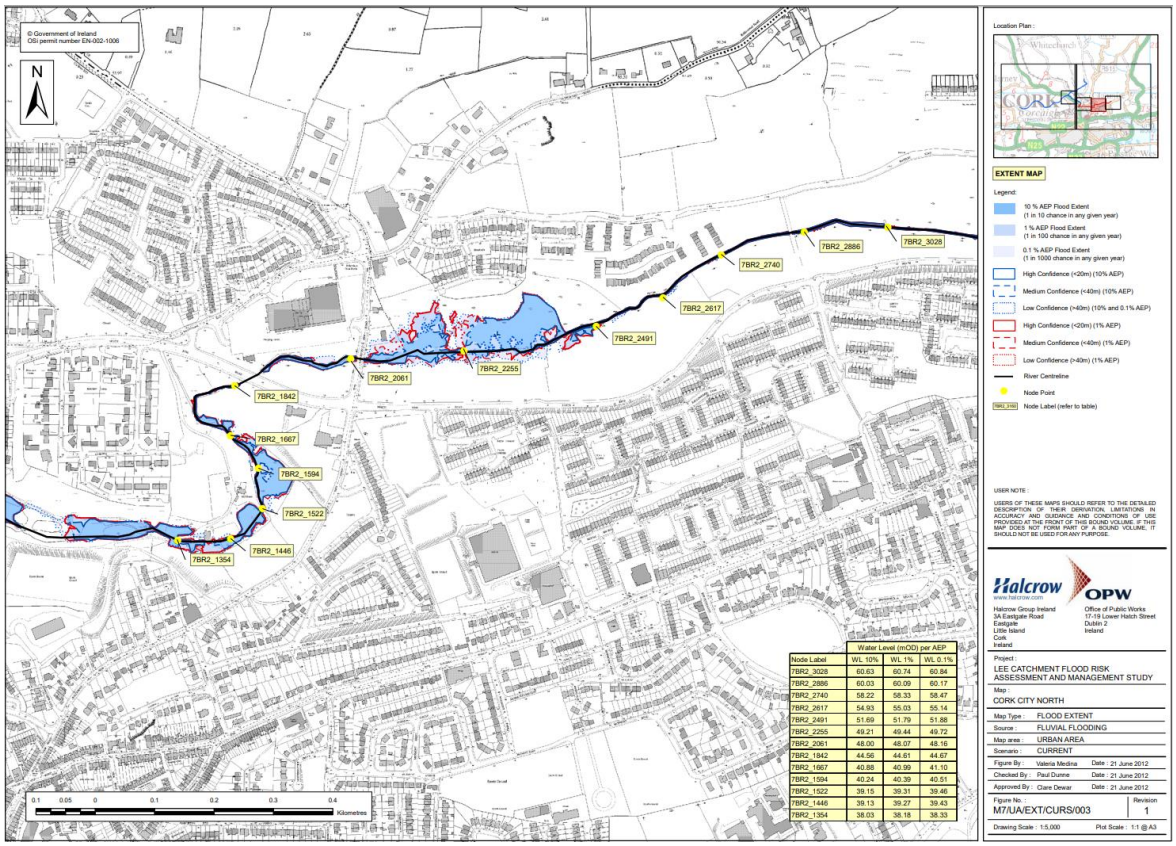


6.4.4.2 Lee CFRAM Study

OPW's Lee CFRAM Study indicates the extent of fluvial flooding in the River Lee catchment area. No fluvial flooding is indicated in the vicinity of the site.

The following Figure shows the location of Fluvial Flooding south of the Fox & Hounds on the Ballyhooly Road approximately 2.0km south of the proposed site.

Figure 6.8 Lee CRFRAM Fluvial Flood Mapping - Ballyvolane



Node Label	Water Level (mOD) per AEP		
	WL 10%	WL 1%	WL 0.1%
7BR2_3028	60.63	60.74	60.84
7BR2_2886	60.03	60.09	60.17
7BR2_2740	58.22	58.33	58.47
7BR2_2617	54.93	55.03	55.14
7BR2_2491	51.69	51.79	51.88
7BR2_2255	49.21	49.44	49.72
7BR2_2061	48.00	48.07	48.16
7BR2_1842	44.56	44.61	44.67
7BR2_1667	40.88	40.99	41.10
7BR2_1594	40.24	40.39	40.51
7BR2_1522	39.15	39.31	39.46
7BR2_1446	39.13	39.27	39.43
7BR2_1354	38.03	38.18	38.33

6.4.5 Existing Foul Drainage

There is an existing 225mm foul sewer running north to south along Ballyhooly Road. This sewer links to the foul sewer serving Brookwood Housing Estate south of the Kilbarry Link Road.

6.4.6 Existing Surface Water Drainage

Existing storm water run-off from the R614 as it passes the site enters the watercourse by way of open drainage cuts through the existing ditch.

The existing greenfield site, the subject of this application, slopes from east to west, draining towards the watercourse on the west side of Ballyhooly Road. A number of land drain connections provide a direct connection from the lands to this watercourse.

6.4.7 Existing Water Supply

As advised by Irish Water, there is presently sufficient capacity in the IW water network to supply the proposed development. The existing public water mains is located approximately 780m to the west of the site in the Dublin Hill area.

6.5 Characteristics of the proposed development

6.5.1 Hydrology

No adverse effects on the hydrology of the surrounding area is anticipated as a result of the proposed development. Proposed surface water attenuation measures within the site will maintain or improve upon the current greenfield runoff rates. SUDS measures are being proposed throughout the site to ensure adequate recharge rates of underlying aquifers are achieved. These include various structures including localised swales and are described on submitted engineering drawings submitted as part of the application package. Further discussion on SUDS is contained in Section 6.5.5.

6.5.2 Hydrogeology

Localised areas of excavation, primarily to the west of the development, will interact with existing groundwater conditions. During construction, the deepest excavations are expected to be required for the installation of the stormwater & wastewater networks (up to 7.0m deep).

Borehole data received indicates the groundwater on site is on average 2.97m below ground level and sits typically within the bedrock.

A groundwater seepage assessment was conducted by JBA Consulting (see Appendix 6.1) to ascertain the potential for seepage from groundwater in areas of excavation. The assessment concluded that groundwater discharge rates may be expected to range from 2-92 m^3/d in the south western part of the site, or 0.00004-0.002 l/s per unit length. The design of the proposed stormwater network for the development uses the higher discharge rate within its design capacity calculations to account for groundwater seepage entering the network at the locations where the proposed drainage will be lower than the recorded groundwater level.

6.5.3 Flood Risk

A Site-Specific Flood Risk Assessment for the proposed development was undertaken by MHL and Associates and accompanies this planning application. It has been carried out in accordance with the requirements of "*The Planning System and Flood Risk Management, Guidelines for Planning Authorities"* and its Technical Appendices.
It finds that the site is not at risk of flooding nor will the propose development create increased flood risk elsewhere.

6.5.4 Foul Drainage

As stated previously in the chapter, the topography of the site generally falls from the east towards the Ballyhooly Road to the west. This allows for the majority of the network to be gravity fed with the exception of phase 5 on the far eastern side of the site.

The following indicates how the foul network will develop as the various phases are complete.

Phase 1: Foul network will be gravity fed and will connect to existing 225mm foul sewer running north to south on Ballyhooly Road.

Phase 2: A new strategic pump station is required along Ballyhooly Road to the south of the residential development. This station is required to accommodate additional phases and future developments in the Urban Expansion Area (UEA). The existing foul network has capacity for Phase 1 only. The applicant has entered into a Project Works Service Agreement (PWSA) with IW for the delivery of this infrastructure.

Phase 3: Additional foul network required for Phase 3 housing will be tied into development foul network and be gravity fed to new Irish Water pumping station.

Phase 4: Additional foul network required for Phase 4 housing will be tied into development foul network installed along Ballyhooly Road and be gravity fed to new Irish Water pumping station.

Phase 5: Due to topography constraints, wastewater from Phase 5 will need to be pumped in order to connect to the overall development foul network. A new pumping station will be constructed bordering Phase 5 to achieve this. The rising main from the pumping station will extend north along the main distributor road through the proposed development before tying into the overall development foul network at a location adjacent to Phase 2. Wastewater will then be gravity fed to the new Irish Water pumping station.

Phase 6: Additional foul network required for Phase 6 will be tied into development foul network and be gravity fed to new Irish Water pumping station.

Based on the development comprising of 753 dwellings and a crèche (103 children, 20 staff), and a local retail area, the total additional foul sewerage flow as a result of the development is summarised as follows:

Table 6.2 Foul Sewerage Flow

Foul Sewerage Flows from Development	
Dry Weather Flow	457.95 cu.m/day or 5.44 l/s
Peak Flow	2,747.70 cu.m/day or 32.64 l/s

Additional foul drainage will be required to service the construction phase of the development. This is subject to the exact quantity of construction workers and their requirements. This water use will be short term in nature.

6.5.5 Surface Water Drainage

A combination of infiltration to the east and stormwater attenuation to the west of the site is proposed to drain the development. Soil infiltration rates to the east of the site were high (Priority Site Investigation Report) while infiltration rates to the west of the site were low. This result informed the design team that SuDS compliant system could be used for surface water collection for the eastern portion of the proposed development while the remainder of the site needed to be positively drained off the site via attenuation tanks. In areas where soil infiltration was not possible due to topography and soil type, SuDS type measures such as the use of permeable paving on internal junctions and open drainage swales have been employed.

To ensure a robust design, attenuation flow rates were restricted to Qbar rates for each of the individual phases. Groundwater seepage rates as stated previously in this chapter were included in the design calculations of the network including the sizing of attenuation tanks.

The use of soakaways for surface water infiltration is proposed in locations generally to the east of the site (in phases 2 & 5).

Surface water quality will be treated through the use of Oil Separators and SUDS measures. For this development, the following SUDS measures are proposed:

- Planted swales running adjacent to roadways where feasible.
- Kilsaran permeable paving at suitable locations throughout the site[2]
- Storm-tech attenuation chambers in conjunction with Hydroflow vortex control to maintain a maximum outflow of 5 l/s/ha (Avg Qbar).
- Infiltration soakaways on the eastern portion of the development where the topography is flatter and infiltration tests were conducive to infiltration.

It is proposed to connect the main surface water discharge to the local network at a location 0.8km south on Ballyhooly Road, Outfall 2. Neighbourhood 4 (Phase 4) will connect at the location shown in Figure 6.3, Outfall 1, and as previously outlined will be used to recharge the existing stream during low flow periods.

The proposed tie-in locations were selected following discussions with Cork City Council. The proposed outlets into the existing watercourse will incorporate outfall header walls to mitigate riverbed erosion; no works will occur within the river-bed.

6.5.6 Water Supply

It is proposed to connect the sites water supply to an existing pipeline present in the Dublin Hill area approximately 780m to the west of the site boundary. The extension of this watermain has been agreed with Irish Water and will comprise a 250mm HDPE watermain.

Based on the development comprising of 753 dwellings and a crèche (103 children, 20 staff) and a local retail area including a Doctors Surgery, the total additional water supply flow as a result of the development are summarised as follows:

Table 6.3 Water Supply Flow

Water Supply Flow from Development	
Average Flow	388.59 cu.m/day or 4.67 l/s
Peak Flow	1,942.95 cu.m/day or 23.35 l/s

[2] In areas that are not to be taken in charge, shared / Kilsaran permeable paving, can be provided subject to any consent. Additional such paving can be provided subject to Council agreement in areas that are to be taken in charge; these can be accommodated in detailed design. This would reduce the size of ground water attenuation and soakaways and services infrastructure.

Water supply will be required to service the construction phase of the development. This is subject to the exact quantity of construction workers and their requirements. This water use will be short term in nature.

A design acceptance has been received from Irish Water pertaining to the proposed watermain serving the entire scheme.

6.6 Potential Impact of the Proposed Development

6.6.1 Construction Phase

Potential impacts during the construction phase may include the following:

- Surface water runoff during the construction phase may contain increased silt levels (e.g. runoff across areas stripped of topsoil) or become polluted by construction activities. The discharge into nearby water bodies has the potential to cause pollution.
- Discharge of rainwater pumped from excavations may also contain increased silt levels (potential impact on existing hydrology e.g. discharge to existing water drainage infrastructure).
- Accidental spills and leaks associated with storage of oils and fuels, leaks from construction machinery and vehicles, and spillage during refuelling and maintenance.
- Concrete runoff, particularly discharge of wash water from concrete trucks (potential impact on existing hydrology e.g. infiltration to ground).
- Discharge of vehicle wheel wash water (potential impact on existing hydrology e.g. discharge to existing/proposed surface water drainage infrastructure).
- Improper discharge of foul drainage from contractor's compound (impact on existing hydrology e.g. cross-contamination of existing surface water drainage).
- Works associated with the crossing of the existing watercourse as part of the diversion of the 38KV Overhead ESB Line
- The potential impacts from the construction phase on surface water is likely to be short term and significant without mitigation measures in place.

6.6.2 Operational Phase

Potential operational phase impacts are noted below:

- Increased impermeable surface area will reduce local ground water recharge and potentially increase surface water runoff (note, the scheme has been designed to attenuate to 5 l/s/ha on average which is equal to or less than greenfield run-off rates for each of the specific neighbourhoods).
- Accidental hydrocarbon leaks and subsequent discharge into piped surface water drainage network (e.g. along roads and in driveway areas – likely to be small scale in nature). The is deemed to be an imperceptible temporary adverse impact.
- Increased discharge to foul drainage network (Daily Foul Discharge Volume = 342 cu.m). Irish Water have confirmed that the proposed pump station has been designed to cater for all future flows in the area.
- Increased potable water consumption (Average Daily Domestic Demand = 381 cu.m). Irish Water have confirmed that with the extension of the 250mm HDPE watermain all future potable water requirements are met.
- It is proposed to facilitate existing residential dwellings, on the local road to the north of the site, to tap into the foul sewer network being constructed should they desire once the development is complete. This will see a series of percolation areas being

decommissioned / bypassed in favour of a conventional mains service. This would have a positive impact on subsurface ground conditions.

6.7 Mitigation Measures

6.7.1 Construction Phase

The following measures are proposed during the construction phase to mitigate against potential risks to the surrounding hydrological environment:

- The site-specific Construction and Environment Management Plan (CEMP) will be developed by the appointed works contractor and implemented during the construction phase. Site inductions will include reference to the procedures and best practice as outlined in this CEMP. Construction will occur on a phased basis and earthworks management will be carried out by contractors in accordance with best practice to prevent surface and ground water impacts.
- The proposed grounding of the 38KV ESB overhead line and subsequent crossing of the watercourse to the west will be carried out in accordance with ESB Networks requirements and will include directional drilling to avoid impact with the stream. All necessary measures including protective bunds, temporary bridges and silt fences will be provided by the appointed contractor. Inland Fisheries Ireland will be consulted before any of these works are carried out on-site.
- Surface water runoff from areas stripped of topsoil and surface water collected in excavations will be directed to on-site settlement ponds where measures will be implemented to capture and treat sediment laden runoff prior to discharge of surface water at a controlled rate, to the existing watercourse. It is anticipated that a suitably experienced Earthworks Contractor will be appointed to carry out the bulk excavations on the site, with all required measures being put in place to the satisfaction of the Local Authority.
- Weather conditions and typical seasonal weather variations will be accounted for when planning the stripping of topsoil and excavations with an objective of minimising soil erosion and protecting the excavated subsoil and rock for re-use on site.
- All spoil/earthworks storage areas (plans of which are included) will be located on well-vegetated lands and will be surrounded by secure silt fencing. It is proposed to use the lands reserved for the school campus as stock-pile areas, in conjunction with existing ditches to create the necessary barriers and sediment ponds to ensure silt run-off is fully controlled.
- If de-watering of earthworks materials is required the resulting water will be pumped out onto well-vegetated areas away from springs, drains or rock outcrops and allowed to run-off into formed settlement ponds prior to discharge to the main drainage system.
- In order to mitigate against spillages contaminating the surrounding surface water and hydrogeological environments, all oils, fuels, paints, and other chemicals will be stored in secure bunded hardstand areas. Refuelling and servicing of construction machinery will take place in a designated hardstand area which is also remote from any surface water inlets or outlets (where not possible to carry out such activities off site). Any hardstand areas will be isolated from main drainage runs and will include petrol interceptors prior to discharge.
- Concrete batching will take place off site and wash down and wash out of concrete trucks will take place off site (at authorised concrete batching plant in full compliance with relevant planning and environmental consents).
- Discharge from any vehicle wheel wash areas will be directed to on-site settlement ponds and will pass through a hydrocarbon interceptor prior to discharge.

- The construction compound will include adequate staff welfare facilities including foul drainage and potable water supply. Foul drainage discharge from the construction compound will be tankered off-site to a licensed facility if necessary, until a connection to the public foul drainage network has been established.
- The construction compound's potable water supply will be protected from contamination by any construction activities or materials in the instance that a temporary well has to be sunk.
- Spill Kits to be kept in designated areas.

6.7.2 Operational Phase

The following mitigative/reductive measures are proposed for the operational phase of the scheme:

- The proposed road gradients, road levels, and dwelling finished floor levels (FFL) have been designed to ensure the concentration of surface water run-off in any one location is avoided.

- Each drainage area has been assessed independently of others in terms of allowable run-off rates. SuDS measures are proposed for each neighbourhood, which have not been included for in the sizing of the storm sewer network, reducing the discharge rate to below greenfield run-off rates (QBar). These proposed interception measures will ensure that the initial 5mm of rainfall is prevented from discharging to the storm network, thereby ensuring the water quality of the receiving watercourse to the west is preserved.

- Surface water runoff on the western side of the site will be attenuated to greenfield runoff rates (Qbar) as agreed with the Drainage Department of Cork City Council.

- SuDS measures in this location will include the use of permeable paving at traffic calmed junctions and the use of planted swales where possible along road edges to provide a primary cleaning of run-off before entering the storm network. Measures will also include soakpits in rear gardens in parts of the development and water butts for each unit.

- Surface water discharge rates will be controlled by a Hydrobrake type vortex control device or similar approved, in conjunction with below ground Stormtech attenuation chamber storage, or similar approved.

- Surface water runoff to the eastern side of the site will be routed to buried Stormtech chambers for infiltration into the existing subsoil in-line with site investigation results. This will facilitate the recharge of aquifers in the area whilst limiting the run-off from the overall site to less than the current rate.

- A contract will be entered into with a suitably qualified contractor for the maintenance of the attenuation system including Hydro-brake and the installed hydrocarbon interceptors.

- The proposed pumping stations can provide for back-up generators and in the case of the Ballyhooly Road pumping station accommodate connection to the pre-existing network in the case of an operational failure.

The following methodologies are being implemented as part of the SuDS surface water treatment approach:

- The use of on-site infiltration where feasible (eastern side of the scheme).
- Permeable Paving at suitable locations in and around the retail/crèche area.
- Permeable Paving to be used for junction treatments and tied into storm sewer network in all locations.
- Planted swales along access roads where practical (including tree-pits).
- Attenuation chambers sized to 30 and 100 year return period storms.
- Installation of Hydrobrake vortex control system (limiting surface water discharge from the site to Qbar (5 l/s/ha)).
- Fuel/oil separators will be sized and installed in accordance with permitted discharge from the site for the various phases.
- Attenuation storage design allows for 20% growth of rainfall intensity due to climate change.
- Green Roof attenuation storage provided for in Apartments in neighbourhood 6.

No specific mitigation measures are proposed in relation to foul drainage however, all new foul drainage lines will be pressure tested and subject to a CCTV survey in order to identify any possible defects prior to being made operational. All testing will be carried out as per the requirements of Irish Water and will be subject to periodic spot-checks by the Irish Water appointed site engineer.

6.8 Predicted Impact of the Proposed Development

6.8.1 'Do-nothing' Scenario

There are no predicted impacts should the proposed development not proceed.

6.8.2 'Worst-Case' Scenario

The accidental loss of fuel that could impact on the water quality via the soil if undetected. Given the nature of the proposed development any spillage would likely be minor to moderate with a short-term duration and impact.

Works near the stream (undergrounding of the 38KV ESB Overhead) resulting in contamination of the stream (likely to be short term and significant without mitigation)

6.8.3 Construction Phase

Implementation of the measures outlined above will ensure that the potential impacts of the proposed development on water and the hydrological environment do not occur during the construction phase.

6.8.4 Operational Phase

There are no predicted residual impacts on the water and hydrological environment during the operational phase. The proposed surface water drainage design is in accordance with the requirements of Cork City Council and SuDS methodologies have been implemented as part of mitigation measures proposed.

The use of on-site infiltration will ensure that the recharge of underlying aquifers continues to occur. Seepage rates from areas of cut have been included in the design of the storm sewer network and will be attenuated prior to discharge to the watercourse.

As previously outlined a maintenance contract will be entered into with a suitably qualified contractor for the on-going maintenance and silt removal for all attenuation tank systems on-site.

6.8.5 Residual Impact of the Proposed Development

An overall assessment of the impacts considering the proposed mitigation measures set out in this chapter concludes that all of the potential impacts both during the construction and operational stages of the proposed development are considered to be of neutral significance and impact and will not result in any adverse residual impacts.

6.8.6 Risks to Human Health

During the course of construction, the cross-contamination of the potable drinking water supply to the construction compound has potential to occur if an on-site borehole is used prior to the public supply coming online. The mitigation measures previously proposed in this chapter will reduce the likelihood and impact of any such occurrences.

6.9 Monitoring

Proposed monitoring during the construction phase in relation to the water and hydrological environment are as follows:

- Adherence to the Construction Environmental Management Plan (CEMP).
- Inspection of fuel / oil storage areas and continued maintenance by a suitably qualified sub-contractor.
- Monitoring cleanliness of adjacent road network, implementation of dust suppression and vehicle wheel wash facilities.
- Monitoring sediment control measures (sediment retention ponds, surface water inlet protection etc.) to be carried out by the appointed Environmental Engineer.
- Monitoring of discharge from sediment retention ponds (e.g. pH, sediment content).

During the operational phase an inspection and maintenance contract will be implemented in relation to the proposed Class 1 full retention fuel / oil separators. These will form part of the “taken in charge” infrastructure. The Pumping Stations will be taken in charge by Irish Water and operational control of those will rest with Irish Water.

6.10 Reinstatement

Oil, fuel, etc. storage areas will be decommissioned on completion of the construction phases. Any remaining liquids will be removed from site and disposed of at an appropriate licensed facility.

All sediment control measures (e.g. sediment retention ponds) will be decommissioned on completion of the construction phase. Such areas will be reinstated in accordance with the landscape architects plan and at the direction of the Site Engineer.

6.11 Interactions and Potential Cumulative Impacts

6.11.1 Interactions

Surface water runoff during the construction phase may lead to soil erosion and contain increased silt levels or become polluted by construction activities.

Increased impermeable surface area may reduce the local ground water recharge and potentially increase surface water runoff.

6.11.2 Potential Cumulative Impacts

The cumulative residual and operational impacts of the proposed development and the following projects have been assessed:

- Cork County Council planning ref. 19/5326 for the construction of 20 no. residential units and all ancillary site works at Banduff Road approved in August 2019.

- Cork County Council planning ref. 17/6781 for the construction of 74 no. residential units at Dublin Pike, Ballincrokig approved in April 2018.

- Cork County Council planning ref. 16/5477 for development comprising the demolition of 1 no. building accommodating an existing Lidl Licenced Discount Foodstore (1,749 sq m Gross Floor Area with 1,391 sq m Net Retail Sales Area) and a disused retail unit formerly occupied by the New Furniture Centre (970 sq m Gross Floor Area with 776 sq m Net Retail Sales Area), and the construction of a new mono-pitched Licenced Discount Foodstore with ancillary infrastructure and associated site development works at Ballyhooly Road approved in August 2016.

- The Ballyvolane Strategic Transport Corridor Project: North Ring Road to Ballincolly. Design of the scheme is being advanced by a team of consultants instructed by Cork City Council supported by the National Transport Authority. The detailed design will be the subject of a Part 8 planning application by Cork City Council.

- The development of the remainder of the Ballyvolane Urban Expansion Area. The lands have been designated for development through the Local Area Plan land use zonings. Infrastructure proposed as part of this planning application i.e. the distributor road and waste-water infrastructure will help to unlock other lands within the expansion area for development. These lands will be subject to separate planning applications in the future.

Cumulatively, these other proposals will not affect the hydrological criteria ratings of the proposed development if best practice construction guidelines and the planning conditions imposed are complied with. Therefore the significance of the impact of the proposed development taking into account the construction and operational stages is imperceptible and not considered to change when considered with other projects

Proposed surface water drainage infrastructure has been designed in accordance with Cork City Council and SuDS. As such, no potential cumulative impacts are anticipated in relation to surface water drainage or flooding. Any future development in the surrounding area would also need to incorporate SuDS guidelines to ensure no future cumulative impacts.

Irish Water have indicated that the existing foul network is capable of meeting the requirements of phase 1, with a new foul pumping station proposed along Ballyhooly Rd. to serve the remainder of the development and future expansions. A Project Works Service Agreement (PWSA) has been entered into between the applicant and Irish Water for the provision of this necessary infrastructure. This will be supported by a Major Connections Agreement by Longview Estates Ltd.

It is envisaged that future IW services to zoned lands, that are both adjoining and adjacent to the Longview Estates proposal will enter into pre connection discussions with Irish Water which will provide for their connection to existing, and new network extensions that are proposed, depending on location.

There are two pumping stations ("PS") proposed as part of the development. A smaller pumping station is located internally within the site adjacent to Phase 5. This PS is designed to IW Spec and will be delivered by / for them to take in change.

The PS adjacent to the Ballyhooly Road is a significant infrastructural item that will support IW's need to service the wider UEA as it arises and other lands in this Northern Suburbs of Cork City. This will be delivered under the consent by IW contractors. It will, via the initial chamber (three are included on the layout), accommodate the Longview proposal and some limited additional inflows from an already consented and under construction consent (App Ref 17/6781 - Construction of 74 no. residential units) further north.

In detail, Irish Water has entered into a Project Works Services Agreement with Longview Estates to service the area by way of PS to be included on their lands in Lahardane, Ballyhooly Road, Cork. The PS will be served by rising mains to be located in the public road and / or public lands before accessing a discharge point to the existing foul network on the R635 adjacent to the R615 / Old Youghal Rd.

This rising main will follow the Ballyhooly Road south from the PS and thereafter along the R635 or otherwise as agreed with Cork City Council though adjoining public lands. The PS and services upgrades to the area will service existing and proposed development allowing for the improved management of foul services as network loadings develop over the coming years with additional projected development.

Figure 6.9 overleaf illustrates Irish Water / Atkins layout solution regarding mains works.

With respect to the details of the network extensions, including layout, design details and the timelines involved relative to the construction, the IW Confirmation of Feasibility initially issued to the applicant and provided to the Board at Pre App stage stated that the conceptual design for the foul and water services provisions had been identified[1]. The phasing proposed for the proposed development also considers the Infrastructure delivery.

In summary, with respect to IW infrastructure, the proposal provides for the following:

- Phase 1 will be accommodated in the current infrastructure with watermain extension.

- Phase 2 onwards will require the Pumping Station and IW Infrastructure to be in place. IW will deliver the required infrastructure by 2022 and subject to the applicant executing a Major Connection Agreement.

[1] Ref IW letter of 18th April.

- The Pumping Station proposed on Ballyhooly Road caters for three potential phases of development; it can be delivered in one phase or a series of phases. With three storage chambers. Chamber 1 would be an initial 1000 units. This would include the proposal and would likely cater for an additional project under construction[2]. Chamber 2 would be to provide for 3000 + units and Chamber 3 would provide for wider expansion of the network in due course to accommodate areas such as Monard if required and subject to consents.

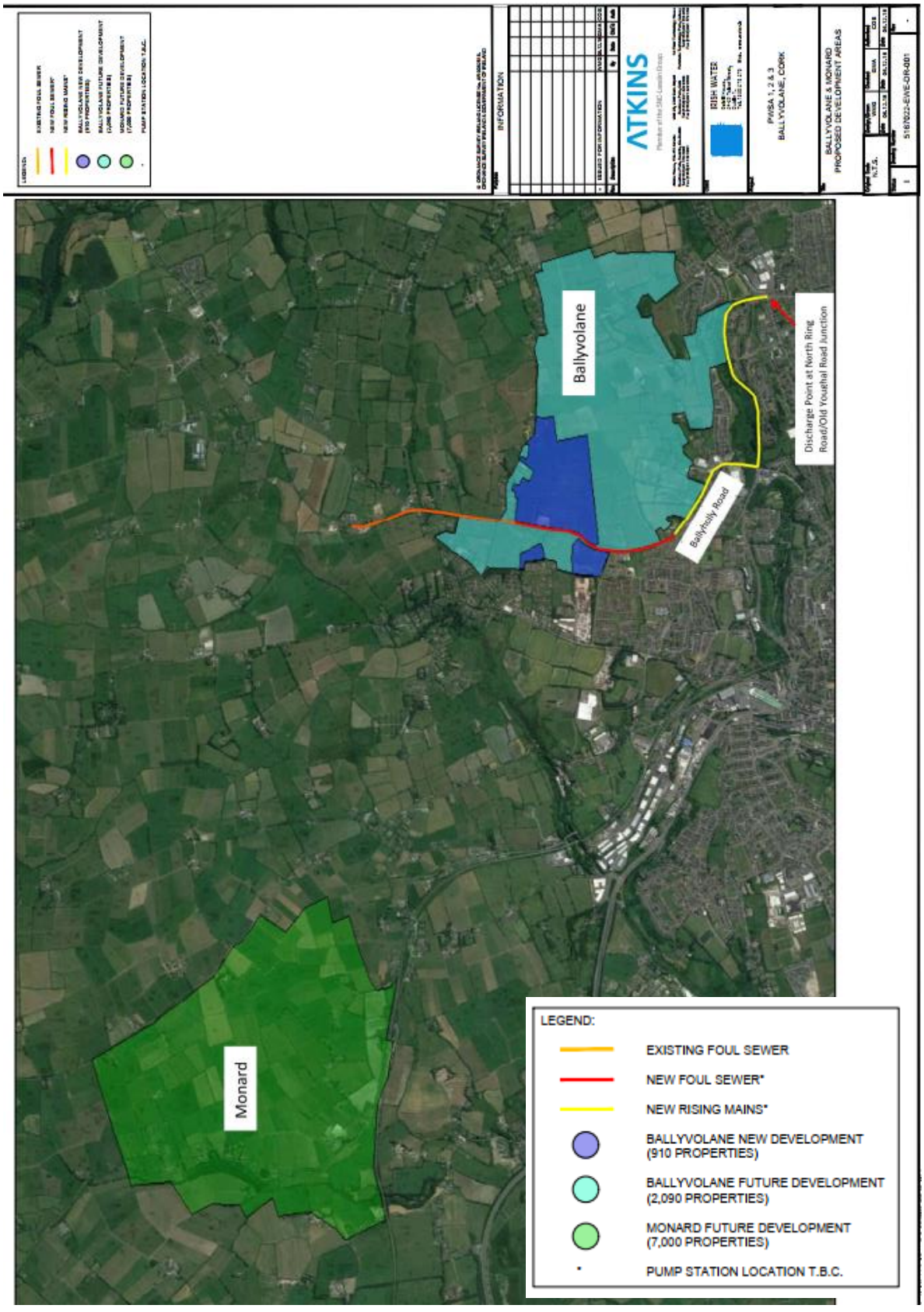
- The agreed PWSA included the delivery by IW, to service this application and potentially adjacent lands, of rising mains from the proposed Ballyhooly Rd Pumping Station, south along the Ballyhooly Rd to the junction with the North Ring Road at which point it will be routed east along the North Ring Road to a termination point at the Old Youghal Rd Junction. The overall rising mains will include 2400 m of 150mm rising main from the Pumping Station to the Old Youghal Road Junction; a parallel length from the pumping station of 800 m of 250 mm diameter watermain to allow connection / network management by IW including potential connect to existing interceptor sewers; or further extension as required. The rising mains will be routed in public roads (or public lands if available). 250 mm dia foul sewer connecting the housing scheme has been incorporated into the scheme drainage to connect to the Pumping Station proposed on Ballyhooly Road for all phases of housing delivery. This will also capture existing flows from the current 225 mm gravity foul to the north.

- Water supply will be delivered on a phased basis but will require the extension of the services by approx. 780 m; from a point to the west on Dublin Hill by way of a 250 mm main extension.

- The initial phase of this housing proposal can be connected to, and serviced by, the existing foul infrastructure in the area. The proposed PS will serve the overall proposal and has capacity to serve the residual Ballyvolane UEA lands subject to connection. The PS can be sized, with the land take offered, so as to form a central part of IW's delivery of serviced lands throughout the Northern City fringes.

[2] **App Ref 17/6781** - Construction of 74 no. residential units comprising 23 no. detached 4-bed dwellings, 44 no. semi-detached dwellings of which 28 no. are 4-bed dwellings and 16 no. are 3-bed dwellings, and 7 no. townhouses of which 6 no. are 3-bed dwellings and 1 no. is a 2-bed dwelling and all associated site development works, foul and storm drainage including attenuation tank, and landscaping and amenity area. The proposed development incorporates 1 no. new access from the L2980 (Dublin Pike) and 1 no. new access from the Ballincollie Road with individual accesses to 13 of the units also from the Ballincollie Road.

Figure 6.9 IW Services Planning Considerations



6.12 References

- Geological Survey of Ireland (GSI) online mapping service:
    - ▪ Groundwater wells and springs
    - ▪ Karst
    - ▪ Drinking water protection areas
    - ▪ Groundwater vulnerability, recharge and resources
    - ▪ Quaternary sediments
    - ▪ Bedrock geology

- Ordnance Survey Ireland (OSI) mapping
    - ▪ Environmental Protection Agency (EPA) interactive mapping and water quality data:
    - ▪ Water quality monitoring locations
    - ▪ WFD water body risk
    - ▪ WFD water body status
    - ▪ River Q values 1971-2016
    - ▪ Protected areas

- GeoHive (http://map.geohive.ie/mapviewer.html)
    - ▪ Topography
    - ▪ Land use
    - ▪ Historic land use

- Met Eireann – met.ie

- Office of Public Works (OPW) National Flood Hazard Mapping and CFRAM Studies (Catchment Flood Risk and Management Studies)
- Irish Water and Cork County Council Records
- Priority Geotechnical Ltd., 2017, 2019. Borehole logs.
- MHL & Associates Ltd., 2019. Longview Estates Development – Overall road design plan.
- Fetter, C.W. 2001. Applied Hydrogeology. 4th Edition, Prentice Hall.
- JBA Consulting, 2019. Groundwater Seepage Assessment Report