11. Water

11.1 Introduction

This section scopes the effects of the proposed development on the hydrological environment including water quality, quantity, hydromorphological and flood risk during both the construction and operational phases. A high level overview of the baseline conditions is included, together with the proposed methodology and a scope of the work likely to be required to undertake a detailed assessment of the impact of the proposed development on the water environment as part of the EIA.

A hydrodynamic and water quality model of Lough Derg and Parteen Basin is under construction and will be used to simulate the abstraction of water from the lake body. Model simulations will rely upon and be informed by the data attained through the monitoring work ongoing on Lough Derg and Parteen Basin.

11.1.1 Policy & Plan Context

The EU Water Framework Directive (2000/60/EC) established a framework for the protection of both surface and ground waters. Transposing legislation (S.I. 792 of 2009, European Communities Environmental Objective (Surface Water) Regulations 2009 as amended) outlines the water protection and water management measures required in Ireland to maintain high status of waters where it exists, prevent any deterioration in existing water status and achieve at least 'good' status for all waters. A number of River Basin Management Plans (RBMPs) were developed to address the requirements of the Water Framework Directive (WFD). The RBMPs of relevance to this assessment (the Shannon RBMP 2009-2015 and the Eastern RBMP 2009-2015) was adopted in 2009 and includes a programme of measures required to facilitate the achievement of the WFD objectives, see WFD objectives in Appendix A-1. This programme of measures included full implementation of existing legislation including the Water Pollution Acts, Water Services Act, Bathing Water Quality Regulations, IPPC Regulations, Urban Wastewater Treatment Regulations, the Foreshore Acts and the Birds and Habitats Directives (particularly the Appropriate Assessment process).

The second cycle of the river basin management planning is currently underway and the second consolidated RBMP[5] is currently under development and is due to be published by the end of 2017. The Draft Plan is due for consultation in Q4 2016. The proposed development will need to take account of the requirement of the next cycle of the RBMP.

Other important pieces of EU and national legislation pertaining to the hydrological environment include:

- S.I. 722 of 2003, European Communities (Water Policy) Regulations, as amended;
- S.I. 792 of 2009, European Communities Environmental Objective (Surface Water) Regulations 2009 as amended;
- S.I. 350 of 2014, European Union (Water Policy) Regulations 2014;
- The EU Floods Directive 2007/60/EC;
- S.I. 122 of 2010 European Communities (Assessment and Management of Flood Risks) Regulations; and
- S.I. 81 of 1988, European Community Environmental (Quality of Surface Water Intended for Human Consumption) Regulations 1984 as amended.

11.1.2 Study Area

This proposed project covers an extensive study area that extends from Parteen Basin on the River Shannon, directly south of Lough Derg in County Tipperary, through the midland counties of Offaly and Kildare, and terminating in the vicinity of Peamount Reservoir and environs in South County Dublin. The extent of the

[5] The Eastern, South Eastern, South Western, Western and Shannon River Basin Districts will be merged to form one national River Basin District.

project, particularly the c.170km treated water pipeline component, requires crossing a significant section of the country.

The study area lies within the Shannon and the Eastern River Basin Districts (RBDs). The key receptors are Lough Derg/Parteen Basin where the proposed abstraction will be located and watercourses crossed by the pipeline corridor.

The preferred abstraction point is as detailed in Section 1.4 above however it should be noted that the study of potential impacts on the surface water environment will focus on the entirety of Lough Derg/Parteen Basin including watercourses feeding Lough Derg/Parteen Basin and watercourses downstream in relation to the proposed abstraction regime.

The study area also includes watercourse crossings up to 200m from the proposed development pipeline corridor landtake boundary, including both upstream and downstream extents of surface waters receptors in the vicinity of this. This will be extended as required dependent upon professional judgement.

Table 11-1 details the WFD waterbodies that connect directly with Lough Derg/Parteen Basin, their type, WFD code and WFD status.

Waterbody Name	Waterbody Type	EU WFD Code	WFD Status
Lough Derg	Lake	IE_SH_25_191A	Moderate
Lough Derg (HMWB)	Lake	IE_SH_25_191B	High
Shannon (Lower)_030	River /Stream	IE_SH_25S012350	Unassigned
Moannakeeba_East_010	River /Stream	IE_SH_25M290660	Unassigned
Shannon (Lower)_060	River /Stream	IE_SH_25S012600	Unassigned
Shannon (Lower)_050	River /Stream	IE_SH_25S012500	Moderate
Lower Village Trib_010	River /Stream	IE_SH_25L080081	Unassigned
Terryglass_010	River /Stream	IE_SH_25T650910	Unassigned
Shannon (Lower)_040	River /Stream	IE_SH_25A050100	Unassigned
Woodford (Galway)_030	River /Stream	IE_SH_25W010300	Good
Kilmastulla_040	River /Stream	IE_SH_25K041000	Good
Lorrha Stream_020	River /Stream	IE_SH_25L050300	Moderate
Carrigahorig Stream_010	River /Stream	IE_SH_25C160500	Moderate
Kilrateera_Upper_010	River /Stream	IE_SH_25K720870	Unassigned
Coos_010	River /Stream	IE_SH_25C080200	Good
Nenagh_070	River /Stream	IE_SH_25N010800	Moderate
Ardcloony_010	River /Stream	IE_SH_25A030100	High
Kilcrow 25_070	River /Stream	IE_SH_25K010700	Moderate
South Boleynagoagh_010	River /Stream	IE_SH_25S690670	Unassigned
Ballyfinboy_070	River /Stream	IE_SH_25B020800	Moderate
Youghal (Tipperary)_010	River /Stream	IE_SH_25Y020200	Moderate
Bow_010	River /Stream	IE_SH_25B100200	Moderate
Derrainy_010	River /Stream	IE_SH_25D100200	Moderate
Clonmakilladuff_010	River /Stream	IE_SH_25C970950	Unassigned

Waterbody Name	Waterbody Type	EU WFD Code	WFD Status
Grange (Tipperary)_010	River /Stream	IE_SH_25G100100	Unassigned
Ardgregane Stream_020	River /Stream	IE_SH_25A040400	Moderate
Newtown_010	River /Stream	IE_SH_25N030200	Good
Bridgetown (Clare)_010	River /Stream	IE_SH_25B230100	Moderate
Graney (Shannon)_050	River /Stream	IE_SH_25G040400	Poor

Table 11-1 WFD Waterbodies in the Vicinity of Parteen Basin (EPA, 2015)

As shown in Table 11-1 the WFD ecological status[6] of Parteen is "High" as reported in the EPA Water Quality in Ireland 2010-2012 data (EPA, 2015).

The Lough Derg WFD Management Unit Action Plan which was published with the Shannon RBMP in 2009 lists the pressures/risks to Lough Derg as including:

- Nutrient sources;
- Wastewater Treatment Plants (WWTP); and
- Industrial Discharges, morphology and abstraction.

There are a number of WFD related protected areas within and adjacent to Lough Derg/Parteen Basin as follows:

- The entirety of Lough Derg is classified under the WFD as a Drinking Water and a Nutrient Sensitive Area;
- There is one recreational area known as Ballycuggeran on Lough Derg;
- There are a number of Salmonid Waterbodies of interest, though none designated under the salmonid regulations; and
- Lough Derg fall within the Lough Derg (Shannon) SPA [004058] and Parteen Basin forms part of the Lower River Shannon cSAC [002165].

In addition to providing a new additional water source for the Dublin Water Supply Area, the pipeline will supply a number of towns in the Benefitting Corridor. However, the water quality assessment for this project will not account for or assess the infrastructure associated with the Benefitting Corridor. All projects associated with the benefitting corridor will be subject to the relevant planning regulations and as required EIA.

The pipeline route has yet to be finalised, however a 200m wide preferred pipeline corridor has been identified within the FOAR. Table 11-2 outlines some of the major watercourse crossings within this 200m corridor including their type, WFD code and WFD status.

[6] or potential as Parteen is a HMWB

Name	Type	EU WFD Code	WFD Status
Kilmastulla River	River	IE_SH_25_1970	Moderate
Nenagh River	River	IE_SH_25_2140	Moderate
Little Brosna River	River	IE_SH_25_633	Moderate
Silver (Kilcormac) River	River	IE_SH_25_3701	Moderate
Clodiagh (Tullamore) River	River	IE_SH_25_550	Moderate
Figile River	River	IE_SE_14_998	Moderate
Liffey River	River	IE_EA_09_1870_4	Moderate

Table 11-2 Major WFD Waterbodies Potentially Crossed by the 200m Corridor

The WFD status of all major WFD Waterbodies is "Moderate". All watercourse crossings detailed in Appendix A-4 will be assessed as part of the EIS:

- Flood risk in the area of the pipeline, this will be based on OPW flood maps and Catchment Flood Risk Assessment and Management Studies where available; and
- WFD protected areas along the pipeline route, such as:
  - Waters used for the abstraction of drinking water;
  - Areas designated to protect economically significant aquatic species;
  - Recreational Waters;
  - Nutrient Sensitive Areas; and
  - Areas designated for the protection of habitats or species.

11.2 Baseline Information

Baseline data was collated and reviewed as part of the Multi Criteria Analysis (MCA) initially undertaken to support the development of the Preliminary Options Assessment Report (POAR) and subsequently the Final Options Appraisal Report (FOAR). This information will be supplemented during the EIA using a desktop study, monitoring data, field surveys and feedback from consultation where relevant.

11.2.1 Desktop Study

A desk study will be carried out to collate the available information on the hydrology of the study area. The following data sources will be referred to during the assessment:

- Ordnance Survey of Ireland - current and historic mapping;
- Environmental Protection Agency (EPA) - water quality monitoring database and reports;
- EPA - flow and water level measurements (EPA Hydronet System);
- Water Framework Directive Ireland Database (www.wfdireland.ie);
- The Shannon RBMP 2009-2015, the South Eastern RBMP 2009-2015, and the Eastern RBMP 2009-2015 and their associated Water Management Unit Action Plans (various) and the draft 2nd Cycle National River Basin Management Plan (due Q4, 2016);
- National Parks and Wildlife Service - designated sites;
- County and Regional Development Plans for the Benefitting Counties in the study area;
- Inland Fisheries Ireland - fishery resources;
- Office of Public Works (OPW) - flood records and the Eastern and Shannon Catchment Flood Risk Assessment and Management Studies (ongoing);
- Historic flood data from the National Flood Hazard Mapping website (www.floodmaps.ie);

- County and as required Local Area Development Plans;
- RPS (2008) Strategic Environmental Assessment (SEA) Environmental Report for the Water Supply Project - Dublin Region;
- WSP Hydrodynamic and Water Quality Modelling DA2.2: First Pass Modelling Report (2015);
- WSP Hydrodynamic and Water Quality Modelling DA2.2: Final Options Appraisal Report (2016);
- Water Supply Project - Dublin Region (The Plan) and subsequent SEA Statement (2011);
- RPS/Veolia Desalination Study Report (2008); and
- Irish Water - Water Services Strategic Plan (2015).

11.2.2 Current Monitoring on Lough Derg/Parteen Basin

Monitoring on Lough Derg/Parteen Basin commenced on a staggered delivery from May 2015, with the follow monitoring currently being carried out:

- Continuous water flow and current monitoring - Vertical Acoustic Doppler Current Profilers (ADCPs) at 3 lake locations and 1 horizontal ADCP across the incoming River Shannon;
- Continuous water level monitoring - Automatic Level stations installed at 6 locations (3 lake sites and 3 river sites);
- Continuous water temperature monitoring - Temperature sensors have been installed at 20 lake station, measuring the water column at varying depths;
- Continuous water quality monitoring – Physiochemical water quality sampling buoys at 5 lake locations – sampling for water temperature, conductivity, dissolved oxygen, pH, nitrates, nitrites, ammonia and phosphates (at near-surface, mid depth and near bed of water column), with additional surface sampling of turbidity and chlorophyll-a;
- Manual water quality spot sampling – Spot sampling at 8 lake locations – sampling from the surface, mid and bottom of the lake water column at fortnightly intervals with laboratory analysis of BOD, chlorophyll a, nitrates, nitrites, ammonia , phosphates, suspended solids and alkalinity;
- Manual water quality spot sampling – Spot sampling at 6 river locations – sampling from the surface of the river column at fortnightly intervals with laboratory analysis of BOD, chlorophyll a, nitrates, nitrites, ammonia , phosphates, suspended solids and alkalinity;
- Plankton surveys at monthly and fortnightly intervals – Sampling at 11 lake sites for 12 month period; and
- Meteorological monitoring using meteorological stations.

See Appendix A-2 for the location of the permanent monitoring stations.

In addition a Bathymetric Survey of Lough Derg/Parteen Basin lake bed was carried out through summer of 2015.

The monitoring suite was developed in consultation with the EPA. These surveys and the associated data are required to aid the development of a hydrodynamic and water quality model to assess the sustainability of an abstraction regime from Lough Derg/Parteen Basin.

11.2.3 Future Data & Survey Needs

In addition to the ongoing monitoring on Lough Derg/Parteen Basin the following will be undertaken as part of the EIA;

- A site walkover will be carried out in late 2016. Visual inspections will be made 200m up and downstream of the abstraction point and major watercourse crossings of the preferred 200m pipeline corridor. Water quality monitoring is proposed for selected watercourse crossings along the preferred pipeline corridor which have the potential to be impacted during the construction phase of the proposed development. The

watercourses to be monitored will be selected based on their sensitivity and the proposed crossing technique to be utilised and will be monitored for parameters such as suspended solids and hydrocarbons. In addition, some biological water quality assessments (Small Stream Risk Score and Q-value indices as relevant), including a characterisation of the macroinvertebrate community, will be obtained from selected watercourses potentially impacted by the proposed development, see Section 9 Biodiversity.

- Consultation will be carried out with the Water Service Departments of the various Local Authorities within the study area and with Irish Water. Initial consultation has been undertaken with the National Federation of Group Water Schemes (NFGWS) in order to identify any drinking water abstraction points in the study area and further consultation will be undertaken with the NFGWS as the project progresses.

11.2.4 Hydrodynamic and Water Quality Model

A 3D hydrodynamic and water quality model of Lough Derg and Parteen Basin is under construction and will be used to simulate the abstraction of water from the lake body. Model simulations will rely upon and be informed by the data attained through the monitoring work ongoing on Lough Derg and Parteen Basin.

An initial modelling exercise has been undertaken, the objective of which was to assess the existing flushing characteristics of Lough Derg and Parteen Basin and examine abstraction options considered in the original SEA process, in order to determine if any changes in the flushing characteristics could be ascertained due to a number of potential abstraction locations and abstraction regimes.

The hydrodynamic and water quality model will continue to be developed up-to (and after) the submission of the Planning Application.

A final validated hydrodynamic and water quality modelling will:

- Determine the physical processes and hydrodynamics of Lough Derg/Parteen Basin and how flow rates impact on circulation;
- Predict water quality and how this varies with flow and circulation; and
- Establish, through hydrodynamic and water quality modelling, how the proposed abstractions will impact on the waterbodies ecosystems for a representative range of climatic conditions including climate change scenarios.

The model will be used during the EIA to determine the potential impacts on Lough Derg/Parteen Basin from the proposed abstraction regime.

11.2.5 Consultation

Consultation on the surface water impact assessment will be undertaken with the following organisations:

- Environmental Protection Agency (EPA);
- Water Policy Advisory Committee (Department of Environment, Community and Local Government);
- The National Parks and Wildlife Service (NPWS);
- The Electricity Supply Board (ESB);
- The Office of Public Works (OPW);
- Water Service Departments of the County Councils in the study area,
- Irish Water;
- National Federation of Group Water Schemes;
- Inland Fisheries Ireland (IFI); and
- Waterways Ireland.

- Local Authorities Water & Communities Office

Note: the above list is not exhaustive and additional bodies/organisations may be contacted as deemed appropriate.

11.3 Potential Impacts

11.3.1 Potential Construction Phase Impacts

During the construction phase there is the potential for pollution of surface water features due to sediment loading and associated anthropogenic polluting substances entering watercourses as a result of surface water runoff and/or spills on-site. Potential sources during the construction phase of the proposed development include:

- Construction works within and adjacent to watercourses particularly during the construction of the abstraction point on Lough Derg/Parteen Basin;
- Excavation and site clearance works;
- Pipe laying works including trenchless techniques;
- Stockpiling of materials;
- Solid waste arising's, in addition to the potential for waste slurry from any tunnelling activities;
- Accidental spillage of anthropogenic polluting substances e.g. oil or diesel in or adjacent to watercourses;
- Commissioning work such as hydrotesting this may also contain chemical additives; and
- Construction plant and vehicle washing.

There is also the potential to disrupt local drainage systems.

11.3.2 Potential Operational Phase Impacts

Potential impacts during operation are primarily related to the potential impact of the abstraction regime on Lough Derg/Parteen Basin. Abstraction pressures manifest in lakes as increased fluctuations in water level and a change in residence time and they can also result in the deterioration of the ecological health of the lake[7]. The water quality in Lough Derg is principally determined by the flushing time of water. In addition to potential change to the residence time and water levels there is a potential to alter the morphology of the lake shore as a result of the installation of the plant and pipe network. The Hydrodynamic and Water Quality Modelling study of Lough Derg will be used to inform the impact assessment from the operational phase of the proposed development. Potential impacts on watercourses feeding into Parteen Basin will also be assesses as part of the EIA.

Potential impacts to the watercourses downstream of Lough Derg/Parteen Basin will also be assessed as part of the EIA.

It is also noted that water will be leaving the current Shannon RBD and will be transferred to the Eastern RBD constituting an inter basin transfer under the WFD. It is proposed that this will be treated potable water therefore there are limited potential impacts to receiving watercourse in the Eastern RBD. An assessment of the impact on Lough Derg levels will be undertaken through the modelling exercise. Consultation on this issue will be undertaken with the EPA and Water Policy Advisory Committee (WPAC) as part of the EIA and potential impacts associated with this inter basin transfer will be assessed as part of the EIA.

As the pipeline will be buried underground, it is considered that there will be minimal impacts from the pipeline on the existing surface water receptors during the operational phase.

[7] Department of the Environment Heritage and Local Government (2010) Eastern River Basin District Programmes of Measures 2009 – 2015.

There is a potential that flood risk due to the proposed development could be exacerbated due to the development of increased hardstanding areas at infrastructure sites such as the Water Treatment Plant (WTP), the termination point reservoir etc. and in turn the proposed development elements could be at risk from flooding.

11.4 Proposed Methodology & Assessment Scope

It is proposed that an assessment of surface water quality will be carried out in accordance with the EPA's current EIS guideline documents and the following guidance and established best practice, and will be tailored accordingly based on professional judgement and local circumstance:

- NRA Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA 2009) [now TII]; and
- Office of Public Works (OPW) Guidelines for Planning Authorities (GPA): The Planning System and Flood Risk Management (OPW and Department of Environment, Heritage and Local Government 2009).

In line with the above guidance this assessment will cover potential impacts to water quality and will describe the existing geomorphological and hydromorphological environment and the likely significant potential impacts associated with the construction and operation of the proposed development on these aspects. The impact assessment process will involve:

- Assigning the receptor sensitivity;
- Identifying and characterising the magnitude and significance of any potential impacts;
- Incorporating measures to avoid and mitigate (reduce) these impacts; and
- Assessing the significance of any residual effects after mitigation.

The assessment will also consider potential impacts to local abstractions potentially affected by the proposed development.

This chapter of the EIS will detail the required mitigation measures during the construction and operational phases. Compliance with these requirements will be one of the specifications required to ensure that residual effects on sensitive receptors are minimised.

As a minimum a flood risk assessment (FRA) Stage 1 will be carried out and appended to the EIS. The FRA will be carried out in accordance with the Office of Public Works (OPW) Guidelines for Planning Authorities (GPA) 20: The Planning System and Flood Risk Management (OPW and Department of Environment, Heritage and Local Government 2009).

Hydrology interrelates to other aspects such as Flora and Fauna and Hydrogeology. Deterioration of surface water quality in the study area as a result of the proposed development could impact on flora and fauna within the study area. In turn any deterioration or impact to groundwater quality could impact on the surface water quality. These interrelations will be assessed and included in the impact assessment for each aspect. Any hydrological effects on ecological areas will be assessed/ reported as part of the Flora and Fauna (Biodiversity) section of the EIA, as discussed in Section 9 of this report, and any hydrogeological effects will be assessed/reported as part of the Land and Soils section of the EIA, see Section 10 of this report.

Other projects within the vicinity of the proposed development could result in cumulative impacts during the construction phase if these projects were to run concurrently. An assessment of potential cumulative impacts will be included in the overall impact assessment as required.

The scope of the EIA proposed in this section would allow an adequate understanding of the potential effects in order to ensure that the mitigation proposed as part of the proposed development design adequately protects the water environment.

11.4.1 Water Framework Directive Compliance Assessment (Abstraction Location)

The impact of the proposed abstraction on Lough Derg / Parteen Basin on water quality, ecology and hydromorphology will need to be assessed in relation to compliance with the objectives set out within the WFD. This will be detailed in the WFD Compliance Assessment Report which will form part of the EIS. The WFD Compliance Assessment will be based on a combination of a desk study, reviewing existing information for the proposed development and affected water bodies, followed by a site visit to allow baseline observations and expert assessment of the potential impacts. Qualified specialists will undertake the individual assessments respectively for the biological, physico-chemical and hydromorphological elements. The following key steps will be undertaken as part of this assessment:

- Collation and review of baseline, desk-based information on the proposed development and water bodies;
- A walkover in the vicinity of the abstraction point (approximately 200m length up and downstream);
- Field surveys of biological and hydromorphological quality elements; and
- An assessment of the likely impacts of the proposed abstraction on Lough Derg/Parteen Basin from a WFD perspective.

As no formal guidance on the WFD assessment process is currently available, professional judgement, other case studies and best practice guidance will be utilised to undertake the assessment. Stakeholder consultation will be undertaken with the EPA and WPAC in relation to the WFD Compliance Assessment. Stakeholder consultation will address a number of areas relating to the assessment including the impending second cycle of the WFD River Basin Management Plans (RBMP's) which is expected in 2017. As part of the second cycle it is noted that within Ireland, there will be only one national river basin district (RBD) as opposed to the current 5 RBD's.