13 SURFACE WATER QUALITY AND DRAINAGE

13.1 Introduction

This chapter has been prepared to describe the existing hydrological environment in the study area and to examine the aspects of the hydrological environment that could be affected by the activities associated with the proposed pipeline.

13.2 Study Area

The study area which was examined in the hydrology and water quality assessment concentrated on a corridor of 25 m either side of the proposed pipeline corridor, which includes the public road, footway and verges within the boundary lines between public and private property. As the proposed pipeline corridor is to be constructed generally in an urban setting and will be limited to this corridor, the receptors will be generally located within 10-25 m of the construction activities. The waterbody catchments that the proposed pipeline corridor traverses were identified and the assessment included the hydrological pathways from these waterbody catchments as far as their outfalls into the receiving estuaries, up to 5 km downstream in some instances. The assessment took cognisance of any environmentally protected areas along these hydrological pathways.

13.3 Assessment Methodology

13.3.1 Information Sources

The following sources of information were considered in this assessment:

- The design layout of the proposed pipeline route
- Published literature as described below
- A desk-based assessment of the surface water hydrology along the proposed route of the pipeline
- A walkover of the proposed route.

As well as considering the relevant EPA guidance with respect to the preparation of an EIS (EPA 2002, 2003), the scope and methodology for the baseline assessment has been devised in consideration of the following guidelines:

- Greater Dublin Strategic Drainage Study (GDSDS): Technical documents of Regional Drainage Policies, March 2005, including Tolka Study Area – Watercourses and Storm Sewers
- Dublin City Council's Dublin Coastal Flood Protection Project DCFPP
- Fingal – East Meath Flood Risk Assessment and Management Study (FEMFRAMS)
- Eastern Catchment Flood Risk Assessment and Management Study (EASTCFRAMS)
- Proposed Cloghran Sewerage Scheme tender drawings
- North Fringe Water Supply Scheme
- Department of the Environment, Heritage and Local Government (DoEHLG) - *The Planning System and Flood Risk Management Guidelines for Planning Authorities, November 2009*
- Requirements for the Protection of Fisheries Habitat During Construction and Development Works at River Sites (Eastern Regional Fisheries Board)
- Biological River Water Quality Data, (Environmental Protection Agency (EPA)
- CIRIA Environmental Good Practice on Site
- BPGCS005, Oil Storage Guidelines
- CIRIA Control of Water Pollution from Linear Construction Sites. Technical Guidance (C648)
- CIRIA Control of Water Pollution from Construction Sites. Guidance for Consultants and Contractors (C532)

- CIRIA Sustainable Construction Procurement. A guide to delivering environmentally responsible projects (C571)
- UK Pollution Prevention Guidelines (PPG):
    - PPG1: General guide to the prevention of water pollution
    - PPG2: Above ground oil storage tanks
    - PPG3: Pollution Prevention Guidelines
    - PPG4: The disposal of sewage where no mains drainage is available
    - PPG5: Works in, near or liable to affect watercourses
    - PPG6: Working at construction and demolition sites
    - PPG8: Safe storage and disposal of used oil
    - PPG21: Pollution incident response planning
    - PPG26: Drums and intermediate bulk containers
- Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes (National Roads Authority, 2008)
- Design Manual for Roads and Bridges (National Roads Authority (NRA) DMRB), March 2013)

Eastern Regional Fisheries Board - Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites (IFI).

13.3.2 Methodology

The methodology used to examine the existing hydrological environment is outlined as follows:

- A review of planning and policy documents in terms of hydrology, flooding and drainage was undertaken
- Responses from statutory bodies during the consultation process were examined, with particular reference to concerns relating to hydrology, drainage and flood risk
- The nature and location of the area in the vicinity of the proposed development was described in terms of the existing hydrological environment
- The existing site geology and hydrogeology was examined in terms of how it relates to the flooding history and the potential for drainage methods of the proposed scheme
- All existing historical information on previous events, studies and surveys, was examined as made available from the OPW flood hazard mapping website
- Flood mapping from the 2005 Report on the Dublin Coastal Flood Protection Project (Dublin City Council) was examined
- A study of the available flood mapping from the EASTCFRAMS
- The available results from the Fingal-East Meath Flood Risk Assessment & Management Study (FEM FRAMS) were studied. Of particular interest were the results shown in the pluvial flood depth mapping prepared for the study of high priority watercourses to the north of the proposed scheme which are relevant to the flood risk assessment (Ref. FEMFRAMS Figure No. M9/PLUV/CURS/005)
- The available results from the River Tolka Flooding Study were assessed
- Information on Watermains, on Foul and Combined Sewers, Storm Sewers and Culverted Watercourses from the GDSDS, DCC, Dublin Port and FCC.

The methodology used to examine the existing water quality environment is outlined as follows:

- A desktop review of water quality datasets was undertaken for the period 2007-2013. These included data from DCC, FCC and the EPA
- A review of waterbody status was carried out using the Water Framework Directive website www.wfdireland.ie and *epa maps* on gis.epa.ie
- A review of the Eastern River Basin District, River Basin Management Plan 2009-2015 (2010)
- Responses from statutory bodies during the consultation process were examined, with particular reference to concerns relating to water quality

- A review of relevant legislation including (the WFD, European Communities (Water Policy) Regulations 2003 and the European Communities Environmental Objectives (Surface Waters) Regulations 2009
- A site walkover of river crossings.

The source and type of each of the potential impacts is described in Section 13.6. Mitigation measures to be put in place are described in Section 13.7. The extent to which mitigation is considered necessary increases as the significance of the impact increases. Mitigation measures are described for any adverse impacts that are deemed to be of moderate or greater significance. The residual impacts are then evaluated in Section 13.8 in terms of magnitude and significance.

13.3.3 Review of Planning and Policy Documents

A number of planning and policy documents were reviewed with respect to their policies in terms of hydrology, flooding and drainage. The policies relevant to flooding and surface water are set out in Chapter 4 – Policy & Planning Context of this EIS. It should be noted in the context of these documents that the proposed pipeline corridor will not impact on any canals, nor will it interfere with any existing walkways alongside watercourses except during short periods during construction. The above ground stations which will be required at both Dublin Port and Dublin Airport, will be constructed inside existing facilities and therefore they will not contribute to a perceptible increase in surface water run-off into existing watercourses.

13.3.4 Review of Responses from Statutory Bodies during the Consultation Process

A number of statutory bodies were consulted as part of the EIA process. Their responses are summarised in Chapter 5 EIA Scoping & Consultation of this EIS. The principal concerns relating to hydrology and water quality are set out below. These concerns were considered in this Chapter in the identification of impacts and in the recommendations for mitigation measures where appropriate.

Dublin City Council

In their response by email on 24 April 2014, DCC stated that the newly formed body 'Irish Water' is the statutory agency now responsible for foul/combined drainage systems while DCC retains responsibility for surface water pipelines and flooding. The Drainage Division effectively acts for Irish Water under the terms of the Service Level Agreement between both organisations.

DCC Drainage Division offered the following comments to cover all the drainage issues:

- *"At the strategic level, the main issues for this Division would be any adverse impacts, due to the construction of this project, on either the pipe network (both SW and Foul) or any of the watercourses en route.*
- *In practice this means that a detailed construction methodology must be drawn up to ensure any clashes with our existing assets are properly managed. From recent experience with An Bord Gais laying a major pipeline through the north city, a system must be put in place to identify where clashes occur, how any proposed diversions/severances will be managed and setting up a process where your engineers can certify to us that any such interventions and re-instatements to the drainage network have been constructed in accordance with our requirements.*
- *No work can be carried out on any of our assets without the specific permission of this Division.*
- *To minimise the risk of pollution, the river crossings shall not take place until agreement is in place between this Division and the Developer with respect to the construction methodology.*
- *A Flood Risk Assessment should take cognisance of the impact of any diversions/severances during the construction phase. (e.g.: temporary removal of road gullies to facilitate construction).*
- *Should it be required, any pumping of groundwater to sewers/watercourses during construction of the pipeline, can only be carried out under a trade effluent discharge licence. Applications for such a licence may be made to the Drainage Division".*

The Local Authorities were forthcoming with records in relation to their watermains, foul and combined sewers, storm water sewers and culverted watercourses. The potential interactions between the proposed pipeline corridor and storm sewer networks from drawings provided by FCC and DCC, together with identified locations of culverted and open watercourses are discussed later in this chapter. A Flood Risk Assessment (FRA) has been prepared for this scheme, which is included in Appendix 13.1 of volume 3 of the EIS. The FRA takes cognisance of the potential impact, during the construction and operation stage, on any of the identified water services and any watercourses crossed by the proposed pipeline corridor.

Fingal County Council (FCC)

In an email received on 22 May 2014, FCC requested that the proposed Cloghran Sewerage Scheme which is proposed over the same corridor along Clonshaugh Road be considered. It was noted that the depth of the sewer is 'fixed' in terms of levels, therefore cognisance will have to be taken of the relative separation and route chosen so as no conflict between the two pipelines arises.

Irish Water

In their letter received on 25 April 2014, Irish Water encouraged FTC to engage with both of the Local Authorities involved to address the potential interactions with water and sewerage services and to ensure appropriate mitigation. Irish Water requested to be consulted if particular risks were identified in the EIS, in relation to Irish Water assets.

Health Services Executive (HSE)

In its response by letter, received on 16 May 2014, the HSE raised the following potential issues relating to surface water:

- It is recommended that regular water quality monitoring/sampling of any surface water bodies, water courses, streams, ditches and groundwater be carried out during construction and operational phases of the proposed development
- Detailed mitigation measures should be identified during the EIA including visual leak detection in relevant and vulnerable areas of water bodies/courses and pipeline equipment
- It is recommended that extra physical protection of pipes be provided at all river and stream crossings including the Tolka, Santry, Mayne, Wad, Naniken Rivers and the Cuckoo and Kilbarrack Streams which will require specialised construction techniques
- It was stated that the pipeline corridor also lies adjacent to the South Dublin Bay and River Tolka Estuary SPA, North Dublin Bay pNHA, Santry Demesne pNHA and Royal Canal pNHA
- The impacts for contamination of substrata and groundwater in the unlikely event of a leakage from the pipe should be outlined in the EIS
- The impacts from the submergence of the pipeline by floodwaters at the Tolka and Santry Rivers during the operation of the pipeline should be assessed during the EIS
- The safe storage and disposal of any waste materials arising from construction/excavation activities or soil heaps stockpiled onsite must be considered so as not to pollute groundwaters, watercourses and aquifers by wind, run-off or rain waters. It is recommended that excavated material be stored separately and re-instated in the same areas as soon as possible
- It is recommended that test water is disposed of in a controlled manner to an appropriate water body in accordance with a discharge licence.

A separate report has been prepared by AMEC Environment and Infrastructure UK Ltd. to investigate the potential for leaks in the pipeline and to examine the leak detection systems proposed. This report is included in Appendix 2.1 of Volume 3 of the EIS and it has been examined in relation to any relevant issues with regard to hydrology and water quality, which are discussed later in this chapter. The findings were also considered in the preparation of the FRA Stage 1 report.

Inland Fisheries Ireland (IFI)

In its response by email, received on 12 May 2014, IFI raised its concerns over the protection of the ecological integrity of surface water systems, the River Tolka (which represents a regionally significant salmonid system), Mayne, Cuckoo and Santry Rivers and stated that these watercourses should not deteriorate in any way as a result of either construction or operation of the proposed development. The IFI stated that the Cuckoo and Mayne Rivers are non-salmonid, however with improvements in habitat and water quality they are hopeful of a positive change in fisheries status. The Santry River is non-salmonid due to the presence of a number of impassable features located toward the lower end of the system. The Wad is extensively culverted and is non salmonid.

IFI requested that the following requirements should be included in relation to surface water:

- All works should be completed in line with a Construction Management Plan which ensures that good construction practices are adopted throughout the construction period and this plan should contain mitigation measures to deal with potential adverse impacts identified in advance of the scheme
- As with any development, all measures necessary should be taken to ensure comprehensive protection of local aquatic ecological integrity, in the first place by complete impact avoidance and as a secondary approach through mitigation by reduction and remedy. River and stream crossings should be planned and executed in an environmentally sensitive way. The proposal to cross all watercourses by trenchless techniques is welcomed. Trenchless crossings will not be subject to salmonid seasonal constraints. Borehole exploratory work in salmonid systems should be completed during the period May to September
- Any works associated with watercourses or riparian habitats including trenchless crossings are subject to Method Statement and must be submitted to IFI (ERBD) for assessment and approval
- Construction works have significant potential to cause the release of sediments and pollutants into surrounding watercourses. Pollution of the adjacent waters from poor on-site construction practices could have a significantly negative impact on the fauna and flora of this surface water system. A comprehensive and integrated approach for river protection during construction and operation should be implemented. Pipe laying activity poses a high risk of suspended solid contamination of surface waters. If dewatering of the launch and reception pits or water jetting of the pipe is required water must be treated by either infiltration over land, discharge to a Local Authority sewer or to a suitably sized and sited settlement pond before discharge to any watercourse. There can be no direct pumping of contaminated water from the works to a watercourse at any time
- Appropriate bunding should be in place at all high risk refuelling and storage locations (hydrocarbon interception etc.). The short-term storage and removal/disposal of excavated material must be considered and planned such that risk of pollution from these activities is minimised
- Works to the river banks/bed must not impact negatively on the water quality/fisheries habitat. All works areas should be reinstated fully in a manner that minimises the potential for erosion.

National Roads Authority (NRA)

In its letter of 9 May 2014, the NRA requested that trenchless technology be used under roads between M1 junctions 1 and 2. The risk of fuel discharging due to a leakage or fracture of the pipe in the vicinity of the tunnel be assessed in detail. This has been assessed by AMEC in their report. The clearance of the Port Tunnel at the proposed crossing is adequate to take the proposed 200 mm pipeline with a separation distance of 1.4 m from the crown of the tunnel. The tunnel is circa 2.9 m below ground. Further assessment in conducted by AMEC as included in Appendix 2.1.It is also proposed to lay the pipe over the Port Tunnel using open cut trench technology.

Health and Safety Authority (HSA)

In its letter of 1 May 2014, the HSA looked for demonstration that the proposed pipeline would not increase the risk of a major accident at the COMAH establishments. This aspect has been assessed by AMEC in their report.

13.4 Hydrology in the Existing Environment

This section describes the aspects of the hydrological environment that could be affected by the activities associated with the installation of the proposed pipeline. The existing hydrological environment is examined with respect to the watercourses/storm sewers which will be crossed along the route of the pipeline and historic flood mapping and source information from historical flood studies such as that conducted on the Tolka River (tidal, fluvial and pluvial).

A Flood Risk Assessment (FRA) Stage 1 report has been prepared for this scheme and is included in Appendix 13.1 of Volume 3 of the EIS.

13.4.1 Description of the Catchments Crossed by the Proposed Pipeline Corridor

The catchments crossed by the proposed pipeline corridor are in Hydrometric Area HA09 passing through the Mayne and Santry River catchments and the coastal catchments of the Tolka and Mayne Rivers.

The Water Framework Directive (WFD - 2000/60/EC) mapping shows the proposed development to be situated within five waterbody catchments as shown in Figure 13.1 – Waterbody Catchment Map. These waterbodies are known as:

- EA_Coastalt1_Sluice1
- EA_Mayne165_Mayne1
- EA_090_0100 – North Bull Island
- EA_Santry166_Santry1
- EA_090_0200 – Tolka Estuary

There are seven watercourse crossings in all, along the pipeline corridor. Five of these crossings are culverted at the locations of the crossing. These rivers are the responsibility of the Eastern River Basin District and Inland Fisheries Ireland.

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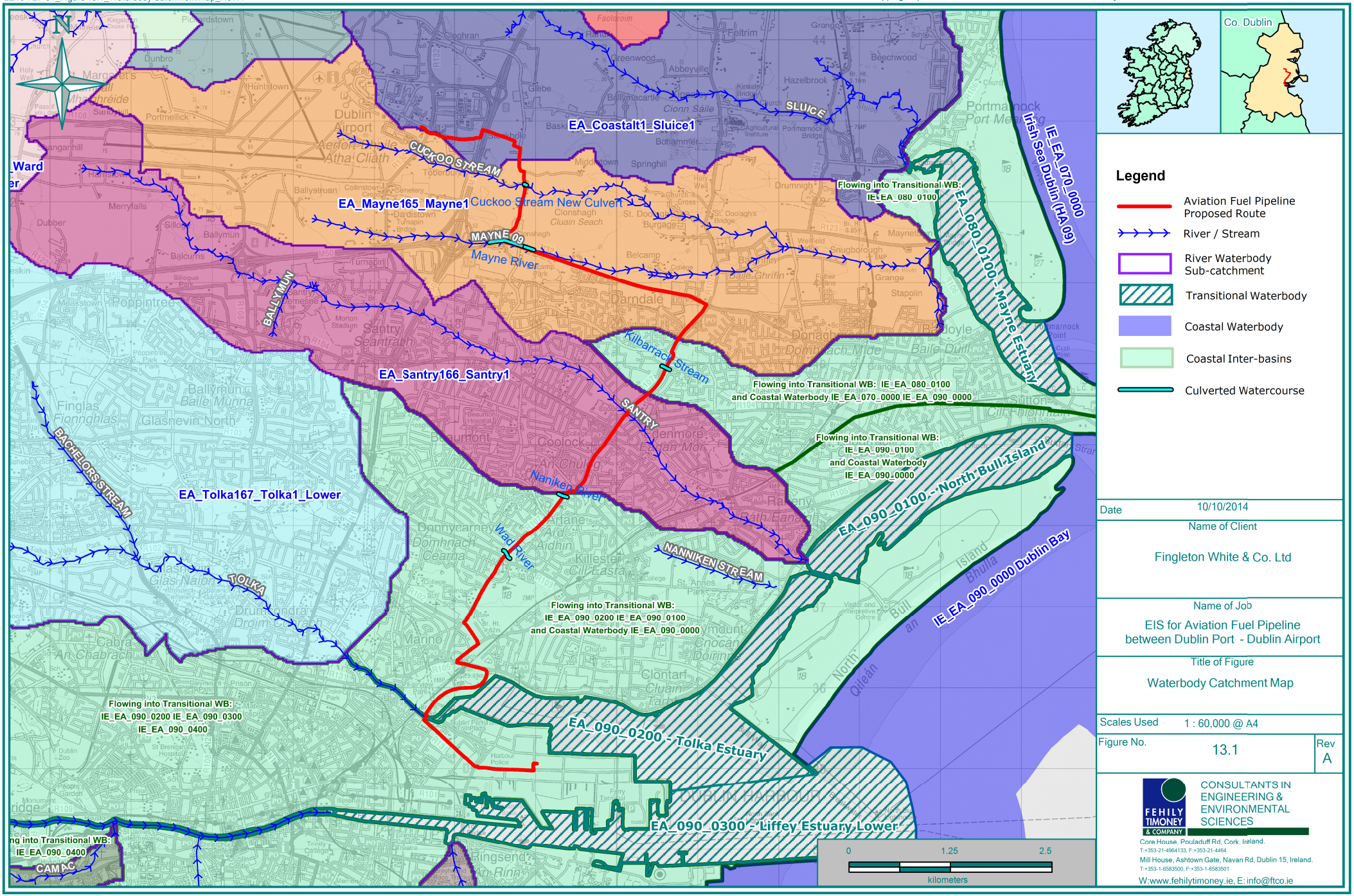
LE10-727-01_Figure 13.1_Waterbody Catchment Map_Rev A



Legend

- Aviation Fuel Pipeline Proposed Route
- River / Stream
- River Waterbody Sub-catchment
- Transitional Waterbody
- Coastal Waterbody
- Coastal Inter-basins
- Culverted Watercourse

Date	10/10/2014
Name of Client	Fingleton White & Co. Ltd
Name of Job	EIS for Aviation Fuel Pipeline between Dublin Port - Dublin Airport
Title of Figure	Waterbody Catchment Map
Scales Used	1 : 60,000 @ A4
Figure No.	13.1
Rev	A

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Situated in a predominantly urban setting, the proposed pipeline corridor will be laid in close proximity to and crossing existing services, including culverted watercourses, storm water sewers, foul sewers, combined sewers and watermains. There are also other proposed schemes in the vicinity of the proposed pipeline. These existing and proposed services are discussed later in this section.

It should be noted that the pipeline corridor will not impact on any canals, nor will it interfere with any existing walkways alongside watercourses except for short periods during construction. There will be no new additional hardstanding areas required as part of the proposed pipeline development and subsequently no increase in surface water run-off into existing watercourses.

A description of each of the watercourses crossed by the proposed pipeline corridor (from north to south) is given below (refer to Figure 13.1):

Cuckoo Stream - The proposed pipeline corridor crosses the Cuckoo Stream, a tributary of the Mayne River, at Clonshagh, approximately 2.5 km downstream of where this stream rises, just south of Dublin Airport. The stream is culverted in two culverts at the point of the crossing, one 700 mm x 900 mm stone culvert and a second concrete culvert 1,830 mm x 1,130 mm. The Cuckoo Stream is not a major watercourse and joins the Mayne River approximately 3 km downstream in the Balgriffin area. The details of the stream crossing are outlined in Table 13.1.

Mayne River - The Mayne River has a catchment of 18 km^2, rising at Dublin Airport and discharging into the Mayne Estuary. The proposed pipeline corridor crosses the Mayne River on the R139 at the roundabout, at the junction with the Clonshaugh Road, approximately 2 km downstream of where this river rises in Dardistown. The river is culverted at the point of the crossing. The Mayne River flows into Baldoyle Bay at Maynetown, which is a cSAC and pNHA, some 5 km downstream of the crossing. The environmentally designated areas are discussed further in Chapter 11 Flora and Fauna. The details of the stream crossing are outlined in Table 13.1.

Kilbarrack Stream – The proposed pipeline corridor crosses the Kilbarrack Stream on the R107 Malahide Road at Newtown. The stream is culverted at the point of the crossing. The Kilbarrack Stream is part of a coastal waterbody that drains into the Mayne Estuary. From the point where it is crossed by the proposed scheme, it continues in an easterly direction for 5 km, through Kilbarrack Lower and turning north through Baldoyle to join the Mayne River at Maynetown just before the Mayne River flows into Baldoyle Bay, which is a cSAC and pNHA. The environmentally designated areas are discussed further in Chapter 11 Flora and Fauna. The details of the stream crossing are outlined in Table 13.1.

Santry River - The River Santry has a catchment area of 27 km^2. It flows for 11 km where it discharges to the sea behind North Bull Island, flowing out into Sutton Creek. The Santry River rises in the semi-rural areas of Harristown and Dubber in County Dublin. The river flows south along the boundary of Dublin Airport, close to the new Dublin Bus Harristown Depot. From there, it flows in an easterly direction through Silloge Public Golf Course, crossing the M50 at Ballymun and crossing Santry Demesne (pNHA). South of the motorway, the land use is predominantly urban, from Santry to the discharge at Raheny, in estuarine waters (EA_090_0100-North Bull Island). The Santry River crosses the M1 at Santry and the proposed scheme crosses the Santry River some 2.5 km east of the M1 at Coolock, just downstream of Coolock Bridge. The Santry River reaches the sea, a further 2.5 km downstream of the proposed crossing, discharging at Raheny Strand, with the mouth of the river forming part of the western lagoon behind North Bull Island (SPA). Raheny Strand is within Dublin Bay cSAC and pNHA, the environmentally designated areas are discussed further in Chapter 11 Flora and Fauna. The details of the stream crossing are outlined in Table 13.1.

The location of the proposed crossing is an open channel section of the Santry River which has been channelized in concrete. It is proposed to cross under the Santry River using trenchless construction methods just downstream of Coolock Bridge where the Malahide Road crosses the river. The river channel is in an open green area. Figure 13.2 shows the areas for the launch and reception pits, along with Figure 13.3 which shows the river channel and immediate habitat. An aerial view can be seen on Drawing No. 0362/D/02/G0023 Strip Map 23, which is included in Appendix 3.4. The riverbank habitat is grassland and the channel itself is highly modified and it is lined with concrete at the location of the crossing. Mitigation measures to prevent sediment run-off during construction will be put in place.

Figure 13.2: Santry River - Launch and Reception Pit Locations

Figure 13.3: Banks at Santry River Crossing Location Looking Southeast

Naniken River – The proposed pipeline corridor crosses the Naniken River on the Malahide Road in Artane. The Naniken River rises to the east at Beaumont. The stream is culverted at the point of the proposed crossing. The Naniken River is part of a coastal waterbody that drains into the Tolka Estuary. From the point where it is crossed by the proposed scheme, it continues in an easterly direction for 3.75 km, through Killester and St. Annes Park before flowing into the Tolka Estuary. The Tolka Estuary is within the South Dublin Bay and River Tolka Estuary SPA and the South Dublin Bay cSAC and pNHA, however the point at which the proposed pipeline crosses the Tolka River is not within any designated site. The environmentally designated areas are discussed further in Chapter 11 Flora and Fauna. The details of the stream crossing are outlined in Table 13.1.

Wad River – The proposed pipeline corridor crosses the Wad River on the Malahide Road, just north of Collins Avenue junction at Donnycarney Bridge. The Wad River rises to the east at Poppintree Park, 4.5 km upstream of the proposed crossing. The stream is culverted at the point of the proposed crossing. The Wad River is part of a coastal waterbody that drains into the Tolka Estuary.

From the point where it is crossed by the proposed pipeline corridor, it continues in an easterly direction for approximately 2 km, through Killester, where it turns south and crosses the Howth Road and the Clontarf Road at a location just to the east of Alfie Byrne Road and then flows into the Tolka Estuary. The Tolka Estuary is within the South Dublin Bay and River Tolka Estuary SPA and the South Dublin Bay cSAC and pNHA, however the point at which the proposed pipeline crosses the Tolka River is not within any designated site. The environmentally designated areas are discussed further in Chapter 11 Flora and Fauna. The details of the stream crossing are outlined in Table 13.1.

Tolka River - The Tolka River has a catchment area of 141 km^2. It rises near Culmullin in County Meath, and flows for 33.3 km to where it discharges into the Tolka Estuary. The Tolka River flows firstly through areas where the land use is predominantly agricultural, before flowing into County Dublin where the land becomes increasing urbanised through Mulhuddart, Corduff, Blanchardstown and Ashtown. The lower reaches of the river pass through Glasnevin, Drumcondra and Marino where it discharges into the Tolka Estuary (EA_090_0200-Tolka Estuary). The catchment of this river is generally divided into three parts, namely the upper, middle and lower catchments. The lower catchment flows into the transitional coastal waterbody that flows into the Tolka Estuary. The river is tidally influenced downstream of Drumcondra, where the proposed pipeline corridor crosses the channel of the Tolka River, at the mouth of the Tolka River Estuary to the north of the East Wall Road and just to the east of John McCormack Bridge. A foreshore licence will be required for the construction of this crossing. Photographs taken at the location of the proposed crossing can be seen in Figure 13.4, Figure 13.5 and Figure 13.6. An aerial view of the crossing is shown on Drawing No. 0362/D/02/G0008 Strip Map 8, which is included in Appendix 3.4. The Tolka Estuary is within the South Dublin Bay and River Tolka Estuary SPA and the South Dublin Bay cSAC and pNHA, however the point at which the proposed pipeline crosses the Tolka River is not within any designated site. The environmentally designated areas are discussed further in Chapter 11 Flora and Fauna.

The location of the proposed reception pit for this trenchless crossing can be seen in the foreground of Figure 13.4 and from a southern direction in Figure 13.6. The River Tolka is heavily modified in this urban setting. The river has been channelised and there is no river bank or riparian habitat at the site of the reception pit. Figure 13.6 demonstrates how the river wall is higher than ground level, which will provide protection during construction. The launch pit is located on Dublin City Council Land. The location of the launch pit is shown in Figure 13.5. It is densely vegetated and a small area of vegetation will be cleared to facilitate construction. The proposed pipeline will be installed a minimum of 2 m below the river bed. The details of the stream crossing are outlined in Table 13.1.

The Tolka River and the Santry River are classified as heavily modified water bodies by the ERB Management Plan due to the flood defences constructed. A heavily modified water body is an existing body of water that has had its original appearance significantly changed to suit a specific purpose. In this case, these bodies of water have undergone re-alignment where flood defences have been constructed.

The pipeline corridor also crosses culverted sections of tributaries of the Tolka River as well as storm water drainage sewers and other utilities. The location of these services are identified in Figure 13.7 and Figure 13.8. It is evident from these figures that there are numerous existing sewers and watermains along the proposed pipeline corridor.

DCC is currently in the preliminary planning stage of the City Centre Sewerage Scheme project. Information on the project is available online at http://www.dublincity.ie/WATERWASTEENVIRONMENT/WATERPROJECTS/Pages/CityCentreSewerage.aspx.

The City Centre Drainage Area Catchment stretches from the Royal Canal in the north to the Grand Canal in the south and from Chapelizod in the west to the Dublin Custom House in the east. A separate drainage area plan has been developed for the docklands part of the catchment. In the last 10 years the area has undergone substantial development and this has put pressure on the drainage system in the catchment. The City Centre Sewerage Scheme is a follow-on project from the Greater Dublin Strategic Drainage Study (GDSDS). The aim of the project is to develop on the GDSDS findings and identify areas of the catchment that are under capacity and to propose solutions. Phase 2 (Surface Water Separation) is the implementation of schemes, in advance of the main scheme, that can remove stormwater from the combined City Centre Interceptor Sewers.

The aim of the scheme is to divert the surface water flow from the Phoenix Park, that currently flows into the north city centre interceptor sewer, so that it flows directly into the River Liffey at the Parkgate Street weir, discharging at the outfall west of Sean Heuston Bridge. In addition, the storm water network in Montpelier can also be diverted to the Liffey due to its proximity. The developer will liaise with DCC on progress on the City Centre Sewerage Scheme project before construction commences.

Table 13.1: Pipeline Crossing Details at Streams

Stream	Culvert 1		Culvert 2		Clearance under Culvert 1/Channel Bed	Clearance Culvert 2	Fuel Pipeline Crossing Method Proposed
	Width (mm)	Height (mm)	Width (mm)	Height (mm)	m	m	
Cuckoo Stream	900	700	1,830	1,100	0.6 m min.	0.82 m min.	Trenchless crossing under culverts
Mayne River		800			0.6 m min.		Trenchless crossing under culverts
Kilbarrack Stream		1,350			1.0 m min.		Trenchless crossing under culverts
Santry River	Approx. 3 m Wide Channel	Approx. channel depth = 1.43 m			1.2 m min.		Trenchless crossing under bed of river channel
Naniken River	1,250	1,020			1.0 m min.		Trenchless crossing under culverts
Wad River	1,490	1,240			1.0 m min.		Trenchless crossing under culverts
Tolka River	25.6 m Wide Channel	Approx. channel depth = 4.16 m			2.0 m min.		Trenchless crossing under bed of river channel
Source: Fingal County Council and Trial Pits undertaken by Fingleton White							

Figure 13.4: Tolka River Channel Looking North at Proposed Crossing

Figure 13.5: Southern Bank of Tolka River Crossing

Figure 13.6: Bank at Tolka River Crossing Location Looking South

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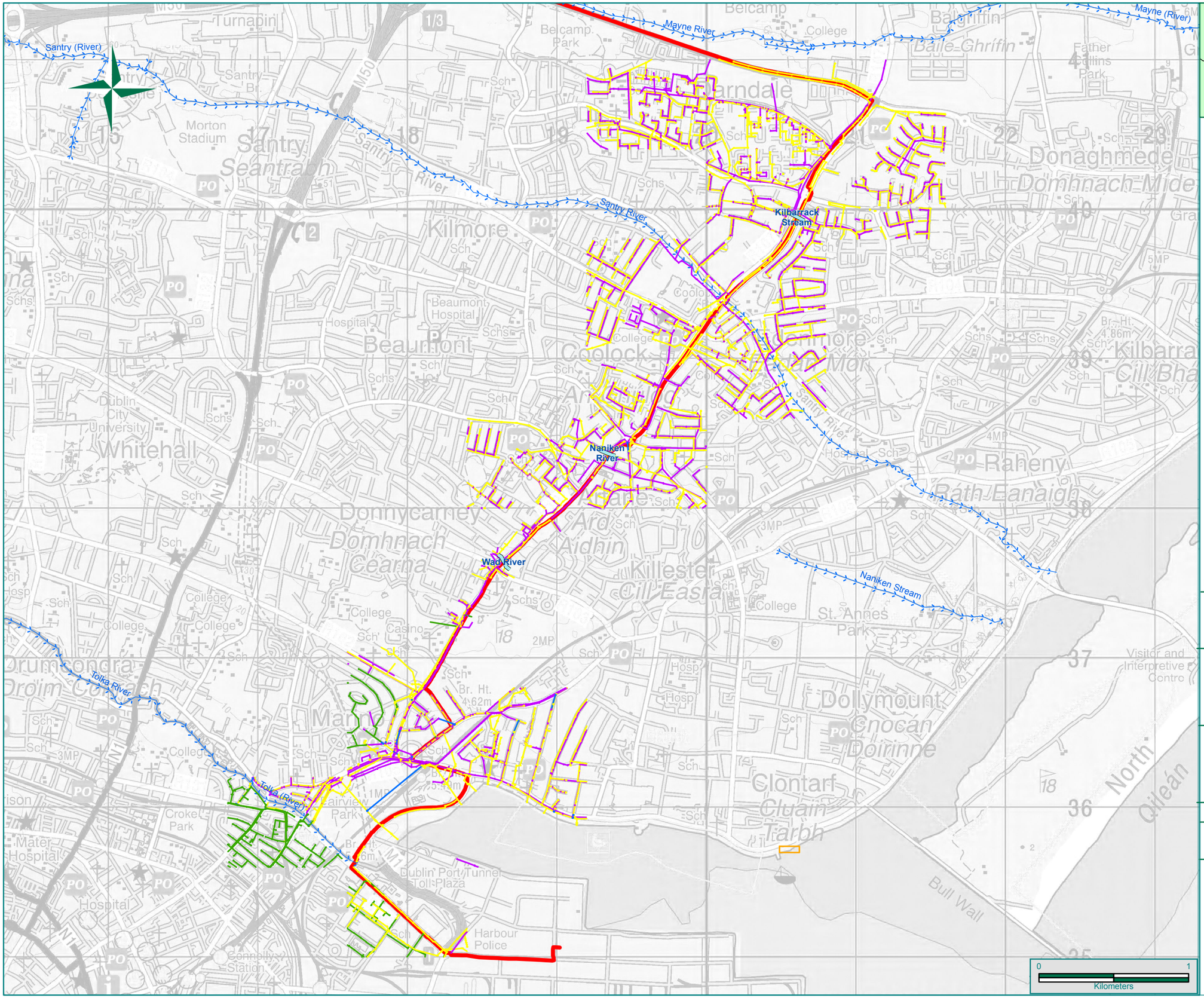
LE1072701_Map 13.7 Storm Sewers and other Service



Legend

- Water Course of Culverted River & Streams
- Aviation Fuel Pipeline
- Rivers

Dublin City Council Sewer & Other Services

- Combined
- Foul
- Overflow
- Pumping Combined
- Storm

Date	10/10/2014
Name Of Client	Fingleton White & Co. Ltd
Name Of Job	EIS for Aviation Fuel Pipeline between Dublin Port - Dublin Airport
Title Of Figure	Dublin City Council Sewer & Other Services Map
Scale Used	1:24,521 @ A4
Figure No.	13.7
Rev	A

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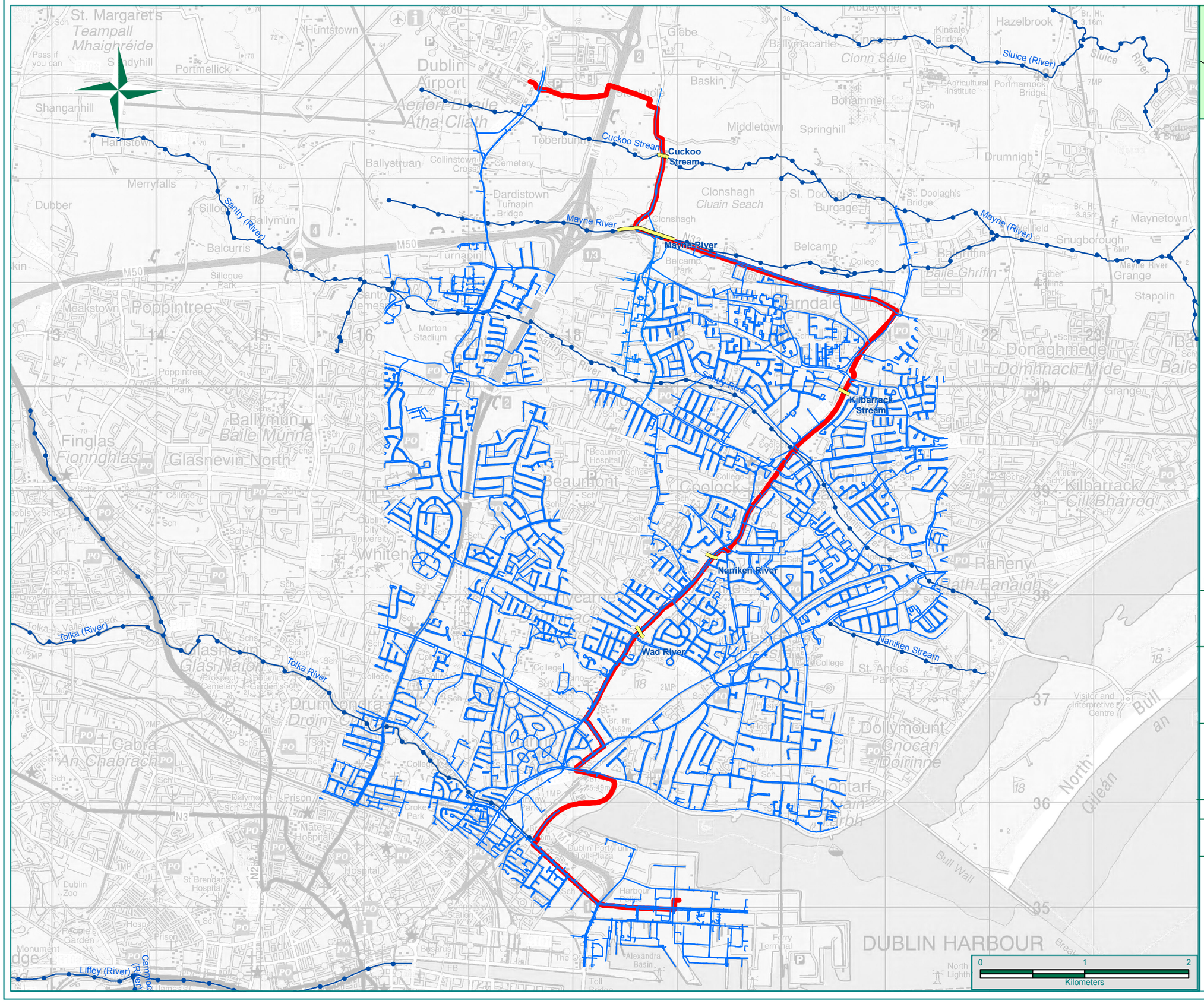
R:\Map Production\2010\LE10\727\01\Workspace\EIS\
LE1072701_Map 13.8 Water Mains



Legend

- Aviation Fuel Pipeline
- Water Mains
- Rivers
- Water Course of Culverted River & Streams

Date	10/10/2014
Name Of Client	Fingleton White & Co. Ltd
Name Of Job	EIS for Aviation Fuel Pipeline between Dublin Port - Dublin Airport
Title Of Figure	Water Mains Map:
Scale Used	1:35,000 @ A4
Figure No.	13.8
Rev	A

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13.4.2 Flood History and Relevant Studies

Flooding History

The national flood hazard mapping website (www.floodmaps.ie) provides data on historical flood locations throughout the country. The website indicates a history of flooding in a small number of locations adjacent to the pipeline corridor. These flood locations are shown on Figure 13.9 - Flood Information Map Overview and the flood history is summarised in Table 13.2 - Historical Flood Incidents.

Table 13.2: Historical Flood Incidents

Flood ID	OPW ID	Flood Location	Year of Flood	Source and Cause of Flooding
OPW 1	Flood ID No 1651	Stockhole Lane (near Airport)	2005	FCC, recorded in minutes of meeting identifying areas subject to flooding - Fingal – Dublin. Road flooding - recurring.
OPW 2		Naniken River Artane	December 1954 & May 1955	DCC correspondence connected to flooding in Artane (Naniken) in north Dublin. Flooding occurred following severe and continued rainfall. Flooding occurred along the line of the Naniken River, flooding the Malahide Road by 3 ft. The culvert was inadequately sized to take the flows and has since been upsized & extended*
OPW 3		Clanmoyle Road, Donnycarney	July 2009	OPW Trim. Rainfall information, description of flooding damage and photograph. A number of properties on Clanmoyle Road, Donnycarney had to be evacuated due to flooding in July 2009.
OPW 4		Wad River Donnycarney	August 2008 & July 2009	DCC. Wad River Flooding. River Tolka, Wad River Sub-Catchment Pluvial Flood Modelling Study, Donnycarney Area Interim Report. In August 2008 and July 2009 flooding occurred at the Malahide Road, north of Collins Avenue, flowed to Collins Avenue East and along it to Clanmoyle Road following the historic floodplain of the Wad River. Flooding occurred at a number of properties. Additional gullies were provided along with minor flood relief works and recommendations for upgrading of the culvert at Clontarf Golf Club and provision of overflow facility.*
OPW 5		Clanmoyle Road, Donnycarney	October 2011	OPW Trim - Report of flooding at Clanmoyle Road, Donnycarney, Dublin 5 on 24th Oct 2011. Data gathered under the Eastern CFRAM Study. The source of the flood waters was the Wad River. Water from the river ran into Collins Avenue and then Clanmoyle Road and ponded around the houses. Max. Flood depth 1 m with damage to properties and road flooding.
OPW 6		Clontarf Rd Seaview	August 2004 &	DCC document. Schedule of locations affected by flooding on 23 Aug 2004.

Flood ID	OPW ID	Flood Location	Year of Flood	Source and Cause of Flooding
		Avenue	Tidal Flood Event October 2004	List and map of properties flooded during heavy rainfall (Estimated 1 in 30 yr event) provided. Account of Tidal flooding, 2.62 m OD Malin Head Flood Level recorded together with waves of 1.5 m to 1.8 m high in October 2004 from the Docklands Engineer to ESBI*

*Flood Defence assets have since been put in place

No flood incidents were recorded in the Cuckoo Stream, Mayne River, Kilbarrack Stream or Santry River in the vicinity of the pipeline corridor.

Flood extents mapping available from the OPW website for the Tolka River indicates historical flooding in the vicinity of the proposed crossing. The outline of the area subject to flooding in the Tolka River is shown on the flood information map in Figure 13.9. A more detailed assessment is undertaken in the Stage 1 FRA Report which is included in Appendix 13.1 of Volume 3 of this EIS.

The OPW has produced indicative flood mapping to assist in a preliminary flood risk assessment (PFRA) on its website www.cframs.ie. These maps were produced by the OPW from a number of sources. It can be seen in Figure 13.9 and Figure 13.10 that the launch and reception areas for the proposed crossing of the Tolka River are outside of the OPW flood extents outline but within a 'Flood Zone A' area i.e. an area with a probability of flooding in a 1 in 100 year flood or 1% AEP (Annual Exceedance Probability).

There is some ambiguity in the flood mapping here at the mouth of the Tolka Estuary. A survey was carried out at this location as part of the FRA – Stage 1 to assist in the interpretation of the flood mapping at this location. The results of the flood risk assessment are discussed later in this Section.

Areas that could be subject to pluvial flooding are also shown on the PFRA mapping. The process used in the preparation of the PFRA mapping, by the OPW, for developing the pluvial flood extent maps was based on 'dropping' various depths and intensities of rainfall over a range of durations, and modelling how that rainfall would flow over the land and, in particular, pond in low-lying areas. A number of pluvial features are shown in the vicinity of Stockhole, at the proposed crossing locations of the Naniken and Wad Rivers, on the Clontarf Road and just to the north of the Clontarf Road, on the Malahide Road (R107). These low-lying areas correspond with some of the historic flood incidents listed in Table 13.2.

R:\Map Production\2010\LE10\727\01\Workspace\FRA\
LE1072701_Map 13.9 Flood Data Overview

Data from GDSDS and DCFPP only extracted where relevant to proposed development

Co. Dublin

Isolation Valve

OPW01

Isolation Valve

OPW02

OPW03

OPW04

OPW05

OPW06

Naniken River

Wad River

Cuckoo Stream

Mayne River

Sluice (River)

Mayne (River)

Kilbarrack Stream

Santry River

Naniken Stream

Tolka (River)

Liffey (River)

Reverse Flood

Wave Overtopping

1:10,000

1:10,000

Legend

- Isolation Valves
- OPW Flood Points
- Water Course of Culverted River & Streams
- Rivers
- Aviation Fuel Pipeline
- Cloghran Sewerage Scheme (Indicative Route)

GDSDS Drainage

- Culverted Watercourse
- Storm Sewer
- GDSDS 100 Year Flood Risk
- Alluvium Deposits

Fingal East Meath FRAMS - Pluvial Flood Depth

- 0 - 0.25m
- 0.25 - 1m
- 1 - 2m
- DCFPP Notes
- Dublin Coastal Flood Protection Project Flood Extents
- PFRA 1% AEP Pluvial Flood Extent
- PFRA 1% AEP Fluvial Flood Extent
- PFRA 0.5% AEP Coastal Flood Extent
- OPW Flood Extents

0 1 2 Kilometers

Date	10/10/2014
Name Of Client	Fingleton White & Co. Ltd
Name Of Job	EIS for Aviation Fuel Pipeline Between Dublin Port - Dublin Airport
Title Of Figure	Flood Zones Overview Map
Scale Used	1:35,000 @ A3
Figure No.	13.9
Rev	I

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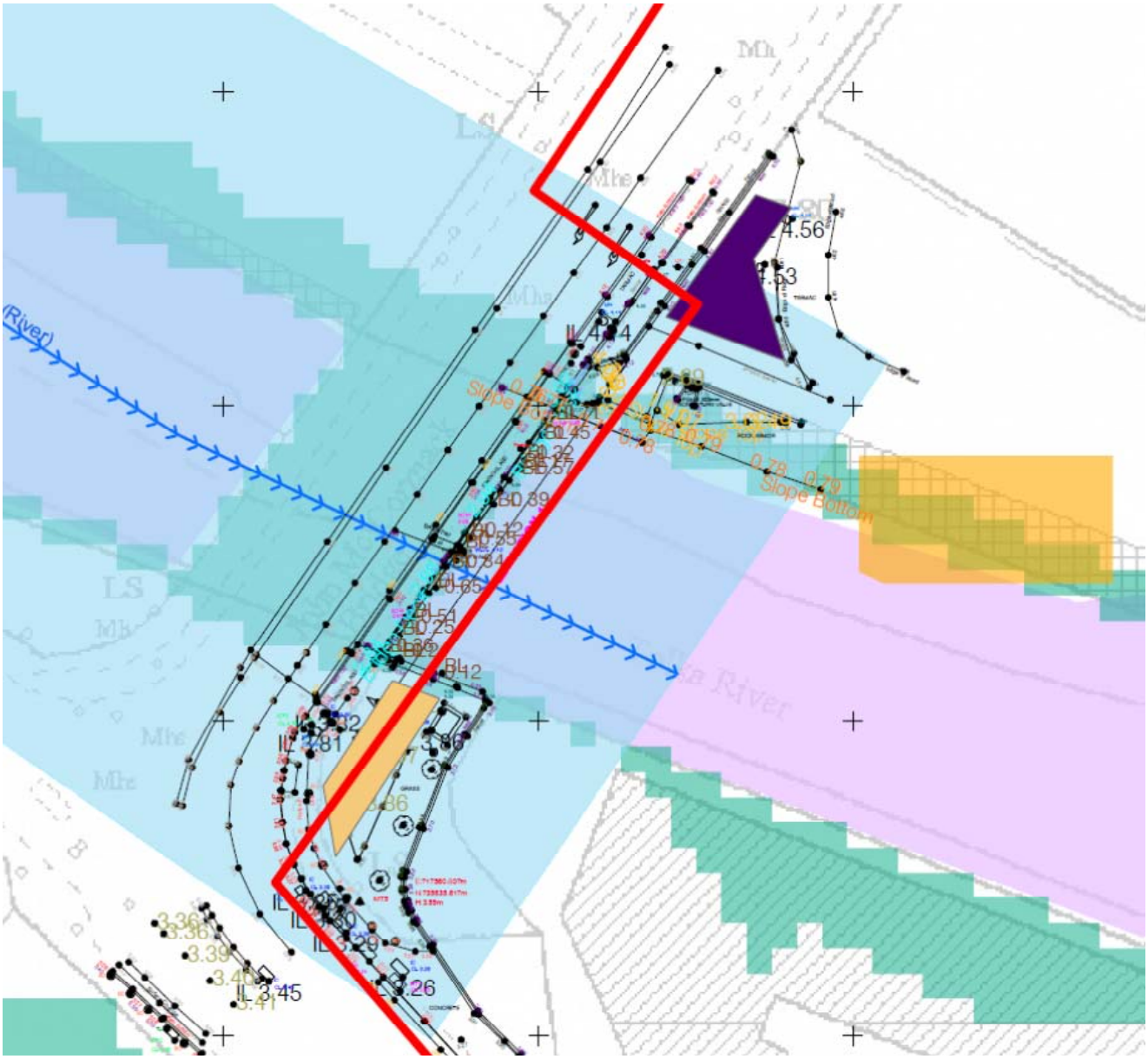

Figure 13.10: Proposed Location of Tolka River Crossing

Greater Dublin Strategic Drainage Study (GDSDS)

The GDSDS was commissioned by Dublin Corporation (now DCC) in 2001 to identify policies, strategies and works leading to the development of a sustainable drainage system for the Greater Dublin Area. As part of this study drainage models were produced for a number of foul and stormwater catchments including the Tolka River and the Santry River. 100-year flood extent maps were prepared for each of the catchments as part of the studies. These maps were examined in the preparation of this section of the EIS and the information has been included in Figure 13.9 Flood Information Map.

Tolka River Flooding Study

The River Tolka Flooding Study was commissioned by DCC in association with FCC, Meath County Council (MCC) and the OPW in 2002 to address concerns in relation to increasing flood risk to properties along the river. The objective of the study was to establish a flood risk profile for the river and to design a scheme to provide a realistic level of protection from a 1 in 100 year flood risk. GDSDS stormwater catchments were divided into S1, S2 and S3 groupings in order of importance. S1 = rivers, S2 = large piped stormwater catchments, and S3 = smaller piped stormwater catchments. The Tolka River came under the category S2 and was not therefore assessed for a 100 year Average Recurrence Interval (ARI) flood level. The OPW predictive flood extent area as shown on the OPW website was therefore indicated on the flood risk mapping in Figure 13.9 Flood Information Map.

The study reports that the Tolka River is subject to occasional significant floods, generally in winter months.

The study indicates that the proposed pipeline corridor will cross culverted sections of tributaries of the Tolka River and storm water drainage sewers amongst other utility services. Relevant detail from the study is shown on Figure 13.9.

As part of the GDSDS Tolka Study – Storm Level 2, the location of known and assumed basements were mapped as important hydraulic considerations. The closest location of basements shown on available mapping from this study, to the proposed pipeline corridor is at the junction of Donnycarney Road and the Malahide Road. These were marked as 'assumed' location of basements. It is proposed to lay the pipeline at the opposite side of the road at this location (Ref. Strip Map Nos. 15 and 16).

Dublin Coastal Flooding Protection Project (DCFPP)

The Dublin Coastal Flooding Protection Project provided information on flood risk areas in the mapping prepared for the study as shown in Figure 13.9. It can be seen that the pipeline route will not encroach on any of the flood risk areas identified in the mapping. The proposed pipeline corridor does however cross the River Tolka downstream of where a flood area was identified by DCC and it borders a flood risk area on the Alfie Byrne Road on approach to the junction with the Clontarf Road.

Eastern Catchment Flood Risk Assessment and Management Study (EASTCFRAMS)

The Eastern Catchment Flood Risk Assessment and Management Study was completed in November 2011. The mapping produced from this study was incorporated into the PFRA mapping and has been included in Figure 13.9.

Fingal-East Meath Flood Risk Assessment and Management Study (FEM FRAMS)

FCC in association with MCC and the OPW engaged a consultant to undertake the FEM FRAMS in the summer of 2008 to address the issue of existing flood risk in the Fingal East Meath area.

A number of high priority watercourses were studied as part of the FEM FRAMS and the resulting pluvial maps were examined in the context of the proposed pipeline corridor. The relevant mapping examined from the FEM FRAMS is included on Figure 13.9 and the information has been derived from the following map from that study:

- Pluvial Flood Depth Map Figure No. M9/PLUV/CURS/005, Fingal East Meath Flood Risk Assessment and Management Study (FEM FRAMS)

The pluvial flood depth map does not report any excessive depths along the proposed pipeline corridor, with the exception of the crossing of the Cuckoo Stream, where flood depths of up to 2 m were observed at the location of the crossing.

The fluvial mapping from FEMFRAMS was considered to be more detailed than that produced for the EASTCFRAMS within the FEMFRAMS study area and thus was adopted in the PFRA mapping. This has been included in Figure 13.9.

Geological Survey of Ireland (GSI) Mapping

The Geological Survey of Ireland (GSI) website provides information on its public online mapping service at www.GSI.ie on subsoils, refer to Figure 13.9 and Figure 12.1 in Chapter 12 Soils, Geology and Hydrogeology. Subsoil mapping provides evidence of alluvium which can be an indicator of past flooding, where flood records are limited in the vicinity of watercourses. The GSI mapping also provides information on estuarine sediments which can be an indicator of past coastal flooding.

Alluvium is evident where the proposed pipeline corridor crosses the Mayne and Santry Rivers as well as along the southern side of the Clontarf Road and across the junction with the Alfie Byrne Road. There is no evidence of estuarine sediments (silts and clays) along the proposed pipeline corridor.

AMEC Environment and Infrastructure UK Ltd.: Safety and Environmental Impact Evaluation Report, October 2014

The Safety and Environmental Impact Evaluation Report investigated the pipeline hazards and protective measures proposed. If a leak occurred the fuel would float on any free water surface. Third party interference is the major risks for leaks. Leaks may also result from, corrosion a mechanical failure due to construction faults or material defects. The proposed protective measures outlined in the AMEC report, along with an assessment of these is summarised as follows:

- Depth of cover 1.2 m
- Pipe wall thickness of 12.7 mm
- Trench backfilled with 700 mm of lean mix concrete providing protection from third party (external) interference
- External leak detection at the Tolka River. This will comprise a slotted duct installed in the pipeline trench with a sensing cable installed in the duct. The duct will have 0.5mm wide slots to prevent it filling with silt. Other river crossings on the route are in culverts or in a concrete open channel (Santry River crossing)
- Marker tape installed in the lean mix concrete – to indicate the presence of the utility
- Cathodic protection system to prevent external corrosion
- Leak detection using instrumentation monitoring to monitor: pressure; flow; mass balance and static pressure together with automatic and manual emergency shut-down capability
- Leak detection by visual inspection which includes a fortnightly walkover of the route by operators Isolation Valves at the beginning and end of the pipeline with two emergency shutdown valves positioned along the pipeline, one on the Malahide Road and one on the R139. The emergency shutdown valves are strategically located to limit the drain down of the pipeline contents to any low point taking into account topography of the route
- Protection for valves and fittings
- Disturbance of the fibre optic communications cable laid above the pipe will automatically initiate an emergency shutdown of the pumps and closure of the section isolation valves.

Flood Zone Map

Information on flood risk was obtained from a number of different sources as outlined above. This information culminated in the production of a flood information map, indicating flood zones, refer to Figure 13.9.

Where a wide floodplain extent has been indicated in the OPW flood map or GDSDS sources it should be noted, the floodplain may have been constricted by an old structure which has since been upgraded. The routing of the proposed pipeline under the existing structure or the river bed may be all that is proposed at these locations. Further, existing flood defences may give a different picture of the extent of the floodplain on the ground as often times these are not considered in flood extent models. The details at the various flood zones identified are assessed further in the Stage 1 FRA which is included in Appendix 13.1 of this EIS. The principal findings of the flood risk assessment together with the survey commissioned to support the FRA are summarised below.

The proposed location of the launch Pit for the Cuckoo Stream just skirts the indicative 1 in 100 year fluvial floodplain and is in a local low point which experiences pluvial flooding. The proposed Reception Pit is outside the indicative fluvial floodplain.

The proposed location of the launch and reception pits for the Mayne River crossing are above the 1 in 100 year indicative floodplain level of the Mayne River at that location.

The section of roadway proposed for the location of the launch and reception pits for the Kilbarrack Stream crossing is below the 1 in 100 year indicative floodplain level of the Kilbarrack Stream at that location.

The proposed location of the launch and reception pits for the Mayne River crossing are above the 1 in 100 year indicative floodplain level of the Mayne River at that location.

The banks of the Santry River, where the launch and reception pits are proposed to be located, are below the 1 in 100 year indicative floodplain level.

The flood record, OPW 6 in Table 13.2 gives an account of Tidal flooding, with a 2.62 m OD Malin Head Flood Level recorded together with waves of 1.5 m to 1.8 m high in October 2004 on the Clontarf Road at Seaview Avenue. The survey along the Clontarf Road indicates levels approaching 2.62 m OD and lower at the junction of Clontarf Road and Alfie Byrne Road, however some protection is provided in the form of flood defences from wave overtopping. It is proposed, to lay the pipe along the inside of Alfie Byrne Road and thus away from the potential flood risk from overtopping waves.

The proposed location of the launch and reception pits for the Tolka River crossing are above the 1 in 100 year floodplain level of the Tolka River at that location.

The developer will ensure that the location of isolation valves and any automated equipment will be outside any flood zones as identified in Figure 13.9. Further, mitigation measures will be provided where the location of launch and/or reception pits are below indicative floodplain levels or where areas are exposed to potential wave action. These measures are outlined later in this chapter.

13.5 Water Quality in the Existing Environment

This section addresses the existing water quality for surface water. The Water Framework Directive (WFD) is the principal legislation governing water bodies. The overriding purpose of the WFD is to achieve at least 'good status' in all European waters by 2015 and ensure that no further deterioration occurs in these waters. European waters are classified as groundwaters, rivers, lakes, transitional and coastal waters. The European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003), the European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. No. 272 of 2009) and the European Communities Environmental Objectives (Groundwater) Regulations 2010 (S.I. No. 9 of 2010) govern the shape of the WFD characterisation, monitoring and status assessment programmes in terms of assigning responsibilities for the monitoring of different water categories, determining the quality elements and undertaking the characterisation and classification assessments. The WFD has been implemented in Ireland by dividing the island of Ireland into eight river basin districts. The proposed pipeline corridor is located in the Eastern River Basin District (ERBD).

13.5.1 Relevant Waterbody Catchments

As discussed in Section 13.4.1, the Water Framework Directive (WFD - 2000/60/EC) mapping shows the proposed development to be situated within five waterbody catchments as shown in Figure 13.1 – Waterbody Catchment Map. A description of these waterbody catchments is provided in Section 13.4.1.

13.5.2 Proposed River/Stream Crossing Locations

As previously stated, there are two proposed crossings of open water channels on the River Tolka and River Santry. One of these, the Santry River, is a concrete lined channel. The other five proposed crossings will take place under culverted sections of the rivers and streams.

Descriptions of the river environment for the open water channel crossings of the Santry and Tolka rivers have been provided in Section 13.4.1 and Table 13.1.

13.5.3 Surface Water Quality - Water Framework Directive

The 2009 Surface Water Regulations[13] give effect to the criteria and standards to be used for classifying surface waters in accordance with the WFD. Waters classified as 'High' or 'Good' must not be allowed to deteriorate, with waters classified as less than good being restored to at least good status within a prescribed timeframe.

A water body must achieve both good ecological status and chemical status before it can be considered to be of 'good' status. A status of less than good is assigned in the case of a surface water body where the environmental objectives are not met.

A baseline risk assessment was completed of the water bodies within each River Basin District in 2005. This assessment involved using information on water pollution indicators, point and diffuse pollution sources, water abstraction and existing commercial activities.

The risk assessment indicated whether the water body would meet the criteria for 'good status' or would be considered 'at risk' of not meeting the standards by 2015. This assessment provided the baseline information to prepare the River Basin Management Plan and Programme of Measures necessary to comply with the WFD standards. The WFD risk status of rivers and transitional waters was sourced from *epa maps* on gis.epa.ie. The risk status can be seen in Table 13.3.

Table 13.3: WFD Risk Status of Rivers and Transitional Waters

Waterbody	Risk Status (2005)
River Tolka	At risk of not achieving good status
River Santry	At risk of not achieving good status
Mayne River	At risk of not achieving good status
Tolka Estuary	At risk of not achieving good status
North Bull Island	At risk of not achieving good status
Mayne Estuary	Possibly at risk of not achieving good status
River Sluice	At risk of not achieving good status
Liffey Estuary	At risk of not achieving good status

[13] European Communities Objectives (Surface Waters) Regulations 2009 (S.I. No 272 of 2009)

13.5.4 Existing Surface Water Quality

The location of the EPA's Q-value stations for the rivers intersected by the proposed pipeline corridor are shown on Figure 13.11 and the details outlined in Table 13.4 below. The most recent EPA biological river quality data is for 2010.

Table 13.4: EPA Biological River Water Quality Ratings in Receiving Waters

Site ID	River	Distance from Pipeline	Q-Value 1996	Q-Value 1998	Q-Value 2002	Q-Value 2005	Q-Value 2007	Q-Value 2010
09T011100 Violet Hill, Finglas	Tolka	4 km u/s	3	2-3	2-3	2/0	3	3
09S010300, Clonasaugh Rd. Br.	Santry	1.5 km u/s	2	1-2	2	2-3	2-3	3
09M030500 Hole-in-the-wall	Mayne	2.5 km d/s	2-3	2/0	3	3	3	3

The current status of the Tolka and Santry Rivers is 'bad' and is classified as 'at risk of failing to achieve 'good' status by 2015 with a date to meet the objectives having been set at 2027. The current status of the Mayne River is 'poor', and is classified as 'at risk of failing to achieve good status by 2015'. The date to meet the objectives has been set at 2027. The WFD status of waterbodies was taken from *epa maps* on gis.epa.ie. The WFD status can be seen in Table 13.5 and in Figure 13.11. The WFD fish status of the Santry is 'bad', and the Tolka is 'poor'. IFI stated in their consultation response that the Tolka is a significant salmonid system and that they are hopeful of positive change for the fisheries status of the Cuckoo and Mayne.

Table 13.5: WFD Status of Rivers and Transitional Waters

Waterbody	Overall Ecological Status
River Tolka	Bad
River Santry	Bad
Mayne River	Poor
Tolka Estuary	Moderate
North Bull Island	Moderate
Mayne Estuary	Moderate
River Sluice	Good
Liffey Estuary	Good

The extent of these waterbodies is shown on Figure 13.1.

13.5.5 Physico-Chemical Water Quality Data

The physico-chemical results from DCC, FCC and the EPA are compared to the WFD criteria for good status in Table 13.5 below. There are monitoring results for the period 2007-2013 but not all parameters were measured every year nor were all monitoring locations.

Table 13.6: Physico-Chemical Results in Receiving Waters

Parameter	River Tolka	River Santry	Mayne River	WFD Criteria
Ammonia	Criteria not met at any of the monitoring locations	Criteria not met at any of the monitoring locations	Criteria not met at any of the monitoring locations	Good Status: mean of ≤0.065 mg N/l
Molybdate reactive phosphorus	Criteria not met at any of the monitoring locations	Criteria met at only one of the monitored sites (U/S Swords Road)	Criteria not met at any of the monitoring locations	Good Status: mean of ≤0.035 mg P/l
Biochemical oxygen demand	Criteria not met at any of the monitoring locations	Criteria not met at any of the monitoring locations	Criteria met at any of the monitoring locations	Good Status: ≤1.5 mg O_2 /l
Oxygen status	Criteria met at one monitoring location*	Criteria met at one monitoring location (Ballymun Road Bridge)	Criteria met at one of the monitoring locations (Belcamp)	Good Status: 95 percentile be above 80% and below 120%
pH	Criteria met at all locations	Criteria met at all locations	Criteria met at all locations	above 6.0 and below 9.0
Dangerous substances[14]	Of parameters measured none exceeded the WFD annual average or maximum allowable concentration during the monitoring period	Of parameters measured none exceeded the WFD annual average or maximum allowable concentration during the monitoring period	Of parameters measured none exceeded the WFD annual average or maximum allowable concentration during the monitoring period	

*monitoring took place at this location 2008-2009

13.5.6 Summary of Existing Water Quality

The current WFD status of the Tolka and Santry rivers is 'bad' and the status of the Mayne River is 'poor'. This is supported by the Q rating data which range from Q2-3 to Q3 and the physico-chemical data. The ammonia, molybdate reactive phosphorus and oxygen demand conditions are generally not met. The pH condition was met at all locations and the dangerous substances measured in the period 2007-2010 did not exceed the relevant maximum allowable concentrations. The Tolka and Santry Rivers are possibly 'at risk of not achieving good status' and the Mayne River is 'possibly at risk of not achieving good status'.

[14] Dataset 2007-2010. Data was not available 2011-2013.

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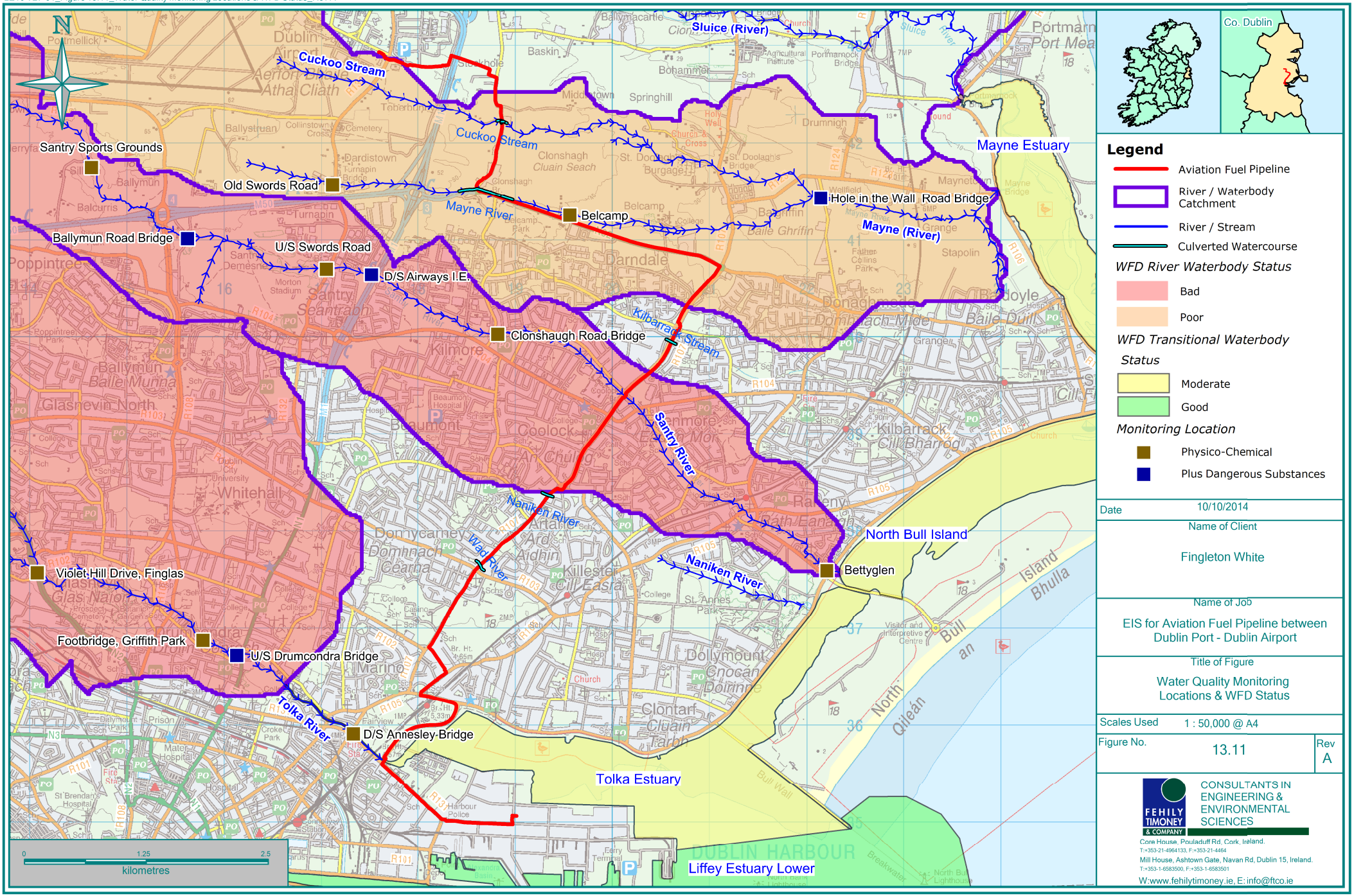
LE10-727-01_Figure 13.11_Water Quality Monitoring Locations & WFD Status_Rev A



Legend

- Aviation Fuel Pipeline
- River / Waterbody Catchment
- River / Stream
- Culverted Watercourse

WFD River Waterbody Status

- Bad
- Poor

WFD Transitional Waterbody Status

- Moderate
- Good

Monitoring Location

- Physico-Chemical
- Plus Dangerous Substances

Date	10/10/2014
Name of Client	Fingleton White
Name of Job	EIS for Aviation Fuel Pipeline between Dublin Port - Dublin Airport
Title of Figure	Water Quality Monitoring Locations & WFD Status
Scales Used	1 : 50,000 @ A4
Figure No.	13.11
Rev	A

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13.6 Summary of Key Possible Impacts

Various elements of both the construction and operational phases have the potential to impact on the surface water environment. The likely potential impacts of both construction and operation of the proposed pipeline prior to mitigation are described in this section of the EIS.

As the proposed pipeline corridor is situated in a predominantly urban setting, the pipeline will be laid in close proximity to and crossing existing services. There are also other proposed schemes in the vicinity of the proposed pipeline. The likely potential impacts of both construction and operation of the proposed pipeline on these existing and proposed services prior to mitigation are described in this section of the EIS.

There will be the requirement for one to two storage compounds. Potential sites have been identified at:

1. Dublin Port
2. Malahide Road Industrial Park off Greencastle Road

13.6.1 Construction Impacts

Potential impacts on hydrodynamics and flooding

During all phases of the construction of the proposed pipeline, certain activities have the potential to result in increased surface water run-off and sediment loading which could potentially impact local drainage patterns, cause siltation of the existing drainage network and result in localised flooding. These activities could also lead to contaminated discharge to the Cuckoo Stream, the Mayne River, the Kilbarrack Stream, the Santry River, the Naniken River, the Wad River, the Tolka River and various unnamed minor culverted streams. These include:

- Poorly managed reconnaissance of existing underground services could lead to damage and subsequent release of water including contaminated water into the environment from existing services such as existing foul/storm sewer pipes, culverted sections of tributaries of the River Tolka, watermains and the North Fringe Water Supply Main. In addition the operation of these conduits could be affected
- The excavation of trenches for pipe laying could lead to the obstruction of surface water flows, preventing the flows from reaching gullies, which could then result in some local ponding on the roads.
- Pumping of groundwater to sewers/watercourses during construction of the pipeline, could lead to overloading and blockages of existing services
- The proximity of the launch and reception areas (trenchless crossings) to a known flood risk area at the crossings of the rivers, presents a risk to construction personnel during the installation of the pipeline in this area and along Clontarf Road which has been identified as a flood risk area
- Works leading to erosion of the river banks/bed could negatively impact on the fisheries habitat.

Potential Impacts on Water Quality

There is the potential for contaminated surface water run-off to arise during the construction phase, particularly in the areas of open excavation close to the Tolka, Santry, Mayne, Wad and Naniken Rivers and the Cuckoo and Kilbarrack Streams. In consideration of the short lengths of trench excavations involved, should this sediment-laden run-off accidentally enter the watercourses, the impact would be low.

In the absence of appropriate mitigation the following potential impacts could arise during the construction of the proposed pipeline:

- Pumping of groundwater to sewers/watercourses during construction of the pipeline, could lead to contamination of existing services and waterbodies
- Uncontrolled release of silt laden surface water run-off, resulting from the construction of the pipeline could flow via drains, streams and rivers, into environmentally protected receiving waters, such as the South Dublin Bay and River Tolka Estuary SPA, North Dublin Bay pNHA and cSAC and Baldoyle Bay pNHA and cSAC

- The storage and disposal of any waste materials arising from construction/excavation activities or soil heaps stockpiled along the pipeline corridor could pollute groundwaters, watercourses and aquifers by wind, run-off or rain waters
- Uncontrolled discharge of water from hydro-static testing of pipeline during commissioning. Contamination with sediment and pollution of watercourses could lead to damage to the ecological integrity of surface water systems, the River Tolka which represents a regionally significant salmonid system, the Mayne and Santry Rivers
- Inadequate bunding at refuelling and storage locations (hydrocarbon interception etc.) in temporary compounds could lead to pollution of watercourses
- Inadequate sanitary facilities could lead to pollution of watercourses
- Poor spill containment measures could lead to pollution of watercourses
- The excavation of trenches for pipe laying, and the launch and reception areas could lead to silt laden surface water run-off
- Fouling of the road network by construction traffic with subsequent potential for sediment run-off to surface water
- Damage and subsequent release of water/effluent into the environment from existing services such as existing foul/storm sewer pipes, watermains etc.
- Inadequate management of construction phasing could lead to concentrated risks to a single watercourse.

Cumulative Impacts during Construction

The cumulative impacts of the construction of the proposed pipeline on the following proposed schemes have been considered for the purpose of this EIA:

- Metro North (on hold post 2016 when budgetary constraints will be reviewed)
- Proposed Eastern By-Pass
- proposed road scheme / bridge over the River Tolka just before the Railway Bridge along East Wall Road
- The proposed pipeline avoids the East Link Road proposals as outlined by DCC for Dublin Bay in the September 2007 Report *An Integrated Economic, Cultural and Social Vision for Sustainable Development*
- Proposed Cloghran Sewerage Scheme
- Rapid Bus Transit Projects
- Greater Dublin Drainage Project - new wastewater treatment works at preferred site north of R139
- North Fringe Water Supply Scheme, Contract 5 - North City Arterial Watermain: The Clontarf Flood Defence project comprises a series of flood bunds and walls along Clontarf Promenade between Alfie Byrne Road and the Bull Wall to protect nearby roads and properties from coastal flooding. The total length is circa 3km. Due to the synergies and common location of the North City Arterial Watermain and the Clontarf Flood Defences it was decided to combine the two projects. Planning approval was received in July 2008, however this project has not yet commenced.

With the implementation of the mitigation measures discussed in the following sections, it is considered that the construction of the pipeline would not increase the magnitude of the impacts of these schemes on the surface water environment along the pipeline corridor.

The developer will liaise with FCC on the Proposed Cloghran Sewerage Scheme route to determine the appropriate separation distances from the sewer.

It will be necessary to liaise with the developers of the above schemes on the phasing of these projects.

13.6.2 Operational Impacts

During the operational phase of the proposed scheme, the potential impacts on the surface water environment in the study area comprise:

Potential impacts on Hydrodynamics and Flooding

The potential impacts from the operation of the proposed pipeline include a risk of ingress of flood waters into the pipeline and/or egress of fuel from the pipeline during a flood event, through the joints or access chambers or through the wall of the pipeline.

A spillage from the pipeline in the vicinity of the lower tier Seveso site at the Tolka Quay Road presents a risk of fire spreading to the nearby site.

A rupture of the pipe could lead to localised flooding of fuel.

Potential Impacts on Water Quality

The main potential risk on water quality from the operation of the proposed pipeline is from a potential leak which if significant, could lead to contamination of groundwater and surface water bodies.

Cumulative Impacts during Operation

The cumulative impacts of the operation of the proposed pipeline with the proposed Metro North, proposed Eastern By-Pass, proposed road scheme/bridge over the River Tolka just before the Railway Bridge along East Wall Road, the R132 Upgrade project, Proposed Cloghran Sewerage Scheme, Rapid Bus Transit Projects and Greater Dublin Drainage Project - new wastewater treatment works at preferred site north of R139 have been considered for the purpose of this EIS. Potential impacts such as a leak causing pollution have been considered. Many of these projects are linear, crossing through different catchments, over a few kilometers, therefore the probability of a significant pollution incident concentrated within any one catchment is very low. With the implementation of the mitigation measures discussed in the following sections, it is not considered that the operation of the scheme would increase the magnitude of the impacts of these schemes on the surface water environment along the pipeline corridor.

13.6.3 Decommissioning Impacts

The main impacts arising from the decommissioning phase include:

Potential Impacts on Water Quality

The main potential risk on water quality from the decommissioning operations include an uncontrolled release of fuel being removed from the pipe and/or an uncontrolled discharge of the water used to flush the pipe to a surface water body.

13.7 Mitigation Measures

This section describes the measures proposed to mitigate the significant adverse impacts of both the construction and operational phases of the proposed pipeline.

13.7.1 Construction Impact Mitigation Measures

Impacts on the surface water environment along the pipeline corridor will be mitigated where appropriate during the construction phase of the proposed scheme by implementing best practices on site. These include, but will not be limited to, the following:

Measures to mitigate potential impacts on hydrodynamics and flooding

- In this chapter of the EIS, mapping showing the locations of existing services and proposed new services has been acquired from DCC and FCC and mapped with the proposed pipeline corridor overlaid to identify any existing services. Liaison will be followed up with DCC, FCC and Irish Water at detailed design stage to seek approval of the proposed construction methodology and to identify any new services at that stage. Any modifications, diversions or replacement of existing drainage network will be constructed in accordance with the requirements of DCC, FCC and Irish Water. No work will be carried out on the assets of DCC, FCC or Irish Water without their specific permission. During the entire construction phase, the works will be programmed and phased so that any blocking of the existing drainage network will be avoided so as to prevent localised flooding. Slit trenching will be undertaken in advance of the works to identify the location of culverted sections of tributaries of the Tolka River, foul and storm water drainage sewers, watermains and the North Fringe Water Supply Scheme amongst other utility crossings along the route of the proposed pipeline. The pipeline will be laid in 24 m sections as construction progresses. The 200 mm diameter pipe will be laid at a nominal depth of cover of 1.2 m. This depth will be increased where necessary to avoid existing sewers or watermains
- Mitigation measures will be provided where surface water flows may be temporarily prevented from reaching gullies during trench excavation. Typical mitigation measures will include the provision of temporary overground surface water channels using sand bagging for example to divert flows to downstream gullies
- The integrity of the pipeline will be high with all joints radiographed
- Should it be required, any pumping of groundwater to sewers/watercourses during construction of the pipeline will only be carried out under a trade effluent discharge licence from DCC or FCC. Discharges from dewatering activities will be passed through a settlement pond before discharging to the surface water sewer network. Alternatively, discharges will be pumped to onsite bowsers where they will be removed off-site for treatment at an appropriate WWTP. There will be no direct pumping of contaminated water from the works to a watercourse at any time
- The proposed pipeline will be laid under all culverts and under the river bed at the Santry River and the Tolka River crossings using trenchless technology techniques
- Trenchless technology will be used under roads between M1 junctions 1 and 2 . This will avoid damage to existing services, and will also avoid major traffic disruption
- A FRA Stage 1 has been prepared which takes cognisance of the impact of the location of construction areas shown to be within the indicative floodplain. The FRA Stage 1 report is included in Appendix 13.1. The section of roadway proposed for the location of the launch pit for the Cuckoo Stream skirts the 1 in 100 year indicative fluvial floodplain of the Cuckoo Stream at that location and it is in a local low point which experiences pluvial flooding. Access to the launch pit will be protected from floodwaters during construction, using temporary mitigation measures, such as temporary berms. The section of roadway proposed for the location of the launch and reception pits for the Kilbarrack Stream crossing is below the 1 in 100 year indicative floodplain level of the Kilbarrack Stream at that location. Access to the pits will be protected from floodwaters during construction at the location of the Kilbarrack Stream. The launch and reception areas for the Santry River trenchless crossing will be raised on platforms during construction to avoid any ingress of floodwaters. Access to the pits will be protected from floodwaters during construction. The crossing location for the Naniken River is within a local low point which may experience pluvial flooding, according to the indicative mapping. Temporary mitigation measures, such as temporary berms will be put in place to divert pluvial flood flows from an extreme event at the Launch and Reception Pits. Flood warnings and extreme weather forecasts will be strictly monitored to ensure the safety of construction personnel during construction activities at Clontarf Road and adjacent to the River Tolka. Construction activities will be suspended and excavations protected in advance of any extreme storm or flood forecasts and they will only resume when the extreme event has passed
- Cognisance will be taken of the NRA "Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes" and the "Requirements for the Protection of Fisheries Habitat During Construction and Development Works at River Sites" (Eastern Regional Fisheries Board) in the planning and implementation of the watercourse crossings. All works areas will be reinstated fully in a manner that minimises the potential for erosion of the bed and banks of rivers and streams. The launch and reception pits will be backfilled with 300 mm of sand or pea gravel, then 700 mm of lean mix concrete to 200 mm below ground surface.

Measures to Mitigate Potential Impacts on Water Quality:

- Discharges arising from the construction phase of the proposed scheme, such as dewatering of trenches, entering the foul/surface water sewer network will be subject to and in accordance with the requirements of any discharge licences granted by DCC and FCC. Any discharges will be passed through a settlement pond before discharging to the surface water/sewer network. Alternatively, discharges will be pumped to onsite bowsers where they will be removed off-site for treatment at an appropriate WWTP. Should it be required, any pumping of groundwater to sewers/watercourses during construction of the pipeline, will only be carried out under a trade effluent discharge licence from DCC or FCC. There will be no direct pumping of any contaminated water from the works to a watercourse at any time
- The river/stream crossings will be completed using trenchless technology. Trenchless techniques will significantly reduce the risk of siltation due to the construction works at the location of the proposed river crossings, as there will be no disturbance to the bed of the river or flow within the channel itself. Silt fencing will be provided around any exposed areas to prevent the ingress of suspended solids into adjacent watercourses. These mitigation measures will prevent surface water contamination and will prevent subsequent flows of contaminated water into watercourses reaching environmentally protected receiving waters
- The construction methods for the crossing of the River Tolka will take cognisance of the IFI "Requirements for the Protection of Fisheries Habitats during Construction and Development Works at River Sites". Cognisance will be taken of the NRA "Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes" in the planning and implementation of the watercourse crossings of the rivers and streams. The project will be subject to and in accordance with a Foreshore Licence for the River Tolka crossing as the river is tidal at that point
- All backfill material (sand & pea gravel and lean mix concrete) will be brought to each working area on an as needed basis and will be not be stockpiled on site. This will prevent silt laden run-off. To minimise runoff from stockpiles, excavated soil will be removed directly onto an awaiting HGV and removed by a permitted contractor for recovery/disposal at an appropriate facility (in agreement with the local authorities)
- Water used during commissioning for hydro-static testing of the pipeline will be collected and either discharged to surface water or sewer (under licence) or collected and transported to an appropriate WWTP. Agreement will be sought from the Local Authorities on the use of water for testing
- All works will be completed in line with the Construction Plan included in Appendix 2.2which will ensure that good construction practices are adopted throughout the construction period and will contain the recommended mitigation measures outlined in this chapter of the EIS to deal with potential adverse impacts identified in advance of the scheme. As requested further consultation will be held with the IFI prior to commencing construction
- Petrol interceptors will be provided at the temporary compound and any stored fuels and oils will be bunded to 110 % of the storage vessel. Drainage from bunded areas will be diverted for safe disposal off site. The integrity and water tightness of bunds and their resistance to penetration by water or other material stored therein will be confirmed by the contractor prior to use as a storage area and checked regularly. Only emergency maintenance to construction plant will be carried out on-site, and will preferably be carried out at the temporary construction compound(s), unless vehicles have broken down necessitating maintenance at the point of breakdown. Re-fuelling of construction equipment and the addition of hydraulic oil or lubricants to vehicles/equipment will take place in designated bunded areas within the temporary construction compound. The vehicles and equipment will not be left unattended during refuelling. All plant and machinery will be stored within the Compound(s) each night
- Portaloo facilities will be emptied by an appointed contractor
- Any hazardous waste residuals or potentially contaminated sludge from spill clean-up will be stored within appropriate metal or plastic containers in temporary bunded storage areas in the construction compounds prior to removal by an authorised waste management contractor for off-site treatment/recycling/disposal at a permitted or licensed facility
- Granular material will be placed over exposed clayey subsoil or made ground, particularly in the vicinity of watercourses, to prevent erosion of fines and/or rutting by site traffic/plant and to prevent fouling of the road network by fines
- Installation of the pipeline will be limited to four sections, each section 24 m in length. This will limit the scale of construction at any one time and avoid any potential risk of large scale pollution occurring.

13.7.2 Operational Impact Mitigation Measures

The likelihood of surface water contamination from the operation of the proposed pipeline is considered low. The depth of burial of the pipeline will be a minimum of 1.2 m, and the River Tolka crossing will have an additional leak detection system. The scheme will not increase the amount of hardstanding in the study area as the locations proposed for the Above Ground Stations are already areas of hardstanding within Dublin Airport and Dublin Port.

In summary, the following mitigation measures will be implemented:

Measures to mitigate potential impacts on hydrodynamics and flooding

- All storm water run-off generated during the operation of the AGIs will be managed by a surface water collection system which will feed into the existing drainage systems at Dublin Port and Dublin Airport. The surface water collection system will accommodate extreme rainfall events with an allowance for climate change
- The pipe material (steel) and wall thickness provides the pipeline with negative buoyancy so it will not float even in a fully flooded open trench empty of product
- The relevant statutory bodies will be consulted in relation to all abstractions and discharges for hydro-testing and the necessary consents will be obtained before commencement of work
- The flood extent has been identified in detail at each crossing location in the FRA Stage 1 report in Appendix 13.1, in order to ensure that the location of any significant infrastructure associated with the pipeline will not be impacted by floodwaters during the operation of the pipeline.

Measures to Mitigate Potential Impacts on Water Quality

Mitigation measures by design include:

Following an examination of the AMEC report on leakage risk and detection it was determined that the pipeline design (which will be designed, constructed and operated in accordance with I.S. EN 14161:2011 – Petroleum and Natural Gas Industries – Pipeline transportation systems (ISO 13623:2009 modified)), provides sufficient confidence in relation to pipe integrity, so as to significantly reduce the risk of leakage. The report states that *The maximum spill size of a pipeline with 2 section isolation valves is less than 3 times that for a road tanker but the frequency is over 90 times lower than that for a road tanker. It is therefore concluded that the optimum solution for the transfer of aviation fuel is by a pipeline with two section isolation vavles*.

In addition:

- The operation of the pipeline will be monitored on a 24/7 basis and in the event that a leak is detected, the automatic leak detection system will ensure that the pipeline shuts down
- A secondary automatic detection of interference in the form of a fibre optic communication cable will be laid above the pipe. The two emergency shutdown valves positioned along the pipeline which will reduce the potential volume of product during an event
- Additional external leak detection will be provided at the Tolka River. This will comprise a slotted duct installed in the pipeline trench with a sensing cable installed in the duct. The duct will have 0.5mm wide slots to prevent it filling with silt. The pipeline itself will be laid 2 m below the bed of the river and therefore a significant event would have to occur for product to enter the surface water
- Leak detection by visual inspection which includes a fortnightly walkover of the route by operators
- The proposed pipeline will be laid under all culverts and under the river bed at the Santry River and the Tolka River using trenchless technology techniques to minimise potential impacts from a leak
- All discharges from the yard areas at the AGIs at Dublin Port and Dublin Airport will discharge to existing surface water networks

13.7.3 Decommissioning Mitigation Measures

In the unlikely event that the pipeline is decommissioned, the pipeline will be decommissioned in accordance with Sections 13.2.4 and 13.6 of I.S. EN 14161:2011. This involves emptied of fuel and flushed with water sourced from mains The water will then be collected, sampled for contaminants and disposed of either to a surface water body or collected and taken offsite for disposal at an appropriate wastewater treatment facility (under licence).

13.8 Do Nothing Impact

If the construction of the pipeline does not go ahead then the risks associated with the overland carriage of fuel in oil tankers will remain at existing levels. These risks include, traffic accidents leading to fuel spillages on roads and subsequent pollution of watercourses. Road spillages also endanger other road users, presenting a risk of skidding on the road surface. The AMEC report, which is included in Appendix 2.1 of Volume 3 of the EIS examined the statistical differences in the risks between the two methods of transport for the fuel i.e. by pipeline and by tanker. The report concluded that although the average spill size from the pipeline is higher than by tanker, the failure frequency is significantly much lower than a road tanker incident giving a much reduced risk.

13.9 Residual Impacts after Mitigation

This section describes any residual impacts when the mitigation measures have been put in place.

13.9.1 Construction Residual Impacts

Provided that the impact mitigation measures outlined in this chapter are put in place, it is considered that all other impacts of the construction phase on surface water within the study area can be mitigated, thus the residual impact is considered low.

13.9.2 Operation Residual Impacts

Pipelines have the potential to leak and contaminate the surrounding ground or nearby watercourses. However, the likelihood of contamination from a leak from the proposed aviation fuel pipeline is low due to the design of the pipeline, the material used and the operational monitoring system. Following implementation of the mitigation measures outlined in this chapter, the residual impact is considered low.

13.10 Monitoring

Hydrostatic testing of the pipeline before operation will ensure the integrity of the pipeline. Leak detection monitoring as outlined in Chapter 3 of the EIS will ensure that any damage to the pipeline is identified at the earliest possible stage to ensure minimal environmental consequences.

13.11 References

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