Cork Line Level Crossings

Volume 3, Chapter 9: Water

Iarnród Éireann

March 2021

Cork Line Level Crossings

Project No:	32111000
Document Title:	Volume 3, Chapter 9: Water
Document No.:	9
Revision:	A04
Date:	March 2021
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Document history and status

Revision	Date	Description	Author	Checked	Reviewed	Approved
A01	December 2019	Client Review	LB	RW	RW/HC	AB
A01	July 2020	Update following client review and updated design	LB	HC	HC	AB
A02	September 2020	Update following Internal Review & FRA	GQ	HC	HC/RM	AB
A03	December 2020	For Legal Comment	HC	RM	RM	AB
A04	March 2021	For Issue to An Bord Pleanála	HC	RM	RM	AB

Contents

9. Water 1
9.1 Introduction 1
9.1.1 Consultation 1
9.2 Study Area 2
9.3 Baseline Environment 3
9.3.1 Desktop Study Data and Information Sources 4
9.3.2 Overview of Surface Water Receptors 4
9.3.3 Designated Sites 8
9.3.4 XC187 Fantstown 9
9.3.5 XC201 Thomastown 10
9.3.6 XC209 Ballyhay 11
9.3.7 XC211 & XC212 Newtown and Ballycoskery 13
9.3.8 XC215 Shinanagh 15
9.3.9 XC219 Buttevant 16
9.3.10 Flood Risk 18
9.4 Assessment Methodology 19
9.4.1 Legislation, Policy & Guidance 19
9.4.2 Determining Significance 20
9.4.3 Mitigation 24
9.5 Potential Effects of the proposed Project 24
9.5.1 Do Nothing Scenario 24
9.5.2 Generic Construction Impacts 25
9.5.3 Drainage Strategy – All Sites 25
9.5.4 XC187 Fantstown 26
9.5.5 XC201 Thomastown 26
9.5.6 XC209 Ballyhay 28
9.5.7 XC211 & XC212 Newtown and Ballycoskery 29
9.5.8 XC215 Shinanagh 32
9.5.9 XC219 Buttevant 35
9.5.10 Combined Effects of all Sites 39
9.6 Mitigation Measures 41
9.6.1 Construction Sequencing 41
9.6.2 Generic Mitigation Measures 41
9.6.3 XC201 Thomastown 46
9.6.4 XC209 Ballyhay 46
9.6.5 XC211 & XC212 Newton & Ballycoskery 46
9.6.6 XC215 Shinanagh 46
9.6.7 XC219 Buttevant 47

9.7 Residual Effects 47
9.8 Interactions 48
9.9 Cumulative Effects 48
9.10 Difficulties Encountered in Compiling Information 48
9.11 References 49

Table 9.1:Consultation Responses 1
Table 9.2 Baseline Conditions of Water Bodies in Shannon Estuary South and Blackwater 6
Table 9.3: Summary of Existing Flood Risk from each source of flooding 18
Table 9.4: Climate Change Impacts 19
Table 9.5: Example Criteria Used to Evaluate the Importance of Surface Water Receptors and their Attributes 20
Table 9.6: Criteria for Estimation of Magnitude of Impact on Surface Water Receptors 21
Table 9.7: Categories of Environmental Impacts 22
Table 9.8: Descriptions of Environmental Impacts 22
Table 9.9: Site specific impacts from the proposed Project (XC201 Thomastown) 26
Table 9.10: Site specific impacts from the proposed Projects (XC211 Newtown and XC212 Ballycoskery) . 29
Table 9.11: Site specific impact at XC215 Shinanagh 33
Table 9.12 Site specific impacts at XC219 Buttevant 35
Table 9.13: Combined Effects across all Sites (Pre-Mitigation) 39
Table 9.14: Residual Construction Impacts 47

Inset Figure 9.1WFD Catchments 3
Inset Figure 9.2 WFD Water bodies 8
Inset Figure 9.3 Water bodies in the vicinity of XC187 Fantstown 10
Inset Figure 9.4 Water bodies in the vicinity of XC201 Thomastown 11
Inset Figure 9.5 Water bodies in the vicinity of XC209 Ballyhay 12
Inset Figure 9.6 Water bodies in vicinity of XC211 Newtown and XC212 Ballycoskery 14
Inset Figure 9.7 Water bodies in the vicinity of XC215 Shinanagh 16
Inset Figure 9.8 Water bodies in the vicinity of XC219 Buttevant 17

Table of Acronyms

Acronym	Meaning
ADS	Arterial Drainage Systems
AEP	Annual Exceedance Probability
CCOP	Construction Code Of Practice
CCTV	Closed Circuit Television
CEMP	Construction Environmental Management Plan
CIRIA	Construction Industry Research and Information Association
DD	Drainage Districts
DO	Dissolved Oxygen
ECoW	Ecological Clerk of Works
EIAR	Environmental Impact Assessment Report
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
EU	European Union
FRA	Flood Risk Assessment
Ha	Hectares
IÉ	Iarnród Éireann
IFI	Inland Fisheries Ireland
LAP	Local Area Plan
LC	Level Crossing
m	Metres
NHA	National Heritage Area
NRA	National Roads Authority
OPW	Office Of Public Works
PFRA	Preliminary Flood Risk Assessment
pNHA	Proposed National Heritage Area
RBMP	River Basin Management Plan
SAC	Special Area of Conservation
SPA	Special Protection Area
SUDS	Sustainable Urban Drainage Systems
TII	Transport Infrastructure Ireland
TSS	Total Suspended Solids
WFD	Water Framework Directive
WWTP	Waste Water Treatment Plant

9. Water

9.1 Introduction

This Chapter assesses the impact of the proposed closure or upgrade of seven level crossings on the Dublin-Cork Railway Line (hereafter referred to as the proposed Project) on surface water receptors. For the purposes of this assessment, a surface water receptor is any watercourse or standing water i.e. pond or lake potentially affected by the Construction Phase or Operational Phase of the proposed Project, as defined by the study areas set out for each element of the proposed Project.

The assessment considers the three principal attributes of each water receptor; hydrology, water quality and geomorphology in order to determine the significance of the impact on the receptor.

The purpose of this chapter of the EIAR is to:

- Identify the surface water receptors within the Shannon South Estuary and the Blackwater (Munster) catchments that have the potential to be affected by the Construction or Operational Phase of the Project;
- Identify the potential effects of the proposed Project on those surface water receptors; and
- Identify any mitigation measures to ensure that there is no adverse significant effect on the Water Framework Directive (WFD) status of nearby water bodies.

A separate Flood Risk Assessment (FRA), which includes details of the proposed drainage strategy for the proposed Project, has been carried out (Volume 5, Appendix 9A) and summary text of the key findings is provided in Section 9.3 Baseline (Stage 1 and 2 Flood Risk Assessment), Section 9.5.9 XC219 Buttevant (Stage 3 FRA), Section 9.5.11 (Justification Tests) and Section 9.5.9.

9.1.1 Consultation

Consultation responses of relevance to this Water Chapter are summarised in Table 9.1

Table 9.1:Consultation Responses

Consultee	Comment	Response
Cork County Council (2nd December 2019)	Level crossings located at XC209 Ballyhay, XC211 Newtown, XC212 Ballycoskery, XC215 Shinanagh and XC219 Buttevant are all located within the catchment of the Blackwater River (Cork/Waterford) Special Area of Conservation (Site Code:2170). It is recommended that a mammal survey for otter should be carried out in respect of each of these sites and consultation should take place with NPWS and IFI in relation to each of these sites as there is potential for direct and indirect impacts on the SAC and fisheries.	Potential water quality effects on the SAC are considered in this chapter, for during construction and operation of the proposed Project. Mammals are considered in Volume 3, Chapter 7: Biodiversity and in the Natura Impact Statement (NIS) at Volume 5, Appendix 7H. IFI and NPWS have both been consulted with directly, during scoping and since.

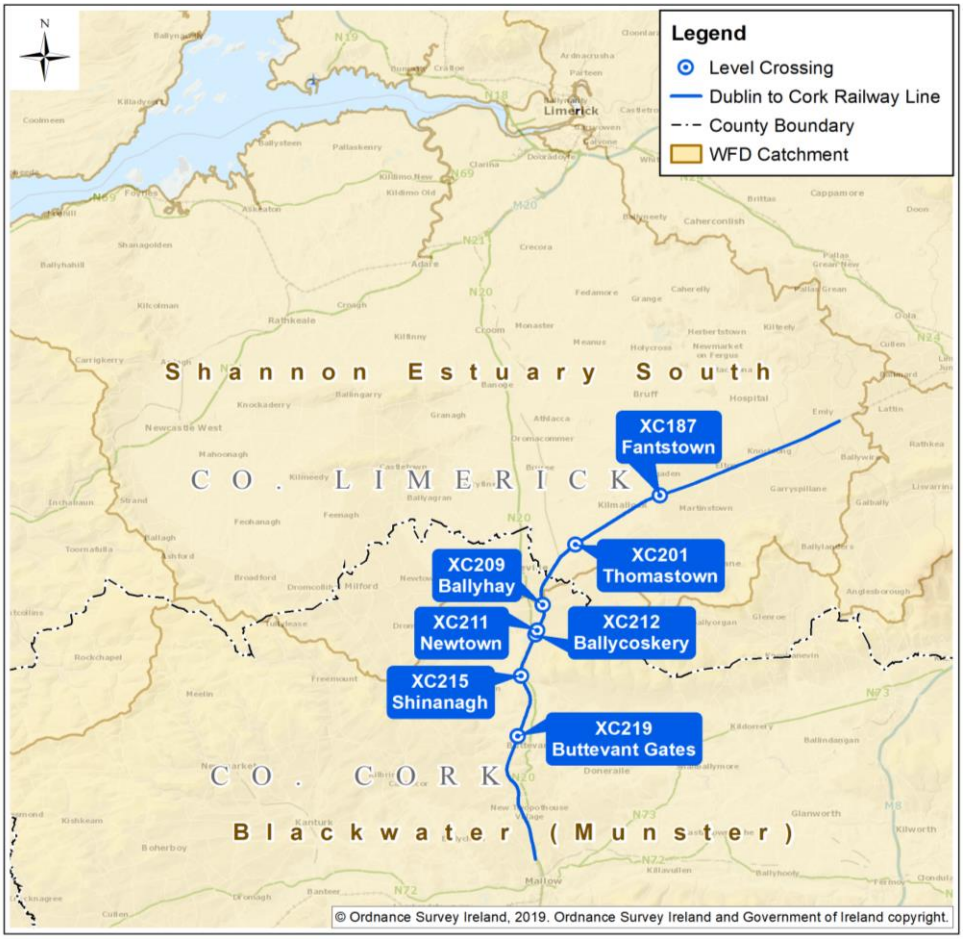
Consultee	Comment	Response
Limerick County Council (10th January 2020)	In relation to water issues, particularly for those crossings with water courses nearby (e.g. Fantstown p. 28) it would be worth giving specific details of measures designed to prevent run off and local water contamination. This might also arise in S17.4 resource use and waste (p.74) and the provision of a construction and Environmental management Plan (CEMP) would help address these issues.	Run off is addressed generally in this Chapter. An outline CEMP has been prepared and is included at Volume 5, Appendix 1I). Specific measures to control silt are planned to be implemented at each of the proposed Project sites.
Inland Fisheries Ireland (3rd December 2019)	The calculations on culvert dimension will be very much 'flood' driven and that the relevant culvert size will adequately allow for fish passage.	Only one site has proposed water body crossings; at XC219 Buttevant a river bridge and culvert are proposed. These have been designed to accommodate flows to minimise flood risk; they have also been designed to allow for fish passage. Further details on this are provided in Volume 3, Chapter 7: Biodiversity.
Various (local)	A number of stakeholders highlighted the potential for some increased surface water as a result of the new overpass at XC219 Buttevant or queried where it may flow to highlighting concerns about any potential increase in surface water flooding as there are some issues with surface water flooding at present with a very small fall in the road.	Flood Risk is addressed in the FRA (Volume 5, Appendix 9A); a summary of key findings is also presented in this chapter. All new roadways have been designed to ensure there is no net increase in runoff as a result of the proposed Project. This includes extensive use of new swales at all seven sites.
Various (local)	A number of stakeholders highlighted the location of pipes which supply their private land at both XC201 Ballyhay and XC219 Buttevant.	Local utilities will be confirmed prior to commencement of construction.

9.2 Study Area

The seven sites are within a 24km stretch of the Dublin-Cork Railway Line; from the northernmost point, Level Crossing XC187 at Fantstown to Level Crossing XC219 at Buttevant. The nearest urban areas to the sites are Kilmallock in the north which lies approximately 2km west of XC187 Fantstown, Charleville which lies approximately 2km north west of XC209 Ballyhay and Buttevant in the south which lies approximately 0.9km south east of XC219 Buttevant.

The sites fall within two hydrological catchments; the Shannon South Estuary in Limerick flowing generally north and west; and the Blackwater (Munster) in Cork, flowing generally south (see Inset Figure 9.1).

Inset Figure 9.1WFD Catchments



The Environmental Protection Agency (EPA) Shannon South Estuary Catchment Assessment 2010 – 2015, states the catchment comprises of 18 sub catchments with 95 river water bodies and 17 lakes.

The EPA Blackwater (Munster) Catchment Assessment 2010 – 2015 states this catchment comprises of 28 sub catchments, with 158 river water bodies and no lakes.

The proposed Project is largely a roads project, with new road over rail bridges and link roads. As such, this assessment has been carried out in accordance with the Transport Infrastructure Ireland (TII) Guidelines on Procedures for Assessment and treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (2009) (hereafter referred to as 'the TII Guidelines'.

In accordance with the TII Guidelines, the study area for direct effects is set at 250m beyond the land take boundary for each of the sites; wider study areas of 1km and 10km have also been used to identify any water body that may be hydrologically connected to the sites and any site designated for biodiversity that may be hydrologically connected to these water bodies.

9.3 Baseline Environment

This Section provides an overview of the baseline environment across the proposed Project as a whole, highlighting particular areas for commentary, where appropriate.

9.3.1 Desktop Study Data and Information Sources

The assessment of surface water consists of a desktop review to collate all available information for the hydrology of the study area. This includes a review of all available information as well as reference to online resources. The following data sources will be referred to during the assessment:

- Ordnance Survey of Ireland - current and historic mapping;
- The Shannon River Basin Management Plan (RBMP) 2009-2015, the South Western RBMP 2009-2015, their associated Water Management Unit Action Plans (various) and the 2nd Cycle National RBMP 2018-2021;
- EPA Shannon South Estuary Catchment Assessment 2010–2015;
- The EPA Blackwater (Munster) Catchment Assessment 2010–2015;
- OPW North Western CFRAM study, fluvial flood extents;
- OPW Preliminary Flood Risk Assessment (PFRA), fluvial flood extents;
- Office of Public Works Historical Flood Reports (Website www.floodmaps.ie);
- County and Regional Development Plans for the Benefitting Counties in the study area; and
- Online interactive maps:
  - EPA maps (www.epa.ie);
  - WFD maps (www.catchment.ie);
  - General maps: (www.geohive.ie);
  - Statistical maps: (www.cso.ie);
  - CFRAM Data (www.floodmaps.ie);
  - CFRAM Flood Risk Types (Preliminary Flood Risk Assessment Data) Mapping, (http://www.cfram.ie/pfra/interactive-mapping);
  - OPW Flood information (https://www.floodinfo.ie).

Details are also drawn from supporting documents to the Application, as follows:

- Drainage Plans (Volume 4, Figures 3.I, 4.G, 5.I, 6.I and 7.K);
- Flood Risk Assessment (FRA) (Volume 5, Appendix 9A);
- Ground Investigation (GI) study (Volume 5, Appendix 3A); and
- Natural Impact Statement (NIS) (Volume 5, Appendix 7H).

9.3.2 Overview of Surface Water Receptors

Shannon Estuary South

This catchment includes the Deel and Maigue sub- catchments and all streams entering the tidal water in the Shannon Estuary between Kilconly Point and Thomond Bridge, Limerick. This drains a total area of 2,033km^2. The population density of the catchment is 55 people per km^2. This catchment is predominantly low-lying, flat and underlain by Tournaisian and Visean limestones bedrock with the exception of a few isolated hills.

XC187 Fantstown and XC201 Thomastown level crossings are within the Shannon Estuary South catchment and are both located within the Maigue_SC_020 sub-catchment.

Blackwater (Munster) Catchment

The Blackwater (Munster) Catchment includes the Blackwater (Munster) and Awbeg (Buttevant) sub-catchments, amongst others, and all water bodies between East Point and Knockaverry, Youghal, Co. Cork, draining a total area of 3,310km^2. The total population of the catchment is approximately 109,030 with a population density of 33 people per km^2. The catchment is underlain by Tournaisian and Visean limestones bedrock with the exception of a few isolated hills.

XC215 Shinanagh and XC219 Buttevant level crossings are located within the Awbeg [Buttevant]_SC_020 sub-catchment; XC209 Ballyhay, XC211 Newtown and XC212 Ballycoskery are within the Awbeg [Buttevant]_SC_010 sub-catchment.

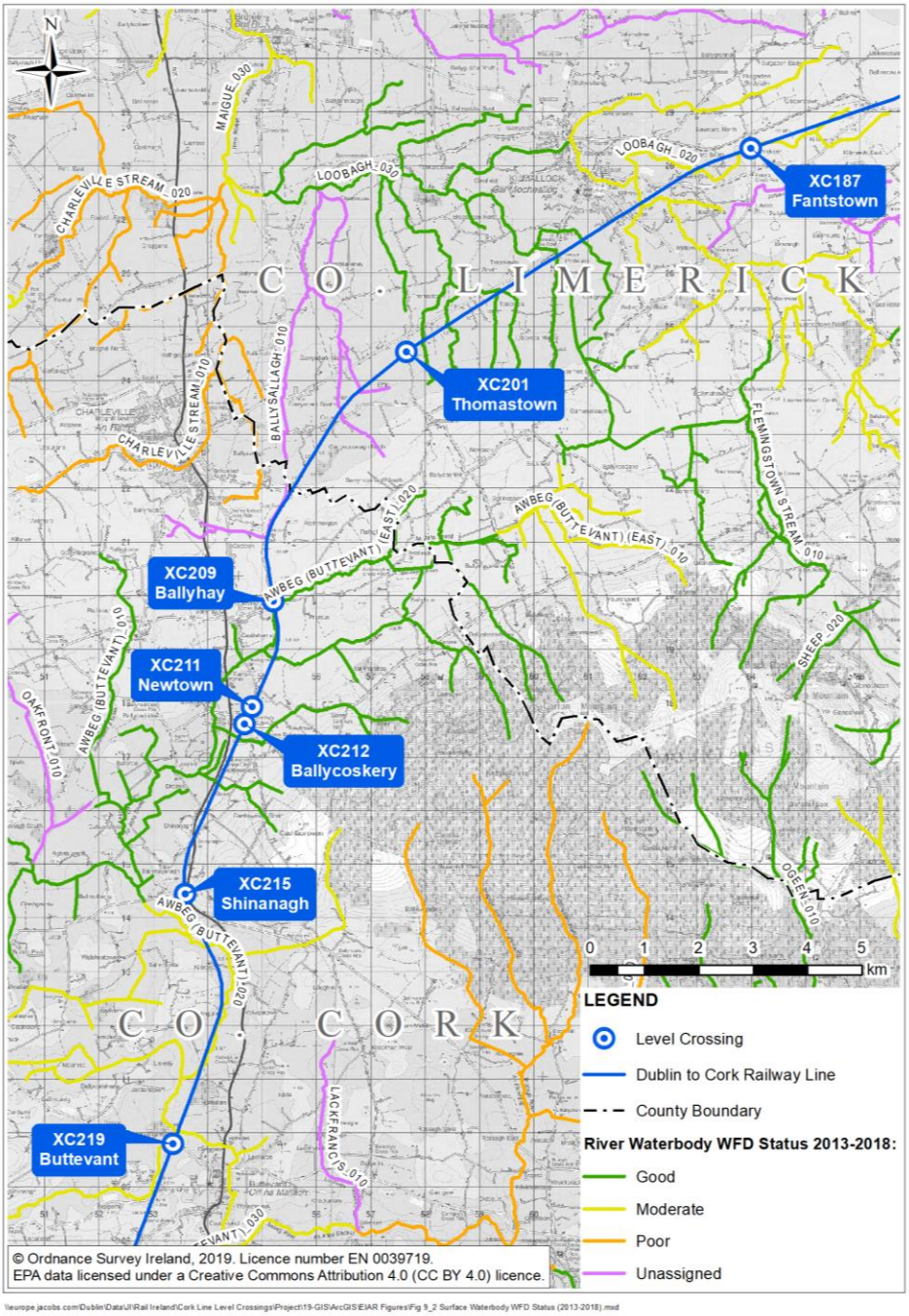
Table 9.2 provides baseline information for the water bodies within the study area, and this information is illustrated on Inset Figure 9.2.

Table 9.2 Baseline Conditions of Water Bodies in Shannon Estuary South and Blackwater

Catchment	Sub-catchment	WFD Water Body (EU Code)	EPA Name	Level Crossing	WFD Status (2013-2018)	WFD Risk Status	Pressures Identified	Protected Areas
Shannon Estuary South	Maigue_SC_020	LOOBAGH_030 (IE_SH_24L010600)	Gortacrank	XC201 Thomastown	Good	Review	Anthropogenic pressures: Nutrient and organic pollution	None
			Kilbreedy 24					
			Thomastown 24					
	Maigue_SC_020	BALLYSALLAGH_010 (IE_SH_24B670530)	Garrynderk North	XC201 Thomastown	Unassigned (assumed Good)	N/A	Agriculture pressure: nutrient pollution	None
	Maigue_SC_020	LOOBAGH_020 (IE_SH_24L010400)	Ahatrishnaun stream	XC187 Fantstown	Moderate	Review	No pressure data available	None
			Ahnagluggin stream					
	Maigue_SC_020	FAIRYFIELD_GLEBE_010 (IE_SH_24F050850)	Fairyfield Glebe	XC187 Fantstown	Unassigned (assumed Good)	Review	Agriculture pressure: nutrient pollution	None
Blackwater (Munster)	Awbeg[Buttevant]_ SC_010	AWBEG (Buttevant) (East)_020 (IE_SW_18A050700)	Rathmorgan	XC209 Ballyhay	Good	At Risk	Pressures from Extractive Industry (Quarry) and Forestry (Clear Felling)	Direct hydrologically linked to Blackwater River (Cork/Waterford) SAC (Flows directly into AWBEG (Buttevant)_010 which is designated as an SAC.
			Awbeg [Buttevant] [East]	XC209 Ballyhay XC212 Ballycoskery XC211 Newton				
			Farran 18					
			FARRAN 18					
			Newton 18	XC212 Ballycoskery				
			Newton Ballyhay					

Catchment	Sub-catchment	WFD Water Body (EU Code)	EPA Name	Level Crossing	WFD Status (2013-2018)	WFD Risk Status	Pressures Identified	Protected Areas
			Aglish Cross Roads	XC211 Newton				
			Awbeg [Buttevant]	XC215 Shinanagh XC219 Buttevant				
			Leap					
			Lisballyhay					
	Awbeg[Buttevant]_ SC_010	AWBEG (Buttevant)_010 (IE_SW_18A050550)	Shinanagh	XC215 Shinanagh, XC212 Ballycoskery, XC211 Newton	Good	At Risk	Hydromorphology – Channelisation Agriculture	Part of Blackwater River (Cork/Waterford) SAC
			Imphrick					
			Awbeg [Buttevant] East					
			Awbeg [Buttevant] West					
			Awbeg [Buttevant]					
	Awbeg[Buttevant]_SC_020	Awbeg (Buttevant)_020 (IE_SW_18A050700)	Pepperhill	XC219 Buttevant	Moderate	At Risk	Pressures from Urban Wastewater (Combined Sewer Overflow), Urban Run-Off and Agriculture	Part of Blackwater River (Cork/Waterford) SAC
			Awbeg [Buttevant]					
		Awbeg (Buttevant)_030 (IE_SW_18A050900)			Moderate	At Risk	Pressures from Urban Wastewater and Hydromorphology as a result of channelisation and erosion	Part of Blackwater River (Cork/Waterford) SAC

Inset Figure 9.2 WFD Water bodies



9.3.3 Designated Sites

Blackwater River (Cork/Waterford) Special Area of Conservation (SAC) is located along the Awbeg (Buttevant)_020. The SAC is located approximately between 0.25km to 1.5km from the sites XC209 Ballyhay, XC211 Newtown, XC212 Ballycoskery, XC215 Shinanagh and XC219 Buttevant. The proposed works at XC219 Buttevant includes the culverting of the Pepperhill EPA segment of Awbeg (Buttevant)_020 approximately 300m upstream of its confluence with the SAC.

XC187 Fantstown and XC201 Thomastown are located approximately 9km to 14km respectively and are in a different catchment to the Awbeg (Buttevant)_020 and so are not hydraulically linked to the SAC; works at these sites cannot adversely impact the SAC.

9.3.4 XC187 Fantstown

Water Bodies and WFD Status

Inset Figure 9.3 presents the location of the site, pluvial and fluvial flood extents and the two WFD water bodies that have been considered within this assessment; the Loobagh_020 which has a Moderate WFD status and the Fairyfield_Glebe_010 water body which currently has unassigned WFD status. All water bodies are in the Maigue_SC_020 sub-catchment and are part of the Shannon Estuary South catchment.

Loobagh_020

The Loobagh_020 is made up of a number of different EPA segments; four of which are within the study area. These are as follows:

The main section of the Loobagh_020 is the Loobagh 24 EPA segment which becomes Loobagh_030 after crossing North Bridge on the R512 in Kilmallock. Two other EPA segments flow directly into Loobagh 24, which are:

- Ahatrishnaun stream is located approximately 0.9km north of the site and flows from east to west before joining the main section Loobagh_020 (Loobagh 24) further downstream, at the North Bridge, north west of Kilmallock.
- Ahnagluggin stream flows from east to west, initially south of the site before crossing the rail line on three occasions before joining the main section of the Loobagh_020 approximately 2.5km downstream. Another small EPA section, Kilbreedy_East flows from north of the site, across the railway line and into Ahnagluggin stream 700m downstream.

Fairyfield Glebe_010

Fairyfield Glebe_010 is a small WFD water body consisting of a number of smaller contributary streams located approximately 0.5km south of the site and flows from east to west before joining the Loobagh_020 (at the main Loobagh 24 EPA segment). The WFD status of this water body is currently has unassigned WFD status.

Inset Figure 9.3 Water bodies in the vicinity of XC187 Fantstown

Survey Findings

No construction works are proposed for this site; no field survey was undertaken.

9.3.5 XC201 Thomastown

Water bodies and WFD Status

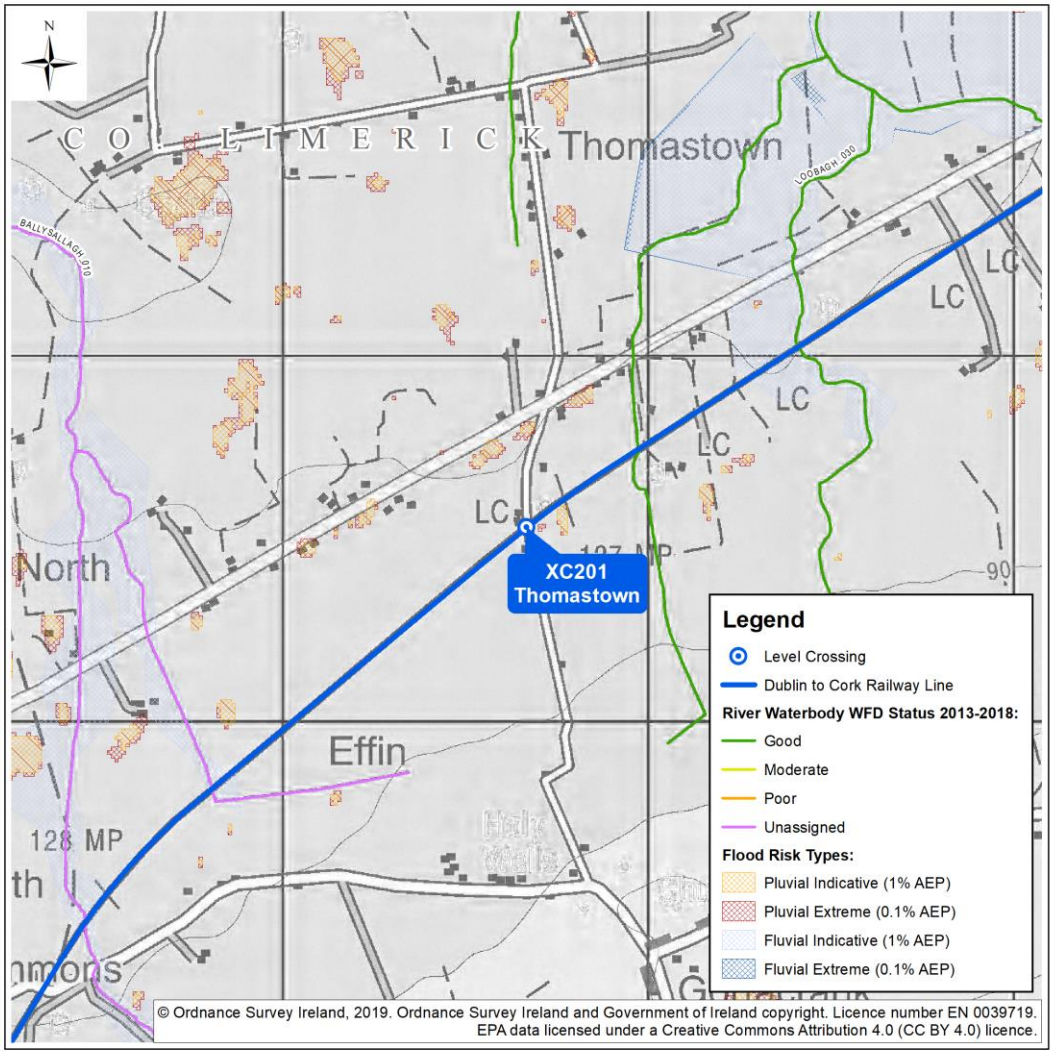
Inset Figure 9.4 highlights the location of the site, fluvial and pluvial flood extents and the two WFD water bodies that have been considered within this assessment; the Loobagh_030 and the Ballysallagh_010. Both water bodies are part of the Shannon Estuary South catchment. Loobagh_030 has good WFD status and the Ballysallagh_010 has an unassigned WFD status. The Ballysallagh_010 was excluded from the assessment on the basis that no pathway could be identified; it is more than 600m from the proposed Project and the existing terrain favours any drainage, during construction or operation, to flow towards the Loobagh_30 waterbody and associated field drains and ditches.

The Loobagh_030 is made up of a number of different EPA segments as follows.

- Gortacrank is located approximately 0.3km east of the site and flows northwards before joining the Knocksouna segment of Loobagh_030 which drains to the main segment of Loobagh_030 (Loobagh 24).
- Thomastown 24 is located approximately 0.8km east of the site and flows northwards before joining Knocksouna which is a tributary to the River Loobagh.

- Kilbreedy 24 is located approximately 0.8km north of the site and flows northwards before joining the River Loobagh.

Inset Figure 9.4 Water bodies in the vicinity of XC201 Thomastown



Survey Findings

An ecological walkover was undertaken in October 2019 of which a previously unidentified fast flowing stream flowing was identified. The stream runs along the eastern side of a field boundary at a farm gate entrance. The ditch either side of the gate entrance was wet and heavily vegetated. The ditch was slightly lower on either side of the stream which suggests that this could possibly be a spring/upwelling.

9.3.6 XC209 Ballyhay

Water bodies and WFD Status

Inset Figure 9.5 highlights the location of the site, fluvial and pluvial flood extents of the only WFD water body within the study area and included in this assessment; the Awbeg (Buttevant) (East)_020 which has Good WFD status. The water body becomes a designated SAC (Blackwater River (Cork/Waterford) SAC) approximately 1.5km downstream. The water body is located in the Awbeg[Buttevant]_SC_010 sub-catchment and within the Blackwater (Munster) catchment.

Awbeg (Buttevant) (East)_020 is made up a of a number of EPA river segments; three of which are within the study area and are described below.

Awbeg [Buttevant] [East]

This is the main segment of the water body and flows from the east to west, crosses the railway line and flows parallel for approximately 0.8km.

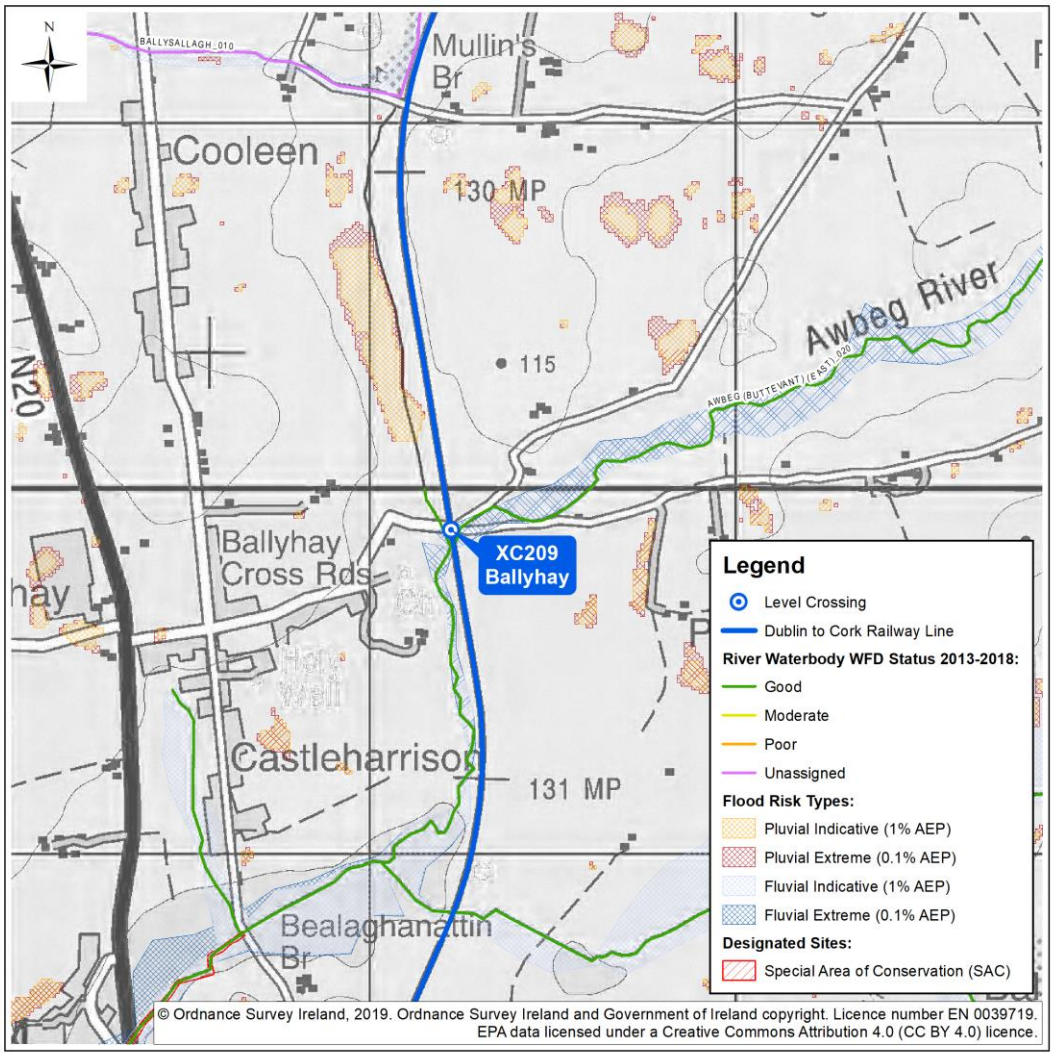
Rathmorgan

This is a small segment located approximately 20m west of the site and flows north to south before meeting the Farran 18.

Farran 18

This water body is located approximately 0.9km south west of the site and flows from Knockafutera mountain approximately 6km upstream and consists of a few smaller tributaries before flowing into Awbeg [Buttevant] [East].

Inset Figure 9.5 Water bodies in the vicinity of XC209 Ballyhay



Survey Findings

The site was surveyed in January 2020 from publicly accessible lands. The survey confirmed that the Rathmorgan EPA segment of Awbeg (Buttevant) (East)_020 is a field drain and at the time of survey it was stagnant with no flow.

9.3.7 XC211 & XC212 Newtown and Ballycoskery

Water bodies and WFD Status

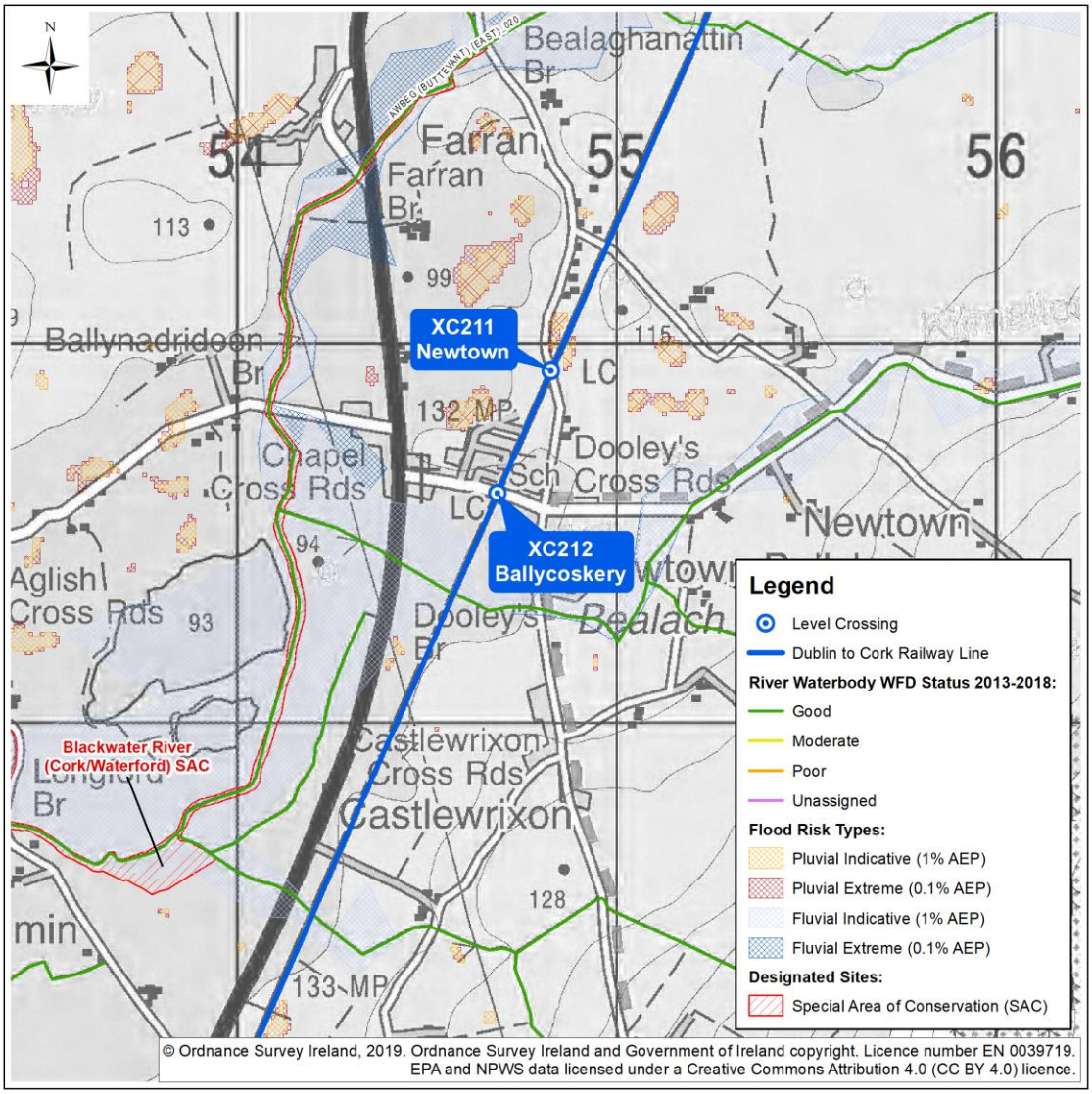
Inset Figure 9.6 highlights the location of the site, fluvial and pluvial flood extents and the WFD water body within the study area for this assessment; Awbeg (Buttevant) (East)_020 which has Good WFD status and is partially designated as SAC (Blackwater River (Cork/Waterford) SAC). The water body is located in the Awbeg[Buttevant]_SC_010 sub-catchment and within the Blackwater (Munster) catchment.

Awbeg (Buttevant) (East)_020

The water body is made up of a number of EPA segments which are as follows:

- Awbeg (Buttevant) [East] is located approximately 0.6km west of the site and is designated as an SAC;
- Newton 18 passes under the Dublin-Cork Railway Line approximately 275m south of the site and flows in a westwards direction before joining the Awbeg [Buttevant] [East].
- Newton Ballyhay is a small segment located approximately 0.6km east of the site and flows in a westerly direction into Newton 18.
- Aglish Cross Roads is a small segment located approximately 0.5km south west of the site and flows in a southwards direction before joining the Awbeg [Buttevant] [East].
- Two settlement lagoons are located approximately 0.5km east of the proposed Project which serve the Ballyhea Readymix (concrete) site.

Inset Figure 9.6 Water bodies in vicinity of XC211 Newtown and XC212 Ballycoskery



Survey Work

An ecological walkover was undertaken October 2019 of which an outfall located near XC212 Ballycoskery was discharging grey water into a nearby field. It was considered that this could be from a non-functional or broken septic tank which may serve the nearby Ballyhea National School. Pre-construction surveys and discussions with landowners will determine if this is an ongoing problem and identify any potential sources so that it can be resolved.

A hydrological site survey was undertaken in January 2020 of the water bodies within the study area. Two additional water features were identified, a drain running parallel to the railway line at Ballycoskery which consisted of poor quality, stagnant water which was heavily vegetated and contained debris such as litter. The drain met another small channel north of Beechwood Grove was identified which contained seemingly good quality, flowing water.

9.3.8 XC215 Shinanagh

Water bodies and WFD Status

Inset Figure 9.7 highlights the location of the site, fluvial and pluvial flood extents of the WFD water bodies that has been considered within this assessment; the Awbeg (Buttevant)_010 which has Good WFD status and the Awbeg (Buttevant)_020 which is Moderate WFD status. Both are partially designated as an SAC (Blackwater River (Cork/Waterford) SAC). The water body is located in the Awbeg[Buttevant]_SC_010 and Awbeg[Buttevant]_SC_020 sub-catchments respectively and both are within the Blackwater (Munster) catchment.

These water bodies are made up of a number of EPA segments which are described below.

Awbeg (Buttevant)_ 010

This is located approximately 0.7km south of the site and flows southwards. This WFD water body consists of a number of EPA segments; those within the study are discussed below:

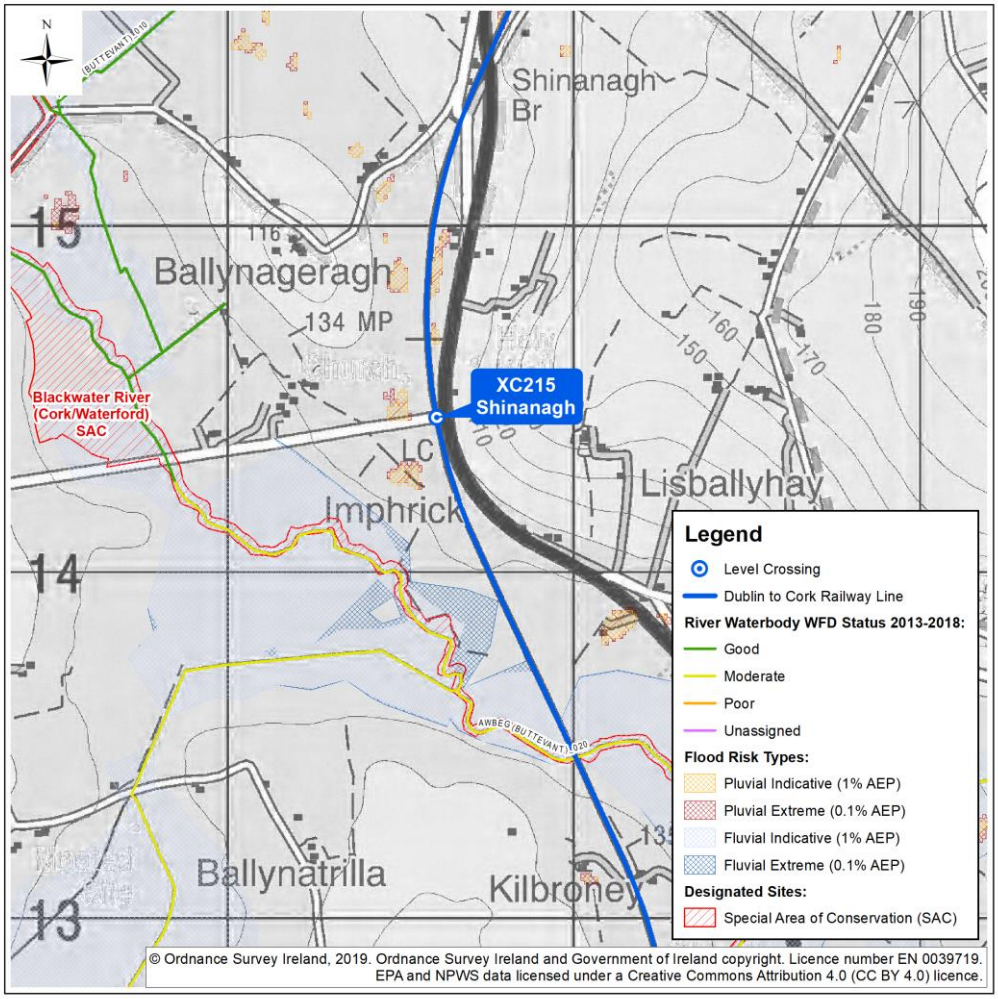
- Shinanagh is located approximately 0.8km north west of the most northern part of the proposed new road and flows southwards into the Awbeg [Buttevant] [East] EPA segment approximately 1.5km downstream;
- Imphrick is a small EPA segment only 0.3km in length, located approximately 0.5km to the west of the proposed new road, at its closest point and flows south west into the EPA segment Awbeg [Buttevant] [East] further downstream;
- Awbeg [Buttevant] East is a key tributary to the main water body Awbeg (Buttevant)_010 and is located approximately 0.8km west of the proposed new road at its closest point. The segment flows southwest into the Awbeg [Buttevant] EPA segment;
- Awbeg [Buttevant] West flows north west to south east and meets Awbeg [Buttevant] East to become Awbeg [Buttevant]; and
- Awbeg [Buttevant] is the main body of the Awbeg (Buttevant)_010 and flows from the north west to the south east and becomes Awbeg (Buttevant)_020 following the crossing of L1320.

Awbeg (Buttevant) (East)_020

- Awbeg [Buttevant] is the main body of the Awbeg (Buttevant)_020 and flows in a south easterly direction towards the N20 before flowing south parallel to the N20 towards Buttevant;
- Leap is an EPA segment which flows from the west into Awbeg [Buttevant]; and
- Lisballyhay is an EPA segment which flows from the east into Awbeg [Buttevant].

The proposed Project does not involve any crossings. However there are field drains and ditches in close proximity with hydrological connections to the Awbeg (Buttevant)_010 and Awbeg (Buttevant)_020.

Inset Figure 9.7 Water bodies in the vicinity of XC215 Shinanagh



Survey Findings

The hydrological survey undertaken in January 2020 resulted in the identification of a field drain running adjacent to the proposed Project which flows north to south. Some surface water flooding was observed in the northern section of the drain. The southern end of the drain had no flow at the time of survey.

9.3.9 XC219 Buttevant

Water bodies and WFD Status

Inset Figure 9.8 highlights the location of the site, fluvial and pluvial flood extents. The only WFD water body within this study area is the Awbeg (Buttevant)_020.

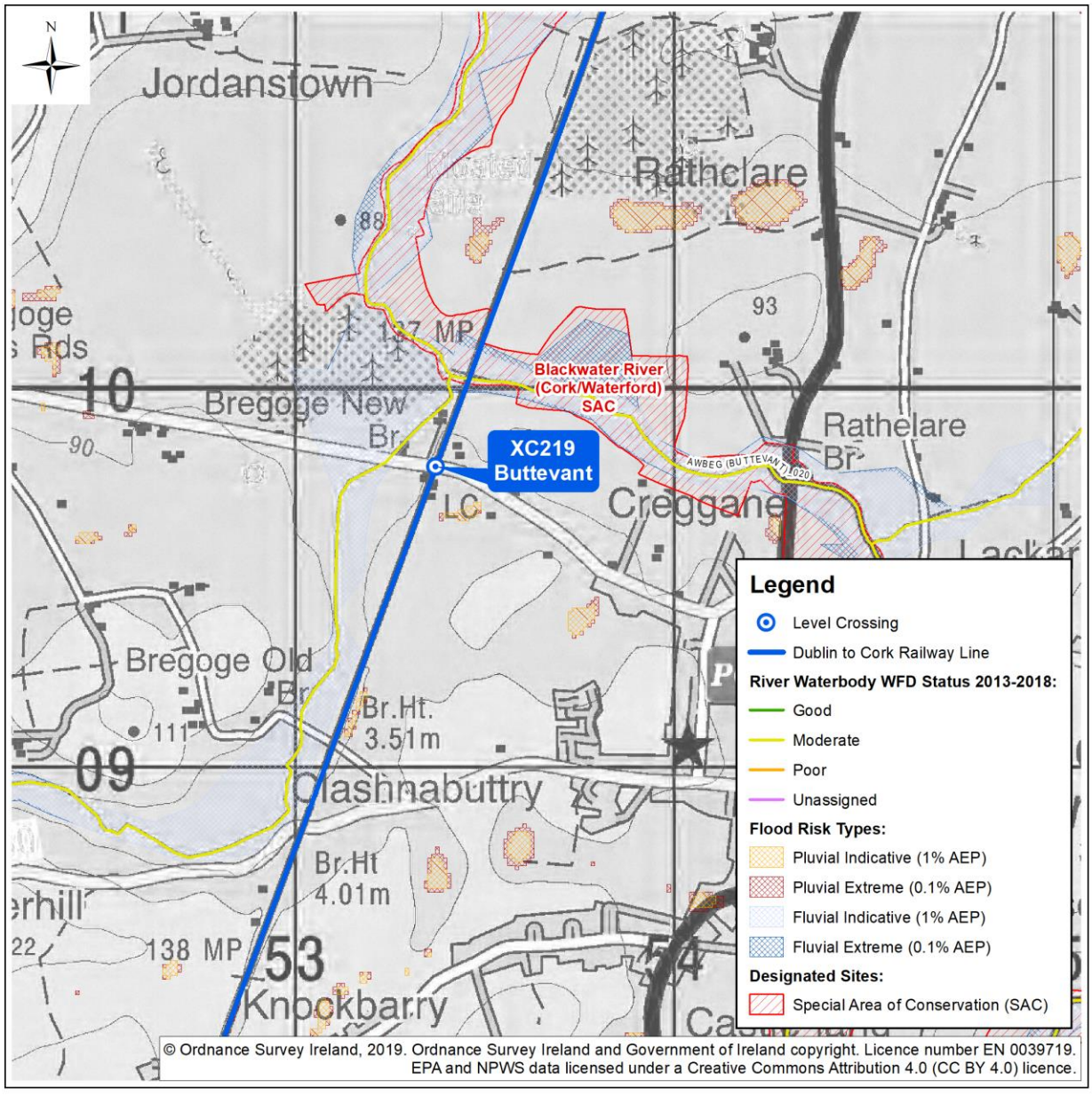
Awbeg (Buttevant)_020

In this area, the water body is made up of the following of EPA segments:

- The Awbeg [Buttevant] is the main body of the Awbeg (Buttevant)_020. It flows from north to south towards Buttevant turning east towards the town before flowing south through Buttevant into the Awbeg (Buttevant)_030 after crossing the R522. This EPA section is part of the Blackwater River (Cork/Waterford) SAC; and
- Pepperhill is an EPA segment which is part of the Awbeg (Buttevant)_020 and flows from the south into the Awbeg (Buttevant) East immediately upstream and west of the railway line.

The proposed road-over-rail bridge crosses the Pepperhill EPA segment (part of the Awbeg (Buttevant) _020 water body) which has Moderate WFD status. The crossing is less then 300m upstream from the Blackwater River (Cork/Waterford) SAC boundary. It also crosses a drainage ditch immediately west of the Pepperhill, which flows from the Pepperhill, effectively acting as an alternative route for draining fields in the area.

Inset Figure 9.8 Water bodies in the vicinity of XC219 Buttevant



Survey Findings

A hydrological walk over survey was undertaken in January 2020. Some surface water flooding was observed in the fields to the north and south of Station Road surrounding the Pepperhill EPA segment of the Awbeg (Buttevant)_020 which is proposed to be crossed by the new access road.

9.3.10 Flood Risk

Flood Risk Assessment

The 'Planning System and Flood Risk Management: Guidelines for Planning Authorities' document outlines the key principles that should be considered when assessing flood risk to proposed Project sites. It recommends that the following staged approach should be adopted:

1) Stage 1: Flood risk identification

To identify whether there may be any flooding or surface water management issues relating to the proposed Project sites that warrant further investigation.

2) Stage 2: Initial flood risk assessment

To confirm the sources of flooding that may affect the proposed Project sites, to appraise the adequacy of existing information and to determine what surveys and modelling approach is appropriate to match the spatial resolution required and complexity of the flood risk issues. This stage involves the review of existing studies, to assess flood risk and to assist with the development of FRM measures.

3) Stage 3: Detailed flood risk assessment

To provide a quantitative appraisal of potential flood risk to a proposed or existing development, of its potential impacts on flood risk elsewhere and of the effectiveness of any proposed mitigation measures. This will typically involve use of an existing or construction of a hydraulic model across a wide enough area to appreciate the catchment wide impacts and hydrological process involved.

A summary of existing flood risk and the potential impacts of climate change is summarised in this section of the chapter. The assessments of the potential impacts from and to the proposed Project at each site is provided in Section 9.5.

Existing Flood Risk

Table 9.3 below provides a summary of the potential flood risk from each of the sources of flooding considered to the seven level crossing of the proposed Project.

Table 9.3: Summary of Existing Flood Risk from each source of flooding

Source of Flooding	XC212 Ballycoskery	XC201 Thomastown	XC209 Ballyhay	XC211 Newtown	XC215 Shinanagh	XC219 Buttevant
Coastal	Low	Low	Low	Low	Low	Low
Fluvial	Moderate	Low	High	Moderate	Low	High
Estuarine	Low	Low	Low	Low	Low	Low
Pluvial	Low	Low	Low	Low	Low	Low
Artificial Drainage Systems	Low	Low	Low	Low	Low	Low
Reservoirs and Other Artificial Sources	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Groundwater	Low	Low	Low	Low	Low	Low

Flood Risk due to Climate Change

Table 9.4 below is a summary of potential impacts of climate change at all of the sites.

Table 9.4: Climate Change Impacts

Source of Flooding	Likely Impacts of Climate Change	Discussion
Coastal	No Impact	No change due to the location of all sites inland meaning they will not be at risk from coastal flooding despite the predicted increase in sea levels.
Fluvial	Change	Since the predicted future climate change indicators will cause an increase in the flows in the Awbeg River, the proposed development at XC209 Ballyhay, XC212 Ballycoskery and XC219 Buttevant that are already within or adjacent to areas of fluvial flood risk will be affected by flooding of increased frequency and magnitude.
Estuarine	No Impact	No change due to the location of all sites being inland mean they will not be at risk from estuarine flooding despite the predicted increase in sea levels.
Pluvial	Possible Change	Future climate change will result in storms of increasing magnitude and frequency, and consequently increased rainfall depths and extents. This has the potential to increase the risk of pluvial flooding to the sites.
Artificial Drainage Systems	No Change	The sites are not subject to flood risk associated with existing drainage systems, primarily due to the rural nature. All additional stormwater drainage required on the sites/proposed developments will be designed to cater for the effects of future climate change.
Groundwater	No Change	No change. Climate change is unlikely to have a significant impact on groundwater flooding in the area and given the proximity of sites to the River Awbeg and River Maigue sub-catchments, it is likely that any groundwater movements beneath the sites will continue to be hydraulically connected to the rivers.

9.4 Assessment Methodology

9.4.1 Legislation, Policy & Guidance

Legislation

The EU Water Framework Directive (WFD) (2000/60/EC) established a framework for the protection of both surface and ground waters. Transposing legislation (Statutory Instrument (SI) 792 of 2009, European Communities Environmental Objective (Surface Water) Regulations 2009 as amended) outlines the 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. RBMPs were developed to address the requirements of the WFD, two of which are of relevance to this assessment, the Shannon RBMP 2009-2015 and the South Western RBMP 2009-2015. A subsequent second phase delivering a consolidated RBMP for the whole of Ireland was adopted in April 2018. The plans from both phases include programmes of measures required to facilitate the achievement of the WFD objectives.

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

- SI 722 of 2003, European Communities (Water Policy) Regulations, as amended;
- SI 792 of 2009, European Communities Environmental Objective (Surface Water) Regulations 2009 as amended;
- SI 350 of 2014, European Union (Water Policy) Regulations 2014;
- The EU Floods Directive 2007/60/EC;

- SI 122 of 2010 European Communities (Assessment and Management of Flood Risks) Regulations; and
- SI 81 of 1988, European Community Environmental (Quality of Surface Water Intended for Human Consumption) Regulations 1984 as amended.

Policy

- Cork County Development Plan 2014;
- Limerick County Development Plan 2010–2016;
- River Basin Management Plan 2018-2021; and
- 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).

Guidelines

- Guidelines on Procedures for Assessment and treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (TII [National Roads Authority (NRA)], 2009);
- Guidelines on the information to be contained in Environmental Impact Statements (EIS). Draft (EPA, 2017); and
- TB13 Revised Road Drainage Standards (TII [NRA], 2015).

9.4.2 Determining Significance

The following method for the assessment of impacts has been adapted from the TII Guidelines, which outline how impact quality, type, magnitude, significance and duration are considered relative to the importance of the hydrological attribute.

Sensitivity of Receptor

The sensitivity of surface water receptors and their 'attributes', that could potentially be affected by the proposed Project have been determined with reference to their relative importance or 'value' (e.g. whether features are of national, regional or local value). Table 9.5 outlines the criteria for estimating the sensitivity of receptors and their attributes.

Table 9.5: Example Criteria Used to Evaluate the Importance of Surface Water Receptors and their Attributes

Sensitivity	Criteria	Typical Example
High	Receptor (or receptor attribute) has a high quality or value on an international scale	▪ Water body protected by EU legislation e.g. 'European sites' designated under the Planning and Development Acts 2000-2017 (See Volume 2, Chapter 4: EIA Process and Methodology) (SAC and SPA) and/or European Communities (Birds and Natural Habitats) Regulations 2011 or 'Salmonid Waters' designated pursuant to the European communities (Quality of Salmonid Waters) Regulations, 1988. ▪ Water body with hydrological importance to 'European sites' or protected ecosystems of international status; and/or internationally important amenity site(s) for wide range of leisure activities. ▪ A water body that appears to be in natural equilibrium and exhibits a natural range of morphological features (such as pools and riffles). There is a diverse range of fluvial processes present, free from any modification or anthropogenic influence. ▪ A water body of Good to High WFD Status (2013-2018). ▪ Water body ecosystem protected by national legislation (Natural Heritage Area (NHA) status). ▪ Water body with hydrological importance to nationally designated or sensitive sites; and/or nationally important amenity site(s) for wide range of leisure activities.

Sensitivity	Criteria	Typical Example
Medium	Receptor (or receptor attribute) has a high quality or value on a local scale	▪ Water body with some hydrological importance to sensitive or protected ecosystems; and/or regionally important amenity site(s) for wide range of leisure activities Salmon fishery. ▪ A water body that appears to be in some natural equilibrium and exhibits some morphological features (such as pools and riffles). There is a diverse range of fluvial processes present, with very limited signs of modification or other anthropogenic influences. ▪ A water body of Moderate to Good WFD Status (2013-2018).
Low	Receptor (or receptor attribute) has a medium quality or value on a local scale	▪ Water body with limited hydrological importance for sensitive or protected ecosystems; and/or locally important amenity for a wide range of leisure. ▪ A water body showing signs of modification, recovering to a natural equilibrium, and exhibiting a limited range of morphological features (such as pools and riffles). The watercourse is one with a limited range of fluvial processes and is affected by modification or other anthropogenic influences. ▪ Evidence of historical channel change through artificial channel straightening and re-profiling. ▪ Water body with Poor to Moderate WFD Status (2013-2018).
Negligible	Receptor (or receptor attribute) has a low quality or value on a local scale	▪ A water feature with minimal hydrological importance to sensitive or protected ecosystems; and/or economic and social uses. ▪ A highly modified watercourse that has been changed by channel modification or other anthropogenic pressures. The watercourse exhibits no morphological diversity and has a uniform channel, showing no evidence of active fluvial processes and not likely to be affected by modification. Highly likely to be affected by anthropogenic factors. Heavily engineered or artificially modified and could dry up during summer months. ▪ Locally important amenity site for small range of leisure. ▪ Many existing pressures which are adversely affecting biodiversity. ▪ Water body with Bad to Poor WFD Status (2013-2018).

Magnitude of Impact

The scale or magnitude of potential impacts (both beneficial and adverse) depends on both the degree and extent to which the proposed Project may impact the surface water receptors during the Construction and Operation phases. Table 9.6 describes the criteria used for determining the magnitude of an impact.

Factors that have been considered to determine the magnitude of potential impacts include:

- Area of influence (the magnitude of an impact is directly related to the size of the area affected);
- Level of deviation from baseline conditions;
- Duration of impact;
- Sensitivity of the resource; and
- Project timing (in relation to season).

Table 9.6: Criteria for Estimation of Magnitude of Impact on Surface Water Receptors

Magnitude of Impact	Criteria
High Adverse	Results in loss of receptor and / or quality and integrity of receptor
Medium Adverse	Results in impact on integrity of receptor or loss of part of receptor
Low Adverse	Results in minor impact on integrity of receptor or loss of small part of receptor

Magnitude of Impact	Criteria
Negligible	Results in an impact on receptor but of insufficient magnitude to affect either use or integrity
Low Beneficial	Results in minor improvement of receptor quality
Medium Beneficial	Results in moderate improvement of receptor quality
High Beneficial	Results in major improvement of receptor quality

Significance of Impacts

The significance of impact is determined by combining the sensitivity of the receptor with the predicted magnitude of impact, as shown in Table 9.7.

Descriptions of the categories in the context of the water environment are based on descriptions and graphics outlined in the Draft EPA Guidance on Information to be Contained within an EIAR (2017) and are given in Table 9.8.

Table 9.7: Categories of Environmental Impacts

Magnitude of Impact	Sensitivity of Receptor			
	Negligible	Low	Medium	High
High	Not significant- to Slight	Moderate	Very Significant	Profound
Medium	Not significant to Slight	Slight to Moderate	Significant	Significant to Very Significant
Low	Not significant	Slight	Slight to Moderate	Moderate to Significant
Negligible	Imperceptible	Not Significant	Not significant	Not significant

Table 9.8: Descriptions of Environmental Impacts

Impact Categories	Description
Profound adverse	Where the proposed Project will potentially result in degradation of the water environment because of very significant adverse impacts on at least one water attribute. For example: ▪ Deterioration of overall status in a High or Good WFD Class water body. ▪ Long term deterioration of an EU Designated Salmonid fishery. ▪ Loss or extensive change to a site / habitat protected under EU or Irish legislation SAC, SPA, Ramsar site, Sites of Special Scientific Interest (SSSI), Water Protection Zone, Salmonid water. ▪ High risk of pollution from spillages when discharging into a Good or High Class under WFD.
Very significant adverse	Where the proposed Project will potentially result in a degradation of the water environment because of highly significant adverse impacts on a water attribute. For example: ▪ Potential deterioration of a WFD quality element, contributing towards overall status deterioration in a High of Good WFD status water body. ▪ Short to medium term Failure in an EU Designated Salmonid fishery. ▪ Moderate risk of pollution from spillages in a Good WFD status watercourse (or one of lower ecological status) and >0.5% for a High status WFD watercourse. ▪ Loss or extensive change to a cyprinid fishery. ▪ Loss or extensive change to a Local Nature Reserve.

Impact Categories	Description
Significant adverse	Where the proposed Project will potentially result in the degradation of the water environment because of significant adverse impacts on at least one attribute. For example: ▪ Potential contribution towards the deterioration of a WFD quality element. ▪ Potential failure of any Environmental Quality Standard (EQS) in a Moderate or Poor WFD status water body. ▪ Failure of any EQS in a High or Good WFD status water body. ▪ Moderate / Low risk of pollution from spillages in a Good WFD status water body. ▪ Moderate / High risk in a Moderate or Poor WFD status water body. ▪ Partial loss or change to a fishery. ▪ Impact on the integrity of the existing flora and fauna.
Moderate adverse	Where the proposed Project will potentially result in a degradation of the water environment because of moderate impacts on one or more attributes. For example: ▪ Potential short-term failure of any EQS in a Moderate or Poor WFD status water body. ▪ Moderate risk of pollution from spillages in a Moderate or Poor WFD status water body. ▪ Low risk of pollution from spillages in High status water body. ▪ Temporary loss to, or loss in productivity of, a fishery.
Slight	Where the proposed Project will potentially result in a minor degradation of the water environment because of slight impacts on a small part of an attributes. For example: ▪ Potential short-term failure of any EQS in a Moderate or Poor WFD status water body. ▪ Low risk of pollution from spillages in a Moderate or Poor WFD status water body. ▪ Risk of pollution from spillages is Low.
No significant impact	Where the net impact of the proposed Project is neutral, because it will result in no appreciable impact, either positive or negative, on the identified attribute. For example: ▪ No risk identified of failing any EQS. ▪ Risk of pollution from spillages is Low.
Slight beneficial	Where the proposed Project provides an opportunity to enhance the water environment or provide an improved level of protection to a small part of an attribute. For example: ▪ Reduction by less than 50% in existing pollution risk from spillages into WFD water features.
Moderate beneficial	All other situations where the proposed Project provides an opportunity to enhance the water environment or provide an improved level of protection to an attribute. For example: ▪ Assessment show that EQS will Pass from previous Fail condition for existing discharges. ▪ Reduction by 50% or more in existing pollution risk from spillages into High to Poor water bodies (when previous spillage risk was Moderate).
Significant beneficial	Where the proposed Project provides an opportunity to enhance the water environment because it will result in a moderate improvement for an attribute. For example: ▪ Contribution toward the improvement of a WFD quality element status. ▪ Assessment shows that EQS will Pass from previous Refer or Fail condition for existing discharges. ▪ Reduction by 50% or more in likelihood of pollution to water bodies from spillages from existing discharges through retrofitting of pollution control to outfalls into a High to Poor water body (existing risk is Moderate). ▪ Recharge of aquifer through provision of treated discharges to ground resulting in measurable improvements to a connected site/habitat of local nature conservation value i.e. Local Nature Reserve.

Impact Categories	Description
Very significant beneficial	It is extremely unlikely that any new or improved development will fit into this category. However, proposals could have a large positive impact from a 'very' or 'highly' significant improvement to a water attribute(s), with insignificant adverse impacts on other water attributes. For example: ▪ Improvement of one or more WFD quality elements contributing to or resulting in the improvement of a WFD water bodies overall status. ▪ Removal of an existing polluting discharge through provision of pollution prevention measures, or any other measure, affecting a site/habitat protected under EU or Irish legislation (SAC, SPA, Ramsar site, NHA and salmonid water). ▪ Reduction by 50% or more in the existing likelihood of pollution arising from a spillage affecting a site/habitat protected under EU or Irish legislation (SAC, SPA, Ramsar site, NHA and salmonid water) where existing risk is Moderate.

9.4.3 Mitigation

In general, a hierarchical approach to mitigation will be adopted for the proposed Project, which seeks to avoid adverse impacts in the first instance. In areas where avoidance is not possible, measures will be proposed to prevent or reduce potentially significant adverse impacts.

Although each potentially significant adverse impact requires mitigation, many impacts will be addressed using generic mitigation including the application of best practice in detailed design and the construction and operational management of the proposed Project (Section 9.6). Specific mitigation has been developed where generic mitigation will be inappropriate, ineffective or insufficient.

Where significant adverse impacts remain after the application of mitigation measures, these are reported in Section 9.7 (Residual Impacts).

9.5 Potential Effects of the proposed Project

9.5.1 Do Nothing Scenario

In this EIAR, the 'evolution of the baseline without the development' is described as the 'Do Nothing' scenario.

The Baseline (see Section 9.3) describes the existing pressures on the water bodies within the study area; these are identified and categorised under the River Basin Management Plan process under baseline conditions (i.e. what is there at present). It is assumed that the more short-term trends will be seen in water quality, with hydrological and geomorphological changes being subject to more long-term trends. From these trends, measures required for the water bodies to meet the requirements of the WFD Directive are identified. This section sets out the key pressures and policy responses in Ireland.

Agriculture is the most significant pressure to 'At Risk' water bodies within the Maige__SC_020 sub catchment, with agriculture and urban wastewater being the most significant pressures within the Awbeg [Buttevant]_SC_010 sub catchment.

It is anticipated that agriculture will continue to have a significant influence on water quality in Ireland. The EPA has established that the projected 50% increase in dairy production under Food Harvest 2020 will pose a 'significant threat' to water quality (EPA, 2010) and the 2013 South East Integrated Water Quality Report states that 'the proposed expansion of the agriculture sector, as detailed in Food Harvest 2020 will bring large increases in farm outputs … and the threat of additional diffuse environmental pressures needs to be addressed' (EPA, 2012).

Urban wastewater pressures usually relate to Urban Wastewater Treatment Plants (WwTPs) and agglomeration networks. A programme of WWTP upgrades across the catchment are scheduled to take place in 2021 and 2024 with some upgrade works already underway.

The EPA Urban Wastewater Treatment in 2017 report highlights that there six areas where improvements are needed. The two key steps to be undertaken to resolve the issues are:

- Upgrade deficient wastewater treatment systems in as timely a manner as possible. This requires increased investment and efficient delivery of infrastructure improvements.
- Get the best performance from the existing treatment systems by continuing to improve how they are operated, managed and maintained.

The (2018) report highlights that, for the essential works to be completed, reliable information is essential to identify environmental risk and plan improvements to mitigate the risks. A number of actions are on Irish Water to complete assessments of their assets to target where future works are required.

9.5.2 Generic Construction Impacts

There are a number of generic impacts which could occur during the construction of the proposed Project. These impacts are only likely at XC201 Thomastown, XC211 Newtown, XC212 Ballycoskery, XC215 Shinanagh; no construction is taking place at XC187 Fantstown, only limited construction will take place at XC209 Ballyhay compared to other sites.

- Silty water run-off: surface water and dewatered groundwater containing high loads of suspended solids from construction activities. This includes the stripping of topsoil during site preparation; the construction of access roads; the dewatering of excavations and the storage of excavated material. In the absence of mitigation there could be effects on the surface water quality of local watercourses;
- Run-off being contaminated by a spillage or leakage of oils and fuels stored on site or direct from construction machinery. In the event of a spillage, there is a high likelihood of groundwater contamination. At the sites where a road-over-rail bridge is proposed, the slopes created by overbridging may increase the likelihood of runoff and pathways to receptors, increasing the likelihood of surface water pollution from a spill;
- Change in the natural hydrological regime due to an increase in discharge as a result of dewatering. This may include changes to surrounding groundwater flow, or contaminated soil from previous land uses being disturbed causing pollutants such as heavy metals to enter ground and surface waters;
- Potential for disrupting local drainage systems due to diversions required to accommodate the construction works;
- Potential for temporary increase in hardstanding areas and/or soil compaction during construction works which could result in temporary increased runoff rates to water features;
- Modifications to the hydraulic characteristics of water features through modifications to the channel dimensions during construction of outfalls and culverts, where required; and
- Potential increase in flooding: depending upon the nature and timing of the construction activities that risk could change. This is principally through either an increase in exposure of people and plant or through changes to landforms that might increase the risk of flooding elsewhere.

9.5.3 Drainage Strategy – All Sites

No drainage works are proposed at XC187 Fantstown as no construction is proposed there; none is required either at XC209 Ballyhay as limited construction is proposed to take place there and the CCTV infrastructure does not require drainage or any alterations to existing drainage systems.

For the remaining sites, in keeping with *NRA TB 13 – Revised Road Drainage Standards,* over the edge drainage is proposed in the design for all locations, supplemented with additional features to accommodate the presence of structures or site constraints where necessary. New swale ditches are proposed, located at the toe of the road embankment, that will then drain back to the low points to maximise attenuation and pollution control as part of a SuDS management chain.

The swale features will be grassed, with shallow side slopes and a long-wetted perimeter to reduce flow rates and velocities. Typically, they will be underlain by a filter material and perforated pipe to provide a second stage of treatment. The width of the swale varies between 3 and 7 metres depending on the site, and the depth (including 0.15 metres freeboard) is up to 0.75 metres and typically less than 0.5 metres. See TII Publication Number CC-SCD-

00525 for typical details. Where agricultural or local access must be maintained, a short section of culvert will be constructed beneath the respective junction to ensure connectivity of the swale ditches either side of the access.

The swale ditches will outfall directly or indirectly into water bodies within the River Maigue or River Awbeg sub-catchments respectively, with further detail provided under each site below. The maximum outflow of the swales will be capped at greenfield runoff rates.

9.5.4 XC187 Fantstown

Construction Phase

The proposal for level crossing XC187 Fantstown involves the straight closure of the level crossing and the diversion of traffic along an existing road-over-rail bridge approximately 3km to the north east. No construction works are proposed, therefore there would be no effects on surface water receptors during the 'construction phase' of the proposed Project at this location.

The site is at high risk of fluvial flooding as noted in the baseline assessment. However, as above, no new works are being constructed so there is no effect on fluvial flood risk.

Operational Phase

The level crossing will be closed and therefore de-manned and an alternative access provided, therefore no significant impacts are foreseen. There is potential for a beneficial effect as a result of fewer vehicles crossing the existing bridge over the Loobagh_020, immediately north of the level crossing. This would reduce the risk of contaminants from road use entering the water body, although it is anticipated that this effect would be Not Significant.

The road carriageway will continue to drain as it does currently and so no additional effects (or benefits) are expected.

9.5.5 XC201 Thomastown

Construction and Operational Phase Impacts

The proposal at XC201 Thomastown involves the provision of alternative access across the railway line via a new road-over-rail bridge which will tie into an existing local road to the south and a new junction on Regional Road R515 to the north. See Table 9.9 below for an assessment of the potential impacts as a result of site-specific construction activities and permanent design elements in the absence of mitigation or control measures. Where potential impacts have been 'designed out' for the operational phase, this is considered 'embedded mitigation' and the assessment takes these into account.

Table 9.9: Site specific impacts from the proposed Project (XC201 Thomastown)

Project Activity	Impacts	Loobagh_030		
		Sensitivity of Receptor	Magnitude of Impacts	Significance of Effects
Construction Phase				
Construction of new bridge	Hydrology and Drainage Construction of new bridge/side road/temporary construction structures may lead to temporary alterations of local drainage networks.	High	Negligible	Not significant

Project Activity	Impacts	Loobagh_030		
		Sensitivity of Receptor	Magnitude of Impacts	Significance of Effects
	Geomorphology Construction activities will be in close proximity to the roadside ditch which outfalls to the Loobagh_030. This heightens the risk of sediment input to the water feature causing smothering of the bed strata and increased turbidity. The ditch is approx. 600m from the Loobagh_030; the area is flat; it is likely most solids will settle in the ditch and little if any would reach the water body.	High	Low	Moderate
	Water Quality Working near the ditch heightens the risks of hazardous material spillages and sediment input to the Loobagh_030. The distance from the Loobagh_030 and the topography of the area mean it is unlikely there would be anything greater than low magnitude of impact on the water body.	High	Low	Moderate
Construction compound location	Hydrology and Drainage The compound is proposed to be located at the site entrance off the R515. There is roadside drainage ditch which discharges into the Loobagh_030. Increased hardstanding would increase the runoff slightly in this area.	High	Negligible	Not significant
	Geomorphology There is potential for silty water runoff during site clearance for the compound area, in close proximity to the drainage ditch. This increased sediment delivery to the channel could smother the bed strata in the ditch. It may reach the Loobagh_030, depending on flows. The ditch is approx. 600m from the Loobagh_030; the area is flat; it is likely most solids will settle in the ditch and little if any would reach the water body.	High	Low	Moderate
	Water Quality Increased sediment delivery to Loobagh_030 via the roadside ditch. There is also the potential for oil and chemical spills from material stored at the compound. The distance from the Loobagh_030 and the topography of the area mean it is unlikely there would be anything greater than low magnitude of impact on the water body.	High	Low	Moderate
Operation Phase				
New impermeable area in form of new road bridge	Hydrology and Drainage Changes to local drainage systems to accommodate the new road and bridge could lead to local issues with drainage and increased flows to the water body; the design of the drainage system for the proposed Project means that there will be no net increase in runoff and no changes to established field drains. No alterations to the ditch are proposed and no new outfall to the Loobagh_030 is proposed.	High	Negligible	Not significant
	Geomorphology Increased pollution loads to an increased impermeable area could result in increased sediment input to the water feature impacting the bed strata. The use of swales in the drainage design means that any sediment will be caught and not impact upon the water body.	High	Negligible	Not significant

Project Activity	Impacts	Loobagh_030		
		Sensitivity of Receptor	Magnitude of Impacts	Significance of Effects
	Water Quality Increased pollution loads due to an increased impermeable area could result in increased input of sediment and other contaminants such as motor oil to the ditch which then outfalls to the water body. The use of swales in the drainage design means that any contaminants will be caught and not impact upon the water body.	High	Negligible	Not significant
New culverts/bridges or modifications to existing culverts/bridge	Hydrology and Drainage There are no new or modified culverts at this site.	N/A	N/A	N/A
	Geomorphology There are no new or modified culverts at this site.	N/A	N/A	N/A
	Water Quality There are no new or modified culverts at this site	N/A	N/A	N/A

Summary of Flood Risk Assessment

The baseline assessment of flood risk at the site is low from all sources. That aside, the introduction of new impermeable areas could potentially increase the volume and peak flow of surface runoff reaching watercourses and could therefore contribute to an increase in flood risk. This potential impact has been assessed and designed out (embedded mitigation) through the proposed drainage strategy (9.5.3).

All swale ditches outfall indirectly to the Loobagh_030 WFD water body (specifically Gortacrank) via existing connecting ditches. Maximum outflow is capped at existing greenfield runoff rates resulting in no increase in flood risk.

The FRA concluded that the XC201 Thomastown site is a less vulnerable development (local transport infrastructure) and is at low risk of flooding from all sources. As such, the proposed works is appropriate and do not require a Justification Test.

9.5.6 XC209 Ballyhay

Construction Phase

The existing level crossing will be upgraded to a CCTV controlled level crossing. There will be some limited construction taking place. There is potential for the proposed works and method of installation of the CCTV to have an impact on the Awbeg (Buttevant) (East)_020 as a result of dewatering of the trenches required to lay cable ducts. The water body is High sensitivity; the magnitude would be medium leading to a significant or very significant impact.

The site is at high risk of fluvial flooding as noted in the baseline assessment. However, as above, no new works are being constructed beyond the CCTV infrastructure so there is no effect on fluvial flood risk.

Operational Phase

The closure of the crossing and provision of alternative access through a road-over-rail bridge will result in no requirement for staff or welfare facilities located at the proposed Project during the operational phase.

The road carriageway will continue to drain as it does currently and so no additional effects (or benefits) are expected.

Summary of Flood Risk Assessment

The proposal for XC209 Ballyhay is for the existing level crossing to be upgraded to a CCTV controlled level crossing. A new Relocatable Equipment Building (REB) will be constructed to the north of the existing level crossing. Whilst the proposed REB will be at risk of flooding, it will be designed to be flood resilient including the provision of Individual Property Protection Measures (IPP) and all electrical switchboards to be elevated and IP67 rated so that they will remain operational if subjected to immersion in flood water.

The proposed works also remove the existing requirement for the level crossing to be manually operated. The new REB and CCTV will mean that the level crossing operates automatically and in all conditions. This will remove the current risk of human exposure to flooding from the required manual operation of the crossing.

A Justification Test was carried out for this site and the design meets all of the criteria of the text. The Justification Test is passed.

9.5.7 XC211 & XC212 Newtown and Ballycoskery

Construction and Operational Phase Impacts

For XC211 Newtown, a new link road to the east of the railway corridor is proposed, to connect the local road to the east side of XC211 Newtown with the local road to the north east. At XC212, Ballycoskery, a new road-over-rail bridge is proposed and a tie-in to an existing local road to the east and west, a new carpark Is proposed for the existing Ballyhea National School; a tie-in to the housing estate and school to the north and existing local road to the south. During the construction phase there is potential for some Significant site-specific impacts on the water environment in the absence of mitigation. See for site specific impacts.

Table 9.10: Site specific impacts from the proposed Projects (XC211 Newtown and XC212 Ballycoskery)

Project Activity	Impacts	Awbeg (Buttevant) (East)_020		
		Sensitivity	Magnitude of impacts	Significance of effects
Construction Phase				
Construction of new road bridge (XC212 Ballycoskery)	Hydrology and Drainage There is potential for disruption to local drainage ditches alongside (east and west) of the railway during the construction phase.	High	Negligible	No significant
	Geomorphology Construction activities will be in close proximity to the ditches. This heightens the risk of sediment input to the water feature causing smothering of the bed strata and turbidity. The ditches are 250m from the WFD water body and since works involve the banks and bed of the ditches (see below- culverts) there could be a medium magnitude of impact.	High	Medium	Significant to Very significant
	Water Quality Working near the ditches heightens the risks of hazardous material spillages and sediment input to the ditch. The relatively close proximity to the water body and in-channel working increase the likelihood of a medium magnitude impact.	High	Medium	Significant to Very Significant
Construction of new culverts (XC212 Newtown)	Hydrology and Drainage The ditches will be temporarily disrupted as culverts are installed. There will be no impact on the drainage of the water body.	Low (drainage ditch)	Medium	Slight to moderate

Project Activity	Impacts	Awbeg (Buttevant) (East)_020		
		Sensitivity	Magnitude of impacts	Significance of effects
	Geomorphology The ditches will be affected by increased sediment load during the construction of the new culverts. This sediment could be transported to the water body.	High	Medium	Significant to Very Significant
	Water Quality The ditches are at risk of increased sediment and hazardous substances during the construction of the culverts. This could potentially reach the water body.	High	Medium	Significant to Very Significant
Construction of compound location (XC212 Ballycoskery but exact location TBC)	Hydrology and Drainage	High	TBC	
	Geomorphology	High	TBC	
	Water Quality	High	TBC	
Construction of new access road (XC211 Newtown)	Hydrology and Drainage There is the potential for disruption to local land drains, however there are no known field ditches on site and pathways to water bodies are limited. There is an area of standing water however which has the potential to cause inundation during construction.	Low	Low	Not significant
	Geomorphology There is no clear pathway to the receptor	N/A	N/A	N/A
	Water Quality There is no clear pathway to the receptor	High	Low	Significant
Construction of new car park for Ballyhea National School at Ballyhea village	Hydrology and Drainage Existing road drains will be disrupted as the new drainage system is installed. This could impact on flows to the water body via the road connection at Dooley's Bridge.	High	Low	Moderate to Significant
	Geomorphology Site clearance and topsoil stripping could result in increased sediment delivery to the water body via local road drains and smother the bed strata. This is an unlikely scenario as the sediment is likely to settle in the drainage system before reaching the water body, even without specific mitigation measures.	High	Negligible	Not significant
	Water Quality Potential for increased sediment loading to the water body, as described above; unlikely, however. Greater risk of spillages of oil during construction activities reaching the water body as this is less likely to be captured in local drainage networks.	High	Medium	Significant to Very Significant
Operation Phase				
New impermeable	Hydrology and Drainage The road-over-rail bridge will drain to swales which will outfall to exiting road drains at current runoff rates. No	High	Negligible	Not significant

Project Activity	Impacts	Awbeg (Buttevant) (East)_020		
		Sensitivity	Magnitude of impacts	Significance of effects
area in form of new road bridge	increase inflow to the water body is expected; existing road drains within the red line boundary will be decommissioned and new carrier drains installed; these will outfall to the swales.			
	Geomorphology Increased run-off due to increased impermeable area could result in increased sediment input to the water feature impacting the bed strata. The installation of swales will catch this sediment, however.	High	Negligible	Not significant
	Water Quality Increased pollution loads due to an increased impermeable area could result in increased input of sediment and other contaminants such as motor oil to the local road drains which then outfalls to the water body. The use of swales in the drainage design means that any contaminants will be caught and not impact upon the water body	High	Negligible	Not Significant
New culverts/bridges or modifications to existing culverts/bridge	Hydrology and Drainage There are no new or modified culverts or bridges at this site	N/A	N/A	N/A
	Geomorphology There are no new or modified culverts or bridges at this site	N/A	N/A	N/A
	Water Quality There are no new or modified culverts or bridges at this site	N/A	N/A	N/A

Without mitigation there is the potential for some Significant impacts to the Awbeg (Buttevant) (East)_020 during the construction phase only; it is a High sensitivity water body, therefore even with Low magnitude impacts anticipated the significance of effects would be Significant in the absence of mitigation.

Summary of Flood Risk Assessment

The proposed Project at XC211 Newtown / XC212 Ballycoskery site includes the construction of a new road-over-rail bridge adjacent to a flood risk area (based on PFRA mapping).

Based on aerial photography, the cause of flooding in the PFRA mapping appears to be associated with the Awbeg River, immediately to the west of the N20. Whilst the proposed Project is located to the east of the N20 at this location, PFRA mapping does indicate that the flooding could extend across the road itself and to the east of the N20 in high magnitude events, either directly or via the backing up of tributaries.

The PFRA outputs show the proposed embankment of XC212 Ballycoskery (particularly the western extent) is adjacent to the 1% AEP fluvial flood extent. 1% AEP flood levels in the area can be estimated to be maximum 95.7mOD based on the available flood extents. This compares to the finished ground levels for the Proposed Project vary but are typically greater than 98.0mOD throughout. This indicates that the Proposed Project will not be at risk of flooding.

Flood Zone Mapping from Cock County Council also shows the proposed works to be located in Flood Zone A. The proposed road and embankment have the potential to cut-off a small section of the existing floodplain. Flows will be prevented from running north, parallel to the railway line. Flows will still however be able to bypass the works to

the east as they spill over the existing road. There is therefore the potential for a small decrease in the risk of flooding to the school.

The proposed works are therefore assessed to have a negligible to potential beneficial impact on flooding.

A Justification Test was carried out for this site and the design meets all of the criteria of the text. The Justification Test is passed.

9.5.8 XC215 Shinanagh

Construction and Operational Phase Impacts

At XC215 Shinanagh it is proposed to tie-in to an existing local road to the north and create a new access road of approximately 1km to connect the local road to the west of the existing level crossing to the road-over-rail bridge to the North See Table 9.11 for site specific impacts. The two water bodies are similar distances from the site, which is a new road of approximately 0.8km in length. The Awbeg (Buttevant)_010 becomes the Awbeg (Buttevant)_020 a short distance downstream of the local road L1320. Similar magnitudes of impacts are anticipated for each as local pathways via drainage ditches and roadside drains are not clear; a precautionary approach has been taken to assume the same magnitude of impact for both.

Table 9.11: Site specific impact at XC215 Shinanagh

Project Activity	Impacts	Awbeg (Buttevant)_010			Awbeg (Buttevant)_020		
		Sensitivity of Receptor	Magnitude Of Impacts	Significance Of Effects	Sensitivity of Receptor	Magnitude Of Impacts	Significance Of Effects
Construction Phase							
Construction of new access road	Hydrology and Drainage There are a number of local field ditches in close proximity to the site which could be disrupted during construction. Flows in local water bodies are not likely to increase during construction, however.	High	Low	Moderate to Significant	High	Low	Moderate to Significant
	Geomorphology Increased runoff is likely to have a high sediment load, this would be transported into the nearby field ditch and from there to the water bodies potentially smothering the substrate and disturbing the natural sediment regime.	High	Low	Moderate to Significant	High	Low	Significant
	Water Quality Additional works required as it is offline works, this means likely more plant and equipment will be in close proximity to the nearby ditch and increase the risks of spillage and contamination which would adversely impact the Blackwater River (Cork/Waterford) SAC.	High	Medium	Significant to Very Significant	High	Medium	Significant to Very Significant
Construction of compound location	Hydrology and Drainage The compound is proposed to be located within the Redline Boundary (RLB) and not close to any ditches. As such it is unlikely to have any impact on drainage.	High	Negligible	Not significant	High	Negligible	Not significant
	Geomorphology There is limited potential for silty water from the compound to reach local ditches and increase sediment load to strata.	High	Negligible	Not Significant	High	Negligible	Not Significant
	Water Quality As above, the location of the compound is such that there is limited opportunity for a pathway to drainage ditches and water bodies.	High	Negligible	Not Significant	Extremely High	Negligible	Not Significant
Operation Phase							

Project Activity	Impacts	Awbeg (Buttevant)_010			Awbeg (Buttevant)_020		
		Sensitivity of Receptor	Magnitude Of Impacts	Significance Of Effects	Sensitivity of Receptor	Magnitude Of Impacts	Significance Of Effects
New impermeable area in form of new road	Hydrology and Drainage The new road will drain to swales and from there into local land and roadside drains. No net increase in runoff will occur. There is no likely impact on local drainage systems.	High	Negligible	Not Significant	High	Negligible	Not Significant
	Geomorphology Increased run-off due to increased impermeable area could result in increased sediment input to the water feature impacting the bed strata. The use of swales in the new drainage system will catch such sediments.	High	Negligible	Not Significant	High	Negligible	Not Significant
	Water Quality Increased run-off due to increased impermeable area could result in increased sediment input to the water feature impacting the bed strata. The use of swales in the new drainage system will catch contaminants such as oil and sediment and prevent any increase in pollution loading to nearby ditches and water bodies.	High	Negligible	Not Significant	High	Negligible	Not Significant
New culverts/bridges or modifications to existing culverts/bridge	Hydrology and Flood Risk No new or modified culverts or bridges are proposed.	N/A	N/A	N/A	N/A	N/A	N/A
	Geomorphology No new or modified culverts or bridges are proposed	N/A	N/A	N/A	N/A	N/A	N/A
	Water Quality No new or modified culverts or bridges are proposed	N/A	N/A	N/A	N/A	N/A	N/A

Without mitigation there is the potential for Significant impacts to the affecting surface water receptors during the Construction phase of the proposed Project. The Awbeg (Buttevant)_010 and Awbeg (Buttevant)_020 are High sensitivity water bodies due to the hydrological connection to Blackwater River (Cork/Waterford) SAC, therefore even with Low magnitude impacts anticipated the effects would be Significant in the absence of mitigation.

Summary of FRA Findings

The baseline assessment of flood risk at the site is low from all sources. That aside, the introduction of new impermeable areas could potentially increase the volume and peak flow of surface runoff reaching watercourses and could therefore contribute to an increase in flood risk. This potential impact has been assessed and designed out (embedded mitigation) through the proposed drainage strategy (9.5.3).

All swale ditches outfall indirectly to the Awbeg (Buttevant) 010 water body via existing connecting ditches and roadside drainage. Maximum outflow is capped at existing greenfield runoff rates resulting in no increase in flood risk.

The FRA concluded that the XC215 Shinanagh site is a less vulnerable development (local transport infrastructure) and is at low risk of flooding from all sources. As such, the proposed works are appropriate and do not require a Justification Test.

9.5.9 XC219 Buttevant

Construction and Operational Phase Impacts

At XC219 Buttevant it is a road-over-rail bridge, a ditch box culvert and a road box culvert plus two retaining walls are proposed. During the construction phase there is potential for an impact on the water environment. See Table 9.12 for site specific impacts. Direct impacts are for the Pepperhill EPA segment, a tributary of the Awbeg (Buttevant) East segment, both are part of the Awbeg (Buttevant)_020 water body. The table presents the impacts for the water body as a whole.

Table 9.12 Site specific impacts at XC219 Buttevant

Project Activity	Impacts	Awbeg (Buttevant)_020		
		Sensitivity	Magnitude of Impacts	Significance of Effects
Construction Phase				
Construction of new road bridge	Hydrology and Drainage Potential disruption to drainage pathways locally and potential for inundation of the site as this is within a flood risk zone.	High	Medium	Significant to Very Significant
	Geomorphology Construction activities will be in very close proximity to the ditch and water body. This heightens the risk of increased sediment loads causing smothering of the bed strata and turbidity.	High	Medium	Significant to Very Significant
	Water Quality Working in close proximity to the channel heightens the risks of hazardous material spillages and sediment input to the water body and ditch and possibly causing exceedances of environmental quality standards.	High	High	Profound
Construction of compound location	Hydrology and Drainage The compound is proposed to be located on IE land to the west of the railway. As such there will be no impact on local drainage.	High	None – no pathway	None

Project Activity	Impacts	Awbeg (Buttevant)_020		
		Sensitivity	Magnitude of Impacts	Significance of Effects
	Geomorphology Due to the location of the compound, there is no requirement for site clearance, no increase in silty water and no pathway to the receptor.	High	None – no pathway	None
	Water Quality Due to the location of the compound there will be no increase in silty water runoff. There is still potential for hazardous material spills, however there is no pathway to the receptor.	High	None – no pathway	None
Construction of new culverts	Hydrology and Drainage Culvert and bridge works require activity directly in the channel, this could cause temporary changes to flows and potential disruption of local drainage systems.	High	High	Profound
	Geomorphology Construction of new culverts would require working within the channel at water features that are in a natural state. Activities would likely cause modifications to the channel bed and substrate as well as potential changes to the immediate surrounding environment including the riparian zone and bank form. The river bridge would not require modification to the bed of the Pepperhill; the culvert for the ditch would be a pre-cast box culvert and so would result in changes to the ditch bed. Installation of both will require cutting into the riverbanks with potential for the release of substantial levels of sediment to the water bodies.	High	High	Profound
	Water Quality As described above, the works required would be directly in the channel the generic risks to water quality are heightened with an increased likelihood of contaminants such as oils, chemicals and sediment entering the water feature.	High	High	Profound
Operation Phase				
New impermeable area in form of new road bridge and tie in access roads	Hydrology and Drainage New drainage system is series of swales or carrier drains to the swales which will outfall to the Pepperhill, the ditch or local road drains as appropriate. There will be no disruption to drainage systems in operation; runoff rates would be no greater than existing.	High	Negligible	Not Significant
	Geomorphology Increased run-off due to increased impermeable area could result in increased sediment input to the water feature impacting the bed strata. The use of swales in the new drainage design means that sediment would be caught and no increase to baseline conditions expected. Potential from reduced pollution load to the water bodies in this location.	High	Negligible	Not Significant
	Water Quality Increased run-off due to increased impermeable area could result in increased sediment input to the water feature impacting the bed strata. The use of swales in the new drainage design means that contaminants would be caught and no increase to baseline conditions expected. Potential	High	Negligible	Not Significant

Project Activity	Impacts	Awbeg (Buttevant)_020		
		Sensitivity	Magnitude of Impacts	Significance of Effects
	from reduced pollution load to the water bodies in this location.			
New culverts/bridges or modifications to existing culverts/bridge	Hydrology and Drainage The river bridge and culvert have been designed to ensure there is no increase in flood risk or disruption to river flows and local drainage systems.	High	Negligible	Not significant
	Geomorphology Alteration of the existing channel and removal of existing riparian vegetation., removal of the natural bed substrate, change to gradient of the channel, alteration of existing flow processes, subsequently leading to changes in the potential for erosion downstream and the morphological features present (including deposits). There will be some permanent loss of banks for the short section under the bridge and culvert; there will also be a short-term impact on a longer stretch of river bank and possibly river beds until bankside vegetation and the river beds are re-established fully through natural processes following reinstatement works.	High	Medium (short term); negligible (long term)	Significant to Very significant (short term); Not significant (long term)
	Water Quality Potential for increased sediment deposits downstream as a result of erosion of banks; river bridge and culvert are designed to avoid this and prevent scour effect.	High	Negligible	Not significant

Without mitigation there is the potential for significant impacts to the affecting surface water receptors during the Construction phase of the proposed Project. The proposed Project involves constructing a new bridge crossing over a water body and ditch which are part of the Awbeg (Buttevant)_020 which is a High sensitivity water body. There is potential for the river bridge and culvert installations, in particular, to result in Medium to High magnitude impacts resulting in Significant to Profound effects on the water body in the absence of mitigation or control measures.

Summary of FRA Findings

The baseline assessment of flood risk at the site is high for fluvial flood risk and low from all other sources.

The proposed embankment of XC219 Buttevant (western extent) is located within the 1% AEP fluvial flood extent. Detailed hydraulic modelling was undertaken to estimate peak flood levels of 83.63mOD in the 1% AEP flood event (including climate change) at the site, consistent with past observations of widespread out of bank flooding in the area. As such, the proposed embankment is located within the existing floodplain between Chainage 0 and 190.

Fluvial flooding in the area is driven by a combination of high flows in the Awbeg River (peak flows of 34.3m^3/s for a 1% AEP flood event) causing backing up of the Pepperhill tributary. High flows in the Pepperhill tributary (peak flows of 5.2m^3/s for a 1% AEP flood event) are less significant in isolation but in combination result in widespread flooding. Figure X illustrates a comparison of the 1% AEP flood extent (including climate change) with flood extents provided by Cork County Council, demonstrating good verification.

The hydraulic design of the new bridge over the Pepperhill tributary has been developed to design out increase in flood risk to the area (embedded mitigation). The key features of this structure are:

- A new 6m clear span concrete box culvert on the main Pepperhill tributary with embedment depth of 0.5m;
- A new 3m clear span concrete box culvert on the side channel immediately upstream of the R522 with embedment depth of 0.5m;

- Both culverts are aligned to the existing natural channel to avoid artificial modification of the planform;
- Freeboard of greater than 0.3m above the 1% AEP flood level including climate change in line with OPW guidance; and
- Removal of the existing culvert on the side channel beneath the R522.

In addition, the introduction of new impermeable areas could potentially increase the volume and peak flow of surface runoff reaching watercourses and could therefore contribute to an increase in flood risk. This potential impact has been assessed and designed out (embedded mitigation) through the proposed drainage strategy (9.5.3).

Swale ditches are not proposed within the existing floodplain as there is a potential for these to be overwhelmed in a fluvial flood event, resulting in a direct pathway between untreated runoff form the highway and the receiving watercourse (Pepperhill). Instead, a gully and pipe network is detailed which will capture surface runoff from the highway. This will discharge into the Pepperhill (indirectly via existing ditches) through an interceptor.

All swale ditches for XC219 Buttevant outfall directly to the Awbeg (Buttevant) 020 WFD water body (specifically Pepperhill for the western section, and Awbeg (Buttevant) for the eastern section).

The increase in fluvial flooding is negligible, therefore the overall effects would be Not Significant, and no mitigation measures are envisaged.

The proposed road embankment results in the existing R522 highway being raised above the 1% AEP water level (including climate change). At present the same section of the R522 is at risk of flooding in the same event and has been known to flood in the past as evidenced by OPW National Flood Hazard mapping and anecdotal evidence. As such, increased resilience of the road infrastructure can be identified as a benefit of the proposed development, and the proposed highway itself is located outside of Flood Zone A and B.

On the basis that the highway itself is raised, the FRA concluded that the XC219 Buttevant site is a less vulnerable development (local transport infrastructure) and is at low risk of flooding from all sources.

A Justification Test was carried out for this site and the design meets all of the criteria of the text. The Justification Test is passed.

9.5.10 Combined Effects of all Sites

Table 9.13 Provides a summary of the potential effects at all of the sites, prior to mitigation and control measures. It allows for the consideration of the potential for combined effects on any single receptors.

Table 9.13: Combined Effects across all Sites (Pre-Mitigation)

Level crossing	WFD Water Body	Sensitivity of Receptor	Receptor attribute	Magnitude of Impact (Construction Phase)	Significance of Effect (Construction Phase)	Magnitude of Impact (Operation Phase)	Significance of Effect (Operation Phase)
XC187 Fantstown	No impacts as no proposed works here						
XC201 Thomastown	Loobagh_030	High	Hydrology	Negligible	Not significant	Negligible	Not significant
			Geomorphology	Low	Moderate	Negligible	Not significant
			Water Quality	Low	Moderate	Negligible	Not significant
XC209 Ballyhay	Awbeg (Buttevant) (East)_020	High	Hydrology	Negligible	Not significant	Negligible	Not significant
			Geomorphology	Negligible	Not significant	Negligible	Not significant
			Water Quality	Medium	Significant/Very Significant	Negligible	Not significant
XC211 Newtown & XC212 Ballycoskery	Awbeg (Buttevant) (East)_020	High	Hydrology	Negligible to Low	Not significant to Moderate/Significant	Negligible	Not significant
			Geomorphology	Low	Significant	Negligible	Not significant
			Water Quality	Low to Medium	Moderate/Significant to Very Significant	Negligible	Not significant
XC215 Shinanagh,	Awbeg (Buttevant) _010	High	Hydrology	Negligible to Low	Not significant to Moderate/Significant	Negligible	Not significant
			Geomorphology	Low	Significant	Negligible	Not significant
			Water Quality	Low to Medium	Moderate/Significant to Very Significant	Negligible	Not significant
	Awbeg (Buttevant) _020	High	Hydrology	Negligible to Low	Not significant to Moderate/Significant	Negligible	Not significant
			Geomorphology	Low	Significant	Negligible	Not significant

Level crossing	WFD Water Body	Sensitivity of Receptor	Receptor attribute	Magnitude of Impact (Construction Phase)	Significance of Effect (Construction Phase)	Magnitude of Impact (Operation Phase)	Significance of Effect (Operation Phase)
			Water Quality	Low to Medium	Moderate/Significant to Very Significant	Negligible	Not significant
XC219 Buttevant,	Awbeg (Buttevant)_020	High	Hydrology	None to High	Not significant to Profound	Negligible	Not significant
			Geomorphology	None to High	Moderate to Profound	Negligible	Not significant
			Water Quality	Medium to High	Significant to Profound	Negligible	Not significant

The findings show that there is potential for cumulative impacts on the Awbeg (Buttevant)_020 as a result of potential effects on hydrology, geomorphology and water quality. The likelihood of these impacts actually combining is low, however. The proposed works will not occur at the same time and there is significant distance between the sites to allow for any impacts to be diminished to imperceptible before reaching a downstream site.

9.6 Mitigation Measures

This sets out measures envisaged to avoid, prevent or reduce any identified significant adverse effects on the environment and, where appropriate, identify any proposed monitoring arrangements. This explains the extent to which significant adverse effects on the environment are avoided, prevented, reduced or offset, and covers both the Construction and Operational Phases. Construction works will take place in accordance with a Construction Code of Practice (CCoP) or Construction Environmental Management Plan (CEMP) (or similar document), which will be written by the Contractor and require the Contractor to conform to industry guidance and incorporates best practice mitigation as set out below. All measure below will be included in the CEMP.

9.6.1 Construction Sequencing

In order to protect water bodies from potential impacts such as increased flood risk, increased volumes of runoff, silty water and accidental spills, it is proposed to install the permanent drainage elements in at the outset, prior to full site clearance.

For roadways, the footprint for the proposed swales would be excavated, the perforated pipes laid, soil back-filled and the topsoil seeded. These are positioned either side of the new highways and would then receive any runoff following the rest of the site clearance. The swales at this point would not be connected into local drainage systems, they would be blocked and a small inspection/pumping chamber or pit left open to allow for visual inspection and either the controlled release of clean water to the local drainage system or, if still slightly silty, pumping out to a settlement tank or silt-buster before being discharged. This also allows the rate of flow to be controlled to prevent any increase in flood risk during the construction phase.

Once the highways and bridge structures are almost completed, the swales will be accessed further from those highways to finish their construction and open up permanent connection to outfall points at each site. Then the roads will be finished. On this basis, and with this management plan in place, no operational effect is expected.

9.6.2 Generic Mitigation Measures

There are many potentially significant impacts on surface water receptors which will be common to most major construction works and are possible across the various elements of this proposed Project. A number of Generic Mitigation Measures have been identified which will be applied across the proposed Project. These are described in this Section.

In addition to this, there are mitigation measures specific to the various proposed Project elements.

Consistent with the assessment of impacts during the Construction Phase, generic control measures are described in order to potentially avoid or reduce the potential impacts outlined.

These measures have been designed with reference to the following guidelines:

- Construction Industry Research and Information Association (CIRIA) C648 Control of Water Pollution from Linear Construction Projects: Technical Guide (Murnane et al., 2006);
- CIRIA C649 Control of Water Pollution from Linear Construction Projects: Site Guide (Murnane et al., 2006);
- 'Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors' (CIRIA, 2001); and
- Inland Fisheries Board document 'Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters'.

Control of Silt Laden Runoff

Specific measures to control silt are planned to be implemented at each of the proposed Project infrastructure sites. Surface water runoff at the construction sites will be managed to prevent flow of silt laden surface water flowing into surface water receptors;

If a discharge to a watercourse is necessary, the water will be treated and controlled in accordance with any conditions imposed by regulatory authorities such as the relevant Local Authority, the EPA and/or OPW. It is anticipated that the levels of suspended solids in any discharge will be not greater than 25mg/l and flows will be controlled to levels appropriate to the receiving water. It is possible that such a discharge may require a licence under the Water Pollution Acts 1977 & 1990, as amended and the Arterial Drainage Act 1945 & 1995, as amended. The Contractor will liaise with the regulatory authorities at an early stage to determine the necessity for licences and include the appropriate application time required in any construction programme.

Silt fences will be erected along the boundary of water bodies to prevent any silt laden runoff from impermeable surfaces, temporary or permanent, as well as spoil heaps within the construction working width.

Reinstatement of any banks affected as a result of silt laden run off during construction will be reinstated back to pre-development conditions.

Stockpiling of Materials

The following measures will be put in place by the Contractor with regard to stockpiling of material:

- Temporary stockpiles will be located away from drains and watercourses. Stockpiles will not be located within 5m of a watercourse;
- For watercourse crossings, stockpiles will not be located anywhere within the crossing working area;
- Management of stockpiles to prevent siltation of watercourse systems through runoff during rainstorms will be required with the final measures to be determined by the Contractor. These will include the following measures or equivalent measures:
- Allowing the establishment of vegetation on the exposed soil;
- Providing silt fences or straw barriers at the toe of the stockpile to mitigate runoff during rain events;
- Surrounding stockpiles with cut-off ditches to contain runoff;
- Directing any runoff to the site drainage system or filter drains along the Construction Working Width and to the settlement pond (or other) treatment systems; and
- Providing bunds or another form of diversion to keep runoff from entering the stockpile area.

Storage of Materials

The following measures will be implemented across the site for the storage of materials:

- All oil and diesel storage facilities will be at least 30m from any watercourse including surface water drains;
- Spill kits and drip trays will be provided for all equipment and at locations where any liquids are stored and dispensed;
- Storage areas for solid materials, including waste soils, will be designed and managed to prevent deterioration of the materials and their escape (via surface runoff or wind blow);
- Storage areas will be kept secure to prevent acts of vandalism that could result in leaks or spills; and
- All containers of any size will be correctly labelled indicating their contents and any hazard warning signs.

Fuel Tanks, Drums, Mobile Bowsers and Bunds

The following measures will be implemented across the site for the prevention of spills:

Fuel tanks, drums and mobile bowsers (and any other equipment that contains oil and other fuels) will have a secondary containment, for example, double skinned tanks. All tanks, drums and mobile bowsers will be located in a sealed impervious bund with sufficient capacity to contain at least 25% of the total volume of the containers or 110% of the largest container, whichever is the greatest:

- Storage areas will be covered, wherever possible, to prevent rainwater filling the bunded areas;
- Fuel fill pipes will not extend beyond the bund wall and will have a lockable cap secured with a chain;
- Where fuel is delivered through a pipe permanently attached to a tank or bowser:
- The pipe will be fitted with a manually operated pump or a valve at the delivery end which closes automatically when not in use;
- The pump or valve will be fitted with a lock;
- The pipe will be fitted with a lockable valve at the end where it leaves the tank or bowser;
- The pipework will pass over and not through bund walls;
- Tanks and bunds will be protected from vehicle impact damage;
- Tanks will be labelled with contents; capacity information and hazard warnings; and
- All valves, pumps and trigger guns will be turned off and locked when not in use. All caps on fill pipes will be locked when not in use.
- Suitable precautions will be taken to prevent spillages from equipment containing small quantities of hazardous substances (for example, chainsaws and jerry cans) including:
- Each container or piece of equipment will be stored in its own drip tray made of a material suitable for the substance being handled; and
- Containers and equipment will be stored on a firm, level surface.

For deliveries and dispensing activities, the Contractor will ensure that:

- Site-specific procedures are in place for bulk deliveries;
- Delivery points and vehicle routes are clearly marked; and
- Emergency procedures are displayed, and a suitably sized spill kit is available at all delivery points, and staff are trained in these procedures and the use of spill kits.

Vehicles and Plant

The use of vehicles and plant poses similar risks to those posed by storage of liquids. Fuel and oil may leak from such equipment which may enter drains and/or watercourses, as well as contaminating the ground itself. The following measures will be implemented to reduce this risk:

- Vehicles and plant provided for use on the site will be in good working order to ensure optimum fuel efficiency, and will be regularly inspected to ensure they are free from leaks;
- Sufficient spill kits will be carried on all vehicles;
- Vehicles and plant will be regularly maintained to ensure that they are working at optimum efficiency and are promptly repaired when not in good working order;
- Vehicles and plant will not park near or over drains; and
- Refuelling of vehicles and plant will be carried out on hard standing, using drip trays to ensure no fuel can contaminate the ground outside of the bunded areas.

Working in or Near Watercourses

The following control measures will be implemented during the construction of the proposed Project in or adjacent to a watercourse:

- Works within and adjacent to watercourses will be conducted during forecast low flow periods where possible;
- In-stream works will not be carried out in watercourses frequented by salmon or trout during the Annual Close Season. The duration of the season varies regionally within the period from the beginning of October to the end of February. The timing of works will be considered on a site-specific basis and in agreement with the IFI because some rivers have late spawning salmonids;
- Operation of machinery in-stream will be kept to an absolute minimum. All construction machinery operating in-stream will be mechanically sound to avoid leaks of oils, hydraulic fluid, etc. Machinery will be cleaned and checked prior to commencement of in-stream works;
- The design of the outfalls and settlement ponds and the construction method statements for their installation will be agreed with IFI prior to construction;
- The area of disturbance of the watercourse bed and bank will be the absolute minimum required for the installation of the outfall;
- Any dewatering flows will be directed to the construction drainage system and to the settlement pond (or other) treatment system;
- A sediment mat / silt trap or similar will be located immediately downstream of the works within and adjacent to the minor watercourse. These should be inspected daily, maintained and cleaned regularly during the course of site works. Diversion of water to and from a temporary diversion channel will only take place during the period March to September or as agreed with the IFI;
- Small check dams will be constructed in the cut-off watercourse to trap any sediment, and a sediment trap will be provided immediately downstream of the diversion to the existing watercourse; and
- Where in-stream bed material is to be removed, coarse aggregates, if present, will be stockpiled at least 10m away from the watercourse for replacement following reinstatement of a watercourse channel.

Reinstatement of any banks affected during construction works near a watercourse will be reinstated back to pre-development conditions.

Use of Concrete

The use and management of concrete in or close to watercourses shall be carefully controlled to avoid spillage. Where the use of concrete near water cannot be avoided, the following control measures will be employed:

- When working in or near the surface water and the application of in-situ materials cannot be avoided, the use of alternative materials such as biodegradable oils shall be used;
- There will be no hosing of concrete, cement, grout or similar material spills into surface water drains. Such spills shall be contained immediately, and runoff prevented from entering the watercourse;
- Concrete waste and wash-down water will be contained and managed on-site to prevent pollution of all surface watercourses; and
- Washout from concrete lorries will not be permitted on-site and will only take place at the batching plant (or other appropriate facility designated by the manufacturer).

Construction Compounds typical Construction Compounds Site Establishment Measures

The following measures will avoid or reduce impacts on the surface water environment:

Site Establishment

The topsoil, and upper level of subsoil, will be stripped and stockpiled over the Construction Working Width. Any existing land drains crossing the works area will be culverted.

The Contractor will be required to provide a temporary geogrid mattress overlain in stone for trafficking within the Construction Compound.

Other developments proposed to occur within the site include the laying of interceptor traps in a demarcated area for refuelling, and drainage works associated with plant cleaning and service areas.

Drainage

Generally, the site will be pervious as it is overlain in stone. Those areas with impervious pavement will be graded to a fuel / oil separator for collection of any surface water runoff contaminants.

Both the bunded refuelling and plant servicing areas will incorporate a forecourt separator for any potential spillages which may occur during vehicle refuelling and road tanker delivery.

The retained contents of the separators will be collected for disposal by a licensed operator to a licensed waste disposal / recovery facility.

Construction Compounds will be provided with a Sustainable Drainage System (SuDS) designed storage and soakaway system for storm water running directly off of site buildings, and pavement such as access and site roads. Storage compounds will have stoned areas for the clean storage of materials.

Construction Monitoring Measures

Continuous monitoring of water quality will take place at the outlets from attenuation areas along the pipeline and the settlement lagoons and surface water attenuation ponds at the Key Infrastructure Sites. If hydrocarbons are observed or other water quality parameters are exceeded, discharges will be suspended until the quality of the water is of a standard acceptable for discharge.

During the Construction Phase, the Contractor will monitor the levels of Total Suspended Solids (TSS), turbidity, pH, temperature, Dissolved Oxygen (DO) and hydrocarbons at the same locations up and down stream of watercourses in close proximity to the works, or at crossing points where relevant, once a week for the duration of the following works:

- Site clearance works, earthworks movements and stockpiling;
- Excavations including those associated with the provision of drainage works; and
- Construction works within and adjacent to watercourses.

The Construction Phase monitoring results will be compared with those results established in pre-construction monitoring. In the event of an elevation above pre-construction levels an investigation will be undertaken by the Contractor and remediation measures will be put in place.

In addition, daily visual inspections of the surface drainage and sediment control measures and the watercourses will be undertaken by the Contractor. Indicators that water pollution may have occurred include the following:

- Change in water colour;
- Change in water transparency;
- Increases in the level of silt in the water;
- Oily sheen to water surface; and
- Floating detritus, or scums and foams.

These inspections will be recorded. In the event that such indicators are observed, works will cease, and sampling will immediately be undertaken as described for the weekly monitoring, and an investigation of the potential cause will be undertaken by the Contractor.

Where the works are identified as the source causing the exceedance the following will apply:

- Works capable of generating sediment and all discharges shall be stopped immediately; and
- The Contractor will be required to take immediate action to implement measures to ensure that such discharges do not re-occur.

This monitoring will alert the Contractor to any detrimental impacts that construction activities could have on water quality such that appropriate remedial action can be taken as quickly as possible. This will also allow the Contractor to demonstrate the success of the mitigation measures employed in maintaining any sediment release within the 'trigger' value established.

9.6.3 XC201 Thomastown

Construction Phase

All impacts associated with the construction activities highlighted within Section 9.5.2 will be reduced through the adoption of good working practice, as outlined in the CEMP.

The hydraulic design of the culvert will be such that the risk of overtopping, backing up and increased flood levels is minimised. As well as this, the structure should be able to convey 1% AEP flood event with an allowance for climate change and where applicable include a suitable blockage freeboard.

9.6.4 XC209 Ballyhay

Construction

It is not anticipated that this would be a significant volume of water will be dewatered from the trenches, however as part of the additional Ground Investigation proposed for prior to construction, groundwater samples will be taken. The groundwater quality samples will tell whether there is any issue with groundwater quality. Based on the results, it may be possible to dewater and discharge to the Awbeg (Buttevant) (East)_020 following settlement; alternatively, if other contamination such as metals or hydrocarbons are detected, additional measures will be needed which could be additional treatment or disposal off site.

9.6.5 XC211 & XC212 Newton & Ballycoskery

Construction Phase

Most of the impacts associated with the construction activities highlighted within Section 9.5.2 will be reduced through the adoption of good working practice, as outlined in the CEMP at Volume 5, Appendix 1I and set out in Section 9.6.2 of this chapter.

In addition, specific control measures are required for the installation of the proposed culvert to the west of the railway. The culvert will be pre-fabricated and clean, so as to avoid concrete washings contamination. If the ditch is flowing, it will be dammed and pumped over the installation area to avoid the transportation of sediment downstream. Additional in-stream measures will also be deployed, such as straw bales and oil booms to ensure there is no downstream impact as a result of the installation process.

9.6.6 XC215 Shinanagh

Construction Phase

All impacts associated with the construction activities highlighted within Section 9.5.2 will be reduced through the adoption of good working practice, as outlined in the CEMP at Volume 5, Appendix 1I and set out in Section 9.6.2 of this chapter.

9.6.7 XC219 Buttevant

Construction Phase

Most impacts associated with the construction activities highlighted within Section 9.5.2 will be reduced through the adoption of good working practice, as outlined in the outline CEMP at Volume 5, Appendix 1I and set out in Section 9.6.2 of this chapter.

In addition, specific control measures are required for the installation of the proposed culverts to the west of the railway. The culverts will be pre-fabricated and clean, so as to avoid concrete washings contamination. The water bodies will be dammed and the water pumped over the installation area to avoid the transportation sediment downstream. Additional in-stream measures will also be deployed, such as straw bales and oil booms to ensure there is no downstream impact as a result of the installation process. The culverts will be embedded and the natural beds of the waterbodies allowed to re-establish naturally following installation and the removal of the upstream dam.

9.7 Residual Effects

This section identifies residual effects. This covers any remaining effects following implementation of mitigation measures, to be done for each site and combined effects for all sites.

All the potential geomorphology (and hydromorphological/WFD) related impacts such as increased silts, for example, identified during the construction phase will be reduced by the mitigation measures. Therefore, there are no residual impacts on geomorphology during construction.

Residual impacts to water quality during the construction of the scheme are expected to be negligible when the mitigation and control measures are implemented.

There are no residual effects identified for the operational phase as all impacts are addressed through design and no additional mitigation is required.

Table 9.14: Residual Construction Impacts

WFD Water Body	Level crossing	Receptor attribute	Sensitivity	Magnitude of Impact (Construction Phase)	Significance of Effect (Construction Phase)
Fairyfield_Glebe_010	XC187 Fantstown	Hydrology	High	None	None
		Geomorphology	High	None	None
		Water Quality	High	None	None
Loobagh_030	XC187 Fantstown	Hydrology	Medium	Negligible	Not significant
		Geomorphology	Medium	Negligible	Not significant
		Water Quality	Medium	Negligible	Not significant
Loobagh_030	XC201 Thomastown	Hydrology	High	Negligible	Not significant
		Geomorphology	High	Negligible	Not significant
		Water Quality	High	Negligible	Not significant
Awbeg (Buttevant) (East)_020	XC209 Ballyhay	Hydrology	High	None	None
		Geomorphology	High	None	None
		Water Quality	High	None	None
Awbeg (Buttevant) (East)_020	XC212Ballycosterky XC211 Newton	Hydrology	High	Negligible	Not significant
		Geomorphology	High	Negligible	Not significant
		Water Quality	High	Negligible	Not significant
Awbeg (Buttevant) _010	XC215	Hydrology	High	Negligible	Not significant

	Shinanagh, XC212 Ballycoskery,	Geomorphology	High	Negligible	Not significant
		Water Quality	High	Negligible	Not significant
Awbeg (Buttevant)_020	XC219 Buttevant,	Hydrology	High	Negligible	Not significant
		Geomorphology	High	Negligible	Not significant
		Water Quality	High	Negligible	Not significant

9.8 Interactions

Water interacts with biodiversity receptors through aquatic ecosystems, both in terms of water quality, flows and hydromorphological aspects. There is a direct connection between groundwater and surface water and geological variations can affect the nature of silty water run-off. Water quality impacts have been taken into account in the biodiversity assessment (Volume 3, Chapter 7 Biodiversity). Pollution control mitigation measures set out in this document will prevent pollution of groundwaters also and have been taken into account in Volume 3, Chapter 8 Soils, Geology and Hydrogeology.

9.9 Cumulative Effects

There is potential for cumulative impacts from five of the seven sites (XC209 to XC219) and these are all within the Awbeg catchment. However, it is considered unlikely as the mitigation and control measures proposed will result in no significant effects on water bodies from any of the sites; as such no combined significant impact is considered likely.

With respect to other projects, the only project of significance within the study area is the upgrading of the N20 to motorway. This project comes close to the proposed Project, particularly at XC211 Newtown, XC212 Ballycoskery and XC215 Shinanagh. As is set out in the Biodiversity assessment, this scheme is currently within the design stage with construction anticipated to commence in 2023 with completion in 2027. As the proposed Project is projected for completion in October 2022 it is anticipated that there will be no overlap with the M20 construction programme.

9.10 Difficulties Encountered in Compiling Information

Water body information is very well documented by the EPA and with access to the EPA interactive maps and their EDEN portal for detailed information relating to each water body, there were no difficulties in compiling the baseline for designated surface and ground water bodies.

Many of the primary receptors were however ditches or drainage channels and water quality, hydromorphology and hydrology information was not available for these. Nor did the site visit include measuring of these factors at each site. As a result, the potential impact on the water body into which these ditches outfall was assessed. This does not leave the ditches unprotected in the construction and operation of the proposed Project; mitigation and design measures are for the ditches themselves, not for the receiving water bodies. There would be a cumulative reduction to, or avoidance of, any impacts on the receiving water as a result of the ditch being protected.

9.11 References

Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community Action in the Field of Water Policy (the Water Framework Directive)

DIRECTIVE 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the Assessment and Management of Flood Risks

SI 722 of 2003, European Communities (Water Policy) Regulations, as amended

SI 792 of 2009, European Communities Environmental Objective (Surface Water) Regulations 2009 as amended;

SI 350 of 2014, European Union (Water Policy) Regulations 2014;

SI 122 of 2010 European Communities (Assessment and Management of Flood Risks) Regulations; and

SI 81 of 1988, European Community Environmental (Quality of Surface Water Intended for Human Consumption) Regulations 1984 as amended.

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River Basin Management Plan for Ireland 2018 – 2021 (Government of Ireland, 2018)

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).

Guidelines on Procedures for Assessment and treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (TII [National Roads Authority (NRA)], 2009);

Guidelines on the information to be contained in Environmental Impact Statements (EIS). Draft (EPA, 2017); and

TB13 Revised Road Drainage Standards (TII [NRA], 2015).