ATTACHMENT NO: B.5

Planning & Environmental Report

AECOM

JENNINGS O'DONOVAN & PARTNERS LIMITED
CONSULTING ENGINEERS

UTAS Wastewater Consultancy Services 12/085-264 - Wexford

Ballyhack / Arthurstown / Duncannon Agglomerations

Planning & Environmental Report

May 2019

UISCE EIREANN : IRISH WATER

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1 INTRODUCTION

AECOM and Jennings O'Donovan were appointed by Irish Water to progress the Untreated Agglomeration Study (UTAS) Wexford agglomerations (12/085-264) from Gate 2 through to Gate 4 based on the recommendations of each Concept Design Report, in order to bring these sites into compliance with the Urban Wastewater Directive. The overall project encompasses 4 no. sites across County Wexford.

The project objective is to provide the detailed design, procurement and management of wastewater treatment systems capable of providing appropriate treatment for the agglomerations within UTAS Wexford.

As part of this process, an Environmental Impact Assessment (EIA) Screening Report was carried out for the project. The EIA Screening Report for Ballyhack / Arthurstown / Duncannon concluded that an EIAR is not required for the proposed development at Ballyhack / Arthurstown / Duncannon (collectively named Arthurstown agglomeration). Therefore, a Report addressing the relevant environmental considerations in relation to the proposed necessary works is being carried out for the Arthurstown agglomeration. This report is the Planning & Environmental Report for the Arthurstown agglomeration.

The objective of this Planning and Environmental report is to outline the potential environmental effects of the proposed works at Ballyhack / Arthurstown / Duncannon and to detail mitigation measures for each potential effect identified.

1.1 BACKGROUND

Ireland's water infrastructure is widely regarded as being in need of substantial upgrades. Irish Water (Uisce Éireann) was formed by the Water Services Act (2013) with the task of upgrading water infrastructure across the country, merging the water and wastewater functions and services of the 34 local authorities into a single entity. Its functions include:

- The abstraction, treatment and distribution of drinking water;
- The collection and treatment of waste water and sludge disposal; and
- Strategic planning for the sector including water resource management.

Irish Water wishes to provide wastewater treatment for the Ballyhack / Arthurstown / Duncannon agglomeration area as part of its remit to improve water and wastewater infrastructure throughout the country. The scheme will ensure that the wastewater discharges from the agglomerations are treated in accordance with the requirements of the Urban Wastewater Treatment Directive (UWWTD).

1.2 NEED FOR THE DEVELOPMENT

The existing wastewater collection networks at the agglomerations of Ballyhack, Arthurstown and Duncannon discharge untreated wastewater to the Barrow Nore Suir Estuary. There are several existing packaged treatment plants serving housing estates within the agglomerations but these are all in poor condition such that wastewater collected in these agglomerations is effectively discharged in an untreated condition.

There are currently Wastewater Discharge Certificates for Arthurstown and Ballyhack for populations less than 500. There is currently a Waste Water Discharge Licence for Duncannon, this is for a Population Equivalent of 1001 -2000. The licence requires Emission Limit Values to be met that are in line with Secondary Level Treatment. As there is little or no wastewater treatment the licence requirements are not being met. This scheme will combine waste water from all three agglomerations to a single wastewater treatment plant (WwTP) and final effluent discharge. Therefore a new Waste Water Discharge Licence (WWDL) will be required from the EPA.

It is in this context that the Wexford UTAS project is being developed, which includes a proposed Arthurstown Wastewater Treatment Plant (WwTP) in Mersheen townland and associated works at Arthurstown, Duncannon and Ballyhack where Wastewater Pumping Stations (WwPS) will be located. New pipelines will transfer untreated wastewater to the WwTP and a new final effluent pipeline will transfer final effluent to the existing outfall at Arthurstown.

The practice of discharging untreated wastewater to the estuary is not acceptable and Irish Water intends to rectify this problem by constructing this new WwTP to ensure that wastewater discharging meets appropriate discharge standards.

None of the agglomerates have infrastructure sites which are suitable for a treatment plant. Therefore, a new treatment site has been selected. An extensive site selection process formed part of a feasibility study that was undertaken to select the WwTP site. Layout of the villages was examined in conjunction with approved planning applications and the overall country wide development strategy in order to select potential sites that would not negatively impact on the character of the villages and would not inhibit future development within the respective villages. This study concluded that the most economic advantageous option would be to treat wastewater from the three agglomerations of Ballyhack, Arthurstown and Duncannon at a single wastewater treatment plant located close to Arthurstown.

Based on a review of the topography and available land in the vicinity of Arthurstown, Ballyhack and Duncannon Piers, it was recommended that three terminal pumping stations would be provided in the pier area of each agglomeration. Nineteen potential treatment plant sites were assessed for the WwTP site. The final site chosen is located close to Arthurstown, where sufficient land has been purchased to serve current and future populations.

The existing discharges at both Ballyhack and Duncannon are end of pier; point discharges, which are above the water level will not be retained. The existing outfall at Arthurstown is in close proximity to the proposed wastewater treatment plant and will be utilised to discharge treated wastewater below the water line.

Network alterations will be required in order to accommodate the new wastewater treatment site. The WwPS at Ballyhack will link to the WwPS at Arthurstown through a wastewater rising main and wastewater gravity pipeline. The WwPS at Arthurstown will link to the Arthurstown WwTP by a wastewater rising main. The WwPS at Duncannon will also link into the Arthurstown WwTP by a wastewater rising main and wastewater gravity pipeline. The project will result in wastewater being treated to secondary treatment level, prior to discharge by gravity at the existing outfall at Arthurstown pier.

1.3 CONSULTATIONS

Inland Fisheries Ireland (IFI) were consulted in relation to the protection of the three Inland Waterway crossings in the catchment area.

National Parks and Wildlife Service (NPWS) Jochen Roller, GIS Consultant, was consulted to identify records for rare and protected flora within the boundary or in close proximity to the proposed wastewater infrastructure.

1.4 AVAILABILITY OF DATA

The planning application may be inspected or purchased, at a fee not exceeding the reasonable cost of making a copy at the following:

Planning Department,
Wexford County Council,
County Hall,
Carricklawn,
Wexford,
Y35 WY93.
Telephone: (053) 9196101

2 PROJECT DESCRIPTION

2.1 SITE DESCRIPTION

The study location is defined by the existing and potential future wastewater collection network serving the villages of Arthurstown, Ballyhack and Duncannon in County Wexford. The three villages are located in the southwest of County Wexford and each is adjacent to Waterford Harbour. Ballyhack and

Arthurstown are located on the R733. Ballyhack is approximately 20km south of New Ross and Arthurstown is a further 1km south. Duncannon is located on the R737, approximately 24km south of New Ross.

The village of Ballyhack is located on the side of a relatively steep hill, with the lower portion of the town running down to meet Waterford Harbour. The village of Arthurstown is located on the shores of Kings Bay, Waterford Harbour. The agglomeration extends from Cois Cuan Housing Estate in the west to Dunbrody Country House in the east. The village of Duncannon is located to the South of Arthurstown and is the largest of the three villages.

Refer to Drawing No. UTAS-AEC-ART-DR-CE-0020 to 0023 in Appendix A.

The wastewater in the villages of Arthurstown, Ballyhack and Duncannon is collected through networks in each village. Wastewater then discharges by gravity flow, without treatment (apart from 2 housing estates in Duncannon[1]), through outfalls at each village. Refer to Figure 2.1 (the full version of which is included in Appendix A as Drawing No. UTWE-AEC-ART-DR-CE-3010).

There is little or no stormwater separation in the agglomerations. There are no secondary discharges from the agglomerations.

[1] There are two WwTP in Duncannon providing secondary treatment for residents of two housing estates. These plants are considered to be in poor condition and such that effluent was considered to be effectively untreated.

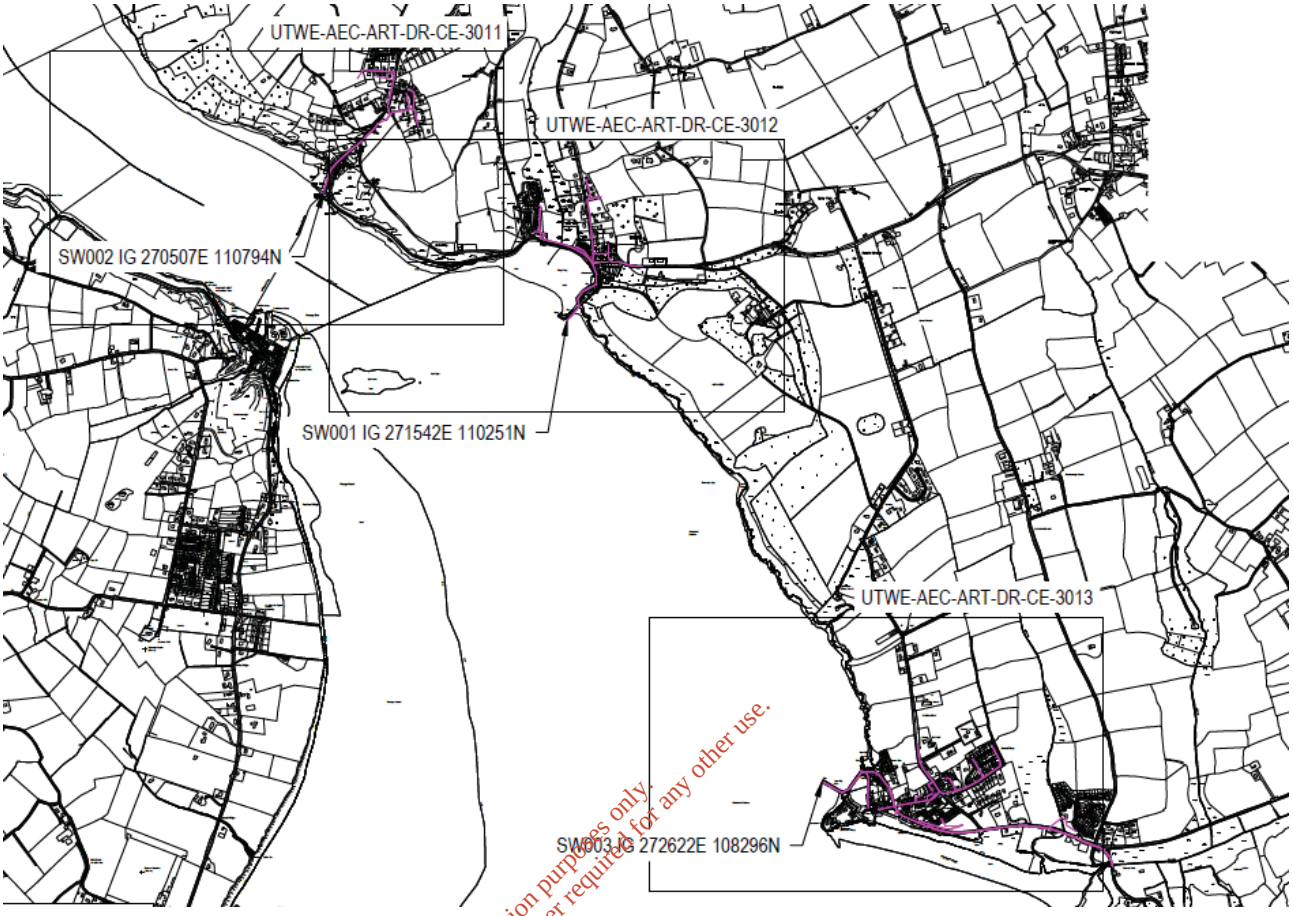


Figure 2.1 - Existing Wastewater Infrastructure

2.1.1 Existing population

The current and future population equivalent (PE) of the combined Arthurstown, Ballyhack and Duncannon agglomeration is shown in Table 2.1.

Table 2.1: Population Equivalents for Arthurstown, Ballyhack & Duncannon

Parameter	Existing		10 Year Horizon		30 Year Horizon	
	Summer	Winter	Summer	Winter	Summer	Winter
Population Equivalent	1817	704	1875	727	2475	1035

2.2 EXISTING LAND USE

The site of the proposed WwTP in the townland of Mersheen on the outskirts of Arthurstown is currently located on an improved agricultural grassland field adjacent to a wooded area (refer to Figure 2.2).

The WwPS at Ballyhack is located on an existing hardstanding area at Ballyhack Harbour which is currently used as a carparking area (refer to Figure 2.3). The site of the proposed WwPS at Arthurstown is on an existing gravelled area which is occasionally used for carparking at the harbour (refer to Figure 2.4 below). The proposed WwPS at Duncannon is located on the site of an existing derelict building at Duncannon pier (refer to Figure 2.5 below). The Wastewater Rising Main and Wastewater Gravity Pipelines will be located along existing asphalt roads (2,750m) and improved agricultural grassland / access track (4,220m). The proposed final effluent pipeline from the WwTP to the outfall at Arthurstown will be laid in an existing access track (440m) and across the roadway before it ties into a point on the existing network upstream of the existing outfall.

Figure 2.2: Site of proposed WwTP at Mersheen Townland, Arthurstown

Figure 2.3: Site of pumping station at Ballyhack

Figure 2.4: Site of pumping station at Arthurstown

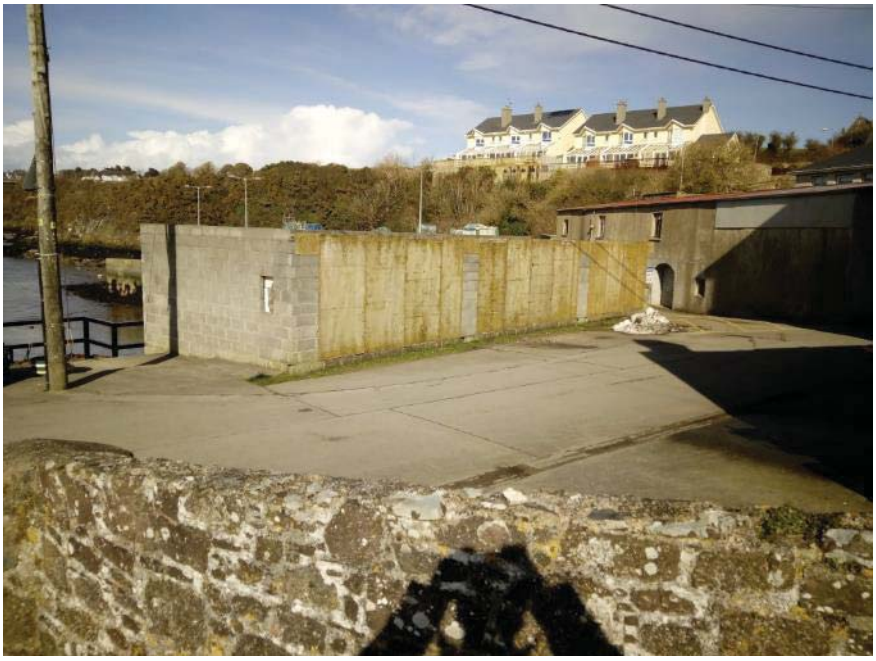


Figure 2.5: Site of pumping station at Duncannon

2.3 DESIGNATED AREAS OF CONSERVATION

The closest European SAC or SPA Site is the River Barrow and River Nore Special Area of Conservation (SAC). Parts of the project infrastructure are located within the SAC boundary, namely, the proposed WwPS and existing outfall at Arthurstown and the proposed WwPS and sections of the proposed rising main at Ballyhack. The proposed WwTP is located c. 300m from the SAC boundary, and the proposed WwPS at Duncannon is c. 20m from the SAC boundary.

The Lower River Suir SAC is 6km north-west of the proposed Arthurstown Agglomerations at Ballyhack. The Tramore Dunes and Backstrand SAC is located 11.5km to the south-west of Duncannon. Hook Head SAC is located 10.7km to the south-east of Duncannon. Bannow Bay SAC is located 7km east of Duncannon. Tramore Back Strand Special Protection Area (SPA) is located 11.5km south-west of Duncannon. Bannow Bay SPA is located c. 7.4km south-east of Duncannon. Keeragh Islands SPA is found approximately 14.6km south-east.

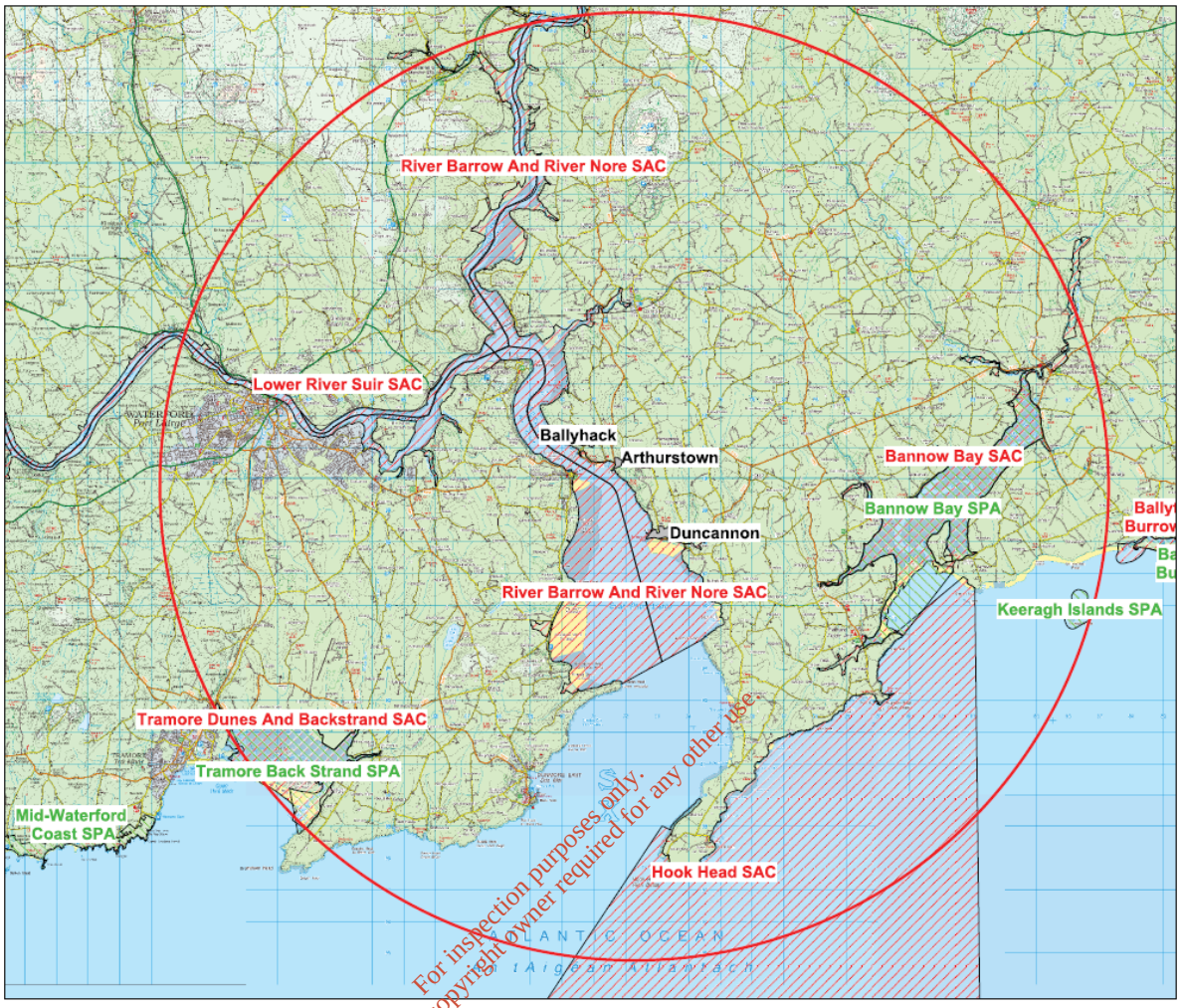


Figure 2.6 Designated European Sites (Drawing No. 5407/NIS/ART-BAL-DUN) within a 15km radius

Table 2.2: Designated European Site within a 5km radius of the Arthurstown agglomeration

Site Name	Designation	Site Code	Approximate distance from site
River Barrow & River Nore SAC	SAC	002162	0m at Arthurstown & Ballyhack 20m at Duncannon 300m from WwTP

Additional information is contained in the Natura Impact Statement (NIS).

2.4 RECEIVING WATERS, DISCHARGE REQUIREMENTS AND ENVIRONMENTAL CONSIDERATIONS

2.4.1 Relevant Statutory and Policy Considerations for the Receiving Water

The wastewater from the area currently discharges untreated effluent to the River Suir estuary through a short outfall adjacent to the harbour in Arthurstown, at the quay wall in Ballyhack, and on the southern side of the quay wall at Duncannon, part of the designated River Nore and River Barrow SAC.

A Waste Water Discharge Licence (Licence Register No. D0245-01) for the Wexford agglomeration at Duncannon was granted by the EPA on 1st September 2014. The Annual Environmental Report (AER) by Irish Water as part of the licence requirements states that the agglomeration is not served by a WwTP and the EPA have identified that the untreated discharges are potentially impacting on the Duncannon bathing water compliance[2]. There are no AERs available for Ballyhack or Arthurstown agglomerations.

A substantial body of legislation and guidelines exists, which deal with wastewater treatment, the aquatic environment and control of pollution discharges. The following sections summarise the legislation together with key factors relevant to the receiving waters of the Ballyhack / Arthurstown / Duncannon agglomerations.

2.4.1.1 Water Framework Directive (WFD)

The WFD requires all EU member states to aim to achieve "good" status for all waters (surface and groundwater) by 2015. The directive defines surface and groundwater types and outlines the legislative documents and other EU directives that should be used in order to ensure compliance.
In order to achieve "good" status compliance with the 2009 Surface Water Regulations and 1991 Urban Wastewater Treatment Directive is required.

The WFD specifies that the requirements of local River Basin Management Plans (RBMP) be followed. The RBMP which applies to Arthurstown, Ballyhack and Duncannon is the South Eastern River Basin District RBMP. This plan does not provide specific objectives, but it does require "good status" to be achieved through the prevention of pollution in environmentally protected areas (e.g. Waterford Harbour is a protected SAC).

The receiving water is the Barrow Nore Suir Estuary, WFD Code: IE_SE_100-0100

2.4.1.2 Surface Water Regulations 2009 (SWR)

The Surface Water Regulations set out the minimum requirements for a waterbody to achieve "good" status.

[2] http://www.epa.ie/licences/lic_eDMS/090151b280526129.pdf

2.4.1.3 *Urban Wastewater Treatment Directive (UWWTD)*

Although the existing PE is less than the 2,000 threshold, the future PE is estimated to be greater than 2,000. Therefore, the proposed development will apply for a Wastewater Discharge Licence for secondary treatment in accordance with the Urban Wastewater Treatment Directive which states that an agglomeration with a PE of 2,000 to 10,000 discharging into estuaries should have secondary treatment. The appropriate treatment standard for the agglomeration will be discussed in more detail later in this report.

2.4.1.4 *Management of Bathing Water Quality (2006/7/EC)*

Currently none of the wastewater outfalls are located in bathing water areas; however, there are three designated bathing areas in Waterford harbour; Duncannon Beach (over 2.6km South of proposed outfall), Dunmore Strand and Counsellors Strand (both approximately 10km South of outfall). The latter two beaches are located on the western shore of the mouth of the harbour and are classified as 'excellent' and both have 'Blue Flag' status. However, the water quality at Duncannon Beach was classified as "sufficient" in 2016.

Figure 2.7 Designated bathing waters in Waterford harbour.

In order for designated bathing waters to obtain/retain Blue Flag status the water quality must be deemed 'excellent' during the bathing season (defined as 1st June to 15th September). Bathing waters are further discussed in Section 7.4.3, operational and cumulative impacts.

2.4.1.5 Shellfish Waters (2006/113/EC)

Waterford Harbour is designated under the Quality of Shellfish Waters Regulations 2009 (S.I. No.55/2009) as shellfish waters (Site code: PA2-0056). The designation extends approximately 4km upstream of Ballyhack to Cheekpoint and approximately 5km downstream of Duncannon to the townland of Broomhill. There is an area in the centre of the Harbour which is not included within the designation. This area is approximately 250 metres wide and is located between Arthurstown and Broomhill. Waterford Harbour is classified as Class B – requiring purification for 48 hours before shellfish can be placed on the market.

The Characterisation Report for these designated shellfish waters identified that key pressures are urban wastewater systems, onsite waste water treatment systems and agriculture. The main water quality parameter that must not be exceeded in shellfish production areas relates to faecal coliforms. Currently wastewater from all the agglomerations discharges into the designated shellfish water. The installation of a secondary WWTP will improve water quality in Waterford Harbour and reduce the cumulative impact from urban wastewater treatment systems on the Shellfish Growing Area. Shellfish waters are further discussed in Section 7.4.3.

2.4.1.6 Freshwater Fish and Salmonid Waters (FFD)

There are no freshwater fish or salmonid waters in the vicinity of the existing outfall locations.

2.4.1.7 Birds Directive (2009/147/EC) and Habitats Directive (92/43/EEC)

The discharge from the WwTP for Arthurstown and environs agglomeration goes directly into the River Barrow and River Nore SAC (Site Code 002162). The site contains Annex I priority habitats and Annex II listed species. A Natura Impact Statement has been carried out for the development. Currently, the effluent being discharged into the SAC is untreated. This project aims to provide secondary treatment to the wastewater effluent prior to discharge into the SAC; this will greatly improve the quality of the effluent discharges.

In accordance with the Birds and Habitats Regulations 2011 (S.I. 477 of 2011) and pursuant to Article 6(3) of the Habitats Directive, the discharges from the proposed development will not result in adverse effects on the integrity of the habitats or species in terms of maintaining favourable conservations status of the designated sites' qualifying interests regarding their conservation objectives (refer to the NIS for the scheme).

2.5 FINALISED PROJECT

2.5.1 General

The proposed works to be completed under this scheme are summarised below:

- Treatment: New Wastewater Treatment Plant (WwTP) located at Arthurstown providing secondary treatment and discharging final effluent through the existing outfall at Arthurstown
- Network: New Wastewater Pumping Stations (WwPS) at Ballyhack, Arthurstown and Duncannon and associated pipelines to transfer effluent to the WwTP.

The proposed scheme layout is illustrated on Drawing No. UTWE-AEC-ART-DR-CE-0020 Overall Scheme Layout, Appendix A.

Delivery of the proposed development will be via a Design and Build contract. Mitigation measures and other conditions attached to a grant permission will form part of the Design Build contract.

2.5.2 Ballyhack Requirements

Terminal Pumping Station:

A terminal wastewater pumping station is required. The proposed location for the station is shown in Drawing No. UTAS-AEC-ART-DR-CE-0020 to 0023. More details of the station are provided on planning drawings UTWE-AEC-ART-DR-CE-2511 and 2512. With the exception of the control kiosk (GRP – 1.8m Long x 1.2m Wide x 1.8m High) and telemetry pole, the pumping station will be located entirely below ground. The pumping station footprint will consist of a reinforced concrete structure with storage volume approximately 18m^3 plus pump working volume. The form of construction will be determined by the contractor. Excavated material will be removed from site. A screened stormwater overflow will discharge to the existing outfall.

Gravity Pipeline:

The existing gravity sewer is 300mm diameter and runs alongside the proposed site. A short gravity pipeline diversion of c.5m shall be required to divert flows into the pumping station.

Terminal Sewage PS Rising Main and Gravity Sewer:

A c.1,500m long pipeline will be laid from the Ballyhack PS to the Arthurstown sewage network. The first c.850m of this pipeline will be rising main of approximately 100mm diameter and will be laid approximately 1.2m below existing ground level. All of the rising main will be laid within existing roads. The remaining c.650m of the pipeline will be gravity pipeline approximately 225mm diameter and will be laid approximately 1.2m below the road surface. The gravity pipeline will be laid within existing roads to the pumping station site. The construction method will be determined by the contractor but has been considered to be open cut, the trench will be backfilled with Clause 804 material, with excavated material being removed from site to a licenced disposal facility.

2.5.3 Arthurstown Requirements

Terminal Pumping Station:

A terminal wastewater pumping station is required. The proposed location for the station is shown on Drawing No. UTAS-AEC-ART-DR-CE-0020 to 0023. More details of the station are provided on planning drawings UTWE-AEC-ART-DR-CE-2513, 2514 and 2515. With the exception of the control kiosk (GRP – 1.8m Long x 1.2m Wide x 1.8m High) and telemetry pole, the pumping station will be located entirely below ground. The pumping station will have storage volume approximately 50m^3 plus pump working volume. The form of construction will be determined by the contractor but is likely to be a precast concrete caisson. Excavated material will be removed from site. A screened stormwater overflow will discharge to the existing outfall.

Gravity Pipeline:

A short gravity pipeline diversion shall be required to divert flows into the pumping station. The existing gravity line runs alongside the proposed site.

Terminal Sewage PS Rising Main:

A c.415m long rising main will be laid from the Arthurstown PS to the WwTP site. The rising main will be approximately 125 mm diameter and will be laid approximately 1.2m below existing ground level. All of the rising main will be laid within existing roads and laneways. The construction method will be determined by the contractor but has been considered to be open cut, the trench will be backfilled with Clause 804 material, with excavated material being removed from site to a licenced disposal facility.

2.5.4 Duncannon Requirements

Terminal Pumping Station:

A terminal wastewater pumping station is required. The proposed location for the station is shown in Drawing No. UTAS-AEC-ART-DR-CE-0020 to 0023. More details of the station are provided on planning drawings UTWE-AEC-ART-DR-CE-2516, 2517 and 2518. With the exception of the control kiosk (GRP – 2.4m Long x 1.8m Wide x 1.8m High) and telemetry pole, the pumping station will be located entirely below ground. The pumping station will have storage volume approximately 90m^3 plus pump working volume. The form of construction will be determined by the contractor but is likely to be a precast concrete caisson. Excavated material will be removed from site. A screened stormwater overflow will discharge to the existing outfall.

Gravity Pipeline:

A short gravity pipeline diversion shall be required to divert flows into the pumping station. The existing gravity line runs alongside the proposed site.

Terminal Sewage PS Rising Main and Gravity Sewer:

A c.1,670m long rising main will be laid from the Duncannon PS to Blackhill. The rising main will be approximately 125mm diameter and will be laid approximately 1.2m below existing ground level. All of the rising main will be laid within existing roads. The construction method will be determined by the contractor but has been considered to be open cut, the trench will be backfilled with Clause 804 material, with excavated material being removed from site to a licenced disposal facility.

The rising main will discharge into a c.375mm diameter gravity sewer. The gravity sewer will extend between the rising main discharge point and the WwTP site. This sewer will be c. 1140m and approximately 500 mm diameter. The sewer will be laid approximately 1.2 to 2.5m below existing ground level and will be located in fields. The construction method will be determined by the contractor but has been considered to be open cut, the trench will be backfilled with Clause 804 material on roads and excavated material on agricultural land, with excavated material being removed from site to a licenced disposal facility.

2.5.5 Wastewater Treatment Plant

The location of the proposed WwTP site at Mersheen townland, Arthurstown is shown on Drawing No. UTAS-AEC-ART-DR-CE-0020 to 0023. More details of the WwTP are provided on planning drawings UTWE-AEC-ART-DR-CE-2505 to 2509. Construction is likely to be open-cut i.e. no cofferdam required. Where possible, excavated material will be retained on site and used for screening/mounding. The following is a summary of what will be included at the site.

Inlet Works

- Required earthworks, formwork and concrete.
- Incoming, outgoing pipework and associated chambers.
- Inlet channel with FFT flume, overflow and associated penstocks.
- 6mm mechanically raked inlet screen.
- Screenings handling unit.
- Use of final effluent as washwater.
- Bypass channel with manually raked screen.
- Associated control equipment, testing and commissioning.

Primary Settlement

- Required earthworks, formwork and concrete.
- Incoming, outgoing pipework and associated chambers.
- 3 no. conical prefabricated primary settlement tanks.
- Desludging valves and pipework.
- Associated control equipment, testing and commissioning.

Secondary Settlement

- Required earthworks, formwork and concrete.
- Incoming, outgoing pipework and associated chambers.
- 3 no. Rotating Biological Contactors.
- 3 no. pyramidal prefabricated final settlement tanks.
- Desludging valves and pipework.

  Associated control equipment, testing and commissioning.

Sludge Handling

- Circular sludge holding tank providing approximately 110m³ of storage.
- Required earthworks, formwork and concrete.
- Incoming, outgoing pipework and associated chambers.
- Sludge tank mixers.
- Associated control equipment, testing and commissioning.

Storm Handling

- Circular storm tank providing approximately 200m³ of storage
- Required earthworks, formwork and concrete.
- Incoming, outgoing pipework and associated chambers.
- Storm tank mixer.
- Testing and commissioning.

Miscellaneous

- Site clearance.
- Road to the site – 300m long x 3.5m wide
- Road within the site – 280m x 4.5m wide
- Watermain to the site and within the site.
- Water supply break tank.
- Control kiosk with welfare facilities.

Pumping Stations

- Sludge pumping station.
- Storm return pumping station.
- Washwater booster set.
- Final effluent washwater booster set.

Final Effluent Pipeline

- C.450m long final effluent pipeline approximately 225mm diameter
- Generally laid 1.2 to 1.5m below ground level but increasing to 3m at the discharge point.
- The pipeline will be laid within the site access road and public road.

2.5.6 Blackhill Service Reservoir Site

A 5.3m high telemetry pole will be installed within the Blackhill Service Reservoir Site (L4052). The location of this is shown on drawing UTWE-AEC-ART-DR-CE-2545.

2.5.7 Site Access

The proposed WwTP is accessible via the existing public road network (Strand Road, R733 in Arthurstown) by an access road. Trees are set back from the track and no tree-felling is required but some overhanging branches may need to be lopped or trimmed. This access road will provide access for construction or maintenance vehicles during construction and operation. The existing access will be widened with new gates and pillars provided. The site entrance is located on a *cul de sac* and has very little traffic with only 3 houses and a small car park. The site entrance has good visibility for vehicles egressing the site. The existing access track will be upgraded to a 3.5m wide bitmac surfaced road from the site entrance to the WwTP site. The proposals are shown on planning drawing No. UTWE-AEC-ART-DR-CE-2506 and UTWE-AEC-ART-DR-CE-2509. The WwPS's will be accessed from local roads within each village.

2.5.8 Site Security

The site of the proposed WwTP will be surrounded by 2.4m high palisade fences and lockable gates to prevent unauthorised entrance by the public. The WwPS's will not require a perimeter fence as all kiosks and covers will have suitable security rating and locks to prevent unauthorised access.

3 POST-PLANNING STAGES

3.1 CONSTRUCTION PROGRAMME

In the event of a grant of permission, it is envisaged that construction will begin in late-2019 and will take 12-18 months to complete. However, this is subject to various factors including weather conditions. Vehicles and equipment will be delivered to the site at the commencement of the relevant construction phase and will remain on site until the work relating to that stage is completed. Such equipment will include wheeled and tracked vehicles for construction of the WwTP, WwPSs, rising mains and pipelines. The anticipated number of Heavy Goods Vehicle (HGV) movements will average approximately 15 per day during the construction phase for the delivery of materials.

The construction phase can be broken into six stages as shown below. Some of the stages may run concurrently:

Stage 1 – Installation of Environmental Mitigation Measures
Stage 2 – WwTP and access road construction
Stage 3 – WwPSs construction
Stage 4 – Laying of Rising main and Pipelines
Stage 5 – Connection of WwTP to existing outfall
Stage 6 – Permanent Security Fencing and Landscaping (as needed)

3.2 OVERVIEW OF CONSTRUCTION METHODS

Soils will be stripped from improved agricultural grassland for the WwTP. Designated storage areas for excavated material will be located within the planning boundary and at least 50m from watercourses. The proposed WwPSs are to be constructed on existing hardstanding areas. The rising main and pipeline will be laid under existing public roads, improved agricultural grassland habitat and recolonising bare ground /bare ground (access track) habitat. No removal of habitats outside of the development works area/footprint will take place during the construction phase. The works area/footprint will be clearly marked for associated construction staff and all staff will be given a toolbox talk addressing the environmental aspects of the construction environmental management plan prior to commencement of construction. The main civil works for the proposed development are outlined in this chapter.

3.2.1 Approach to Site

The proposed site of the WwTP and associated access road can be accessed from the R733 regional road along an existing track that will be upgraded. The site for the Duncannon WwPS can be accessed from the R737 which passes through the village. The Rising Main and Gravity Pipeline can be accessed from the R737 and onto the Blackhill local road to Arthurstown. The Ballyhack WwPS can be accessed from the R683 regional road and the R733 and onto the Kilhile local road from the north.

3.2.2 Temporary Site Compound

There will be a temporary construction compound located at the proposed WwTP site within the planning boundary. A hardstanding area will be constructed to accommodate the site compound and will consist of a gravel surface compound, approximately 0.22ha in area. The compound will be used for vehicle parking during the construction phase, as well as a contractor's temporary construction compound and set down area for deliveries.

For the duration of the construction stage, the temporary compound will be required to house the temporary site offices, toilets and canteen facilities, employee parking, fuel storage tanks and a contractor's lock-up facility.

A concrete bunded area with an associated oil interceptor will be provided within the compound for the storage of lubricants, oils and site generators and coalescing media oil water separator will be installed to mitigate against any hydrocarbon spillages. All refuelling shall be carried out within this bunded area.

Depending on the location of the compound, it may be fenced all round and secured with locked gates. Fencing would only be utilised where significant risk of danger to third parties or vandalism was envisaged.

Self-contained portable toilets with an integrated wastewater holding tank will be used, maintained by the providing contractor, and removed from site on completion of the construction works. These will be located in the temporary compound. The portable toilets will be emptied on a weekly basis (or more frequently as required). Water usage for construction activities will be very low and any water required for the construction activities will be brought on site by a water tanker. Power will be provided using a diesel or petrol driven generator where the permanent power supplies to site have not been connected.

Potable water will be delivered to site in suitable canisters on a daily basis for use in the temporary site facilities compound. Domestic type waste generated during the construction phase will be stored on site in enclosed skips. The contractor will dispose of waste periodically at a licensed facility. The site offices, toilets, canteen facilities and bunded area will all be removed at the end of the construction period and the temporary compound area will be reinstated. Any areas of the temporary compound within the temporary land acquisition area will be reinstated to grassland. Areas within the permanent land acquisition will be reinstated to hardstanding or gravel surface in accordance with the scheme drawings.

3.2.3 Drainage System

The approach to the treatment of surface-water is as follows:

- To minimise alterations to the ambient site hydrology and hydrogeology.

- To provide settlement and treatment controls as close to the site footprint as possible, and to replicate where possible the existing hydrological environment of the site.
- To preserve green-field runoff rates and volumes in applicable areas i.e. the WwPS sites, WwTP site and access roads.
- Drainage systems designed for rainfall storm events of 1 in 5 years, thereby, safeguarding no detrimental impacts of flooding at the site or to adjacent areas.
- Appropriate site management measures are taken to see that runoff from the construction site is not contaminated by fuel, sewage or lubricant spillages.
- Any vegetation loss during construction will be reinstated as early as possible with identical, similar or enhanced local vegetation.
- There will be no discharge of trade effluent, sewage effluent or contaminated drainage into any watercourse system or ditch.
- Additional drainage measures will only be added as necessary.

The access road to the WwTP will be constructed of bitumen with an adjacent permeable strip for surface water to soak away. Internal site roads will be constructed with a concrete surface and have a permeable area along the side. Hardstanding areas and roofs within the site will drain to permeable gravelled areas or soak-aways.

The Ballyhack WwPS will be located in an area of existing hardstanding. The site levels will not be changed at this location such that existing surface drainage systems will remain in operation and surface water will not be impeded.

The Arthurstown WwPS will be located in an existing gravelled area. Only those areas of the site required for site operations will be paved in hardstanding and the majority of the land acquired for the pumping station will remain in gravel. Site runoff will discharge to the gravelled areas adjacent to the hardstanding such that no additional storm runoff will be generated.

The Duncannon WwPS site is currently impermeable; either in hardstanding or on the site of an existing building. The site levels will be managed such that existing surface drainage systems will be used and no ponding will occur on the site.

Two minor watercourses were noted along the route of the proposed development, namely Ballyhack 13 and Coleman Stream (Figure 3.1). A third minor drain (<1m wide) is allocated close to Blackhill, at the commencement of the gravity pipeline, along the access track.

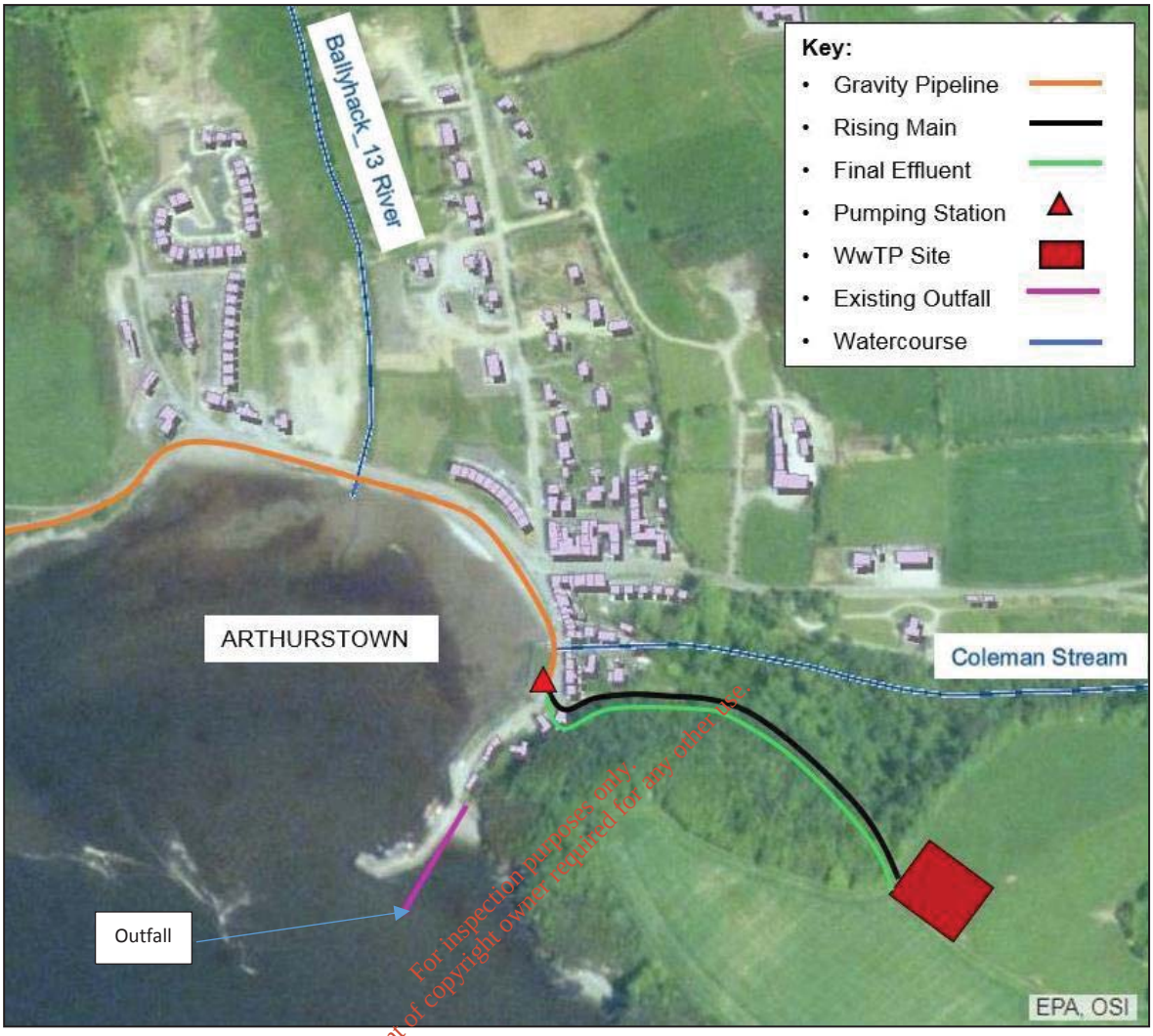


Figure 3.1 Two minor watercourses Ballyhack 13 and Coleman Stream discharge directly into Arthurstown harbour

Both Ballyhack 13 and Coleman Stream watercourses discharge directly into Arthurstown harbour and will be crossed during the laying of the pipeline from Ballyhack to Arthurstown. According to the WFD River Network both watercourses come under the Curraghmore_010 network.

Ballyhack 13 River (1.3km) is a short, isolated river, 1-3 m wide, flowing in from the north and is not directly connected to the SAC as a tributary, but flows directly into the marine SAC after being piped under the roadway. Similarly, the Coleman stream flowing into Arthurstown from the east is another isolated, short stream, < 50 cm wide and discharges into the marine SAC at the end of the Arthurstown wall, on the south end of the village. This stream is also piped underground before discharging directly into the harbour. Both watercourses appear to have a reasonable flow at times, as scouring of the harbour/estuary substrate was noted in the form of a narrow riverine gorge directly from the outfalls, especially Ballyhack 13 river. This is also evident from aerial imagery.

To protect water quality and sediment control in these watercourses (Arthurstown to Ballyhack), a silt fence will be erected during the construction phase of the laying of pipeline along the road. It is proposed to lay the pipe beneath the current culverts of both minor watercourses.

3.2.4 Site Road

Approximately 300m of new on-site road will be required to allow access to the WwTP. The road will drain to an adjacent permeable strip. The rising main (trade wastewater, domestic wastewater and final effluent) will be placed minimum 1.2m beneath the track structure so that existing natural drainage and surface water systems are maintained.

3.2.5 Rising Mains & Gravity Mains

3.2.5.1 Wastewater rising main and effluent gravity mains

The development of the pipeline lengths totals c4,800m and will be laid minimum 1.2m underground and will not be visible once laid.

Two watercourse crossings will take place along the gravity fed pipeline close to Arthurstown. The pipelines will be laid beneath the culverts by open cut method. A further minor crossing occurs on the eastern section of the gravity fed pipeline to Duncannon.

3.3 DESIGN BUILD

The scheme will be procured by Irish Water on a design and build contract. It is possible that during the construction phase, minor changes may be made to the design such as the following elements:

- Location of plant within the WwTP site
- Access road layout with the WwTP site
- Form of construction and construction methodology e.g. the use of precast concrete elements in place of in situ reinforced concrete elements, or the use of trenchless methods in place of open cut for pipeline installation.
- Location of plant within the WwPS boundary
- Location of pipelines within the road corridor.

The design approach to permitted development, by the Design Build Contractor, will be materially compliant with the planning permission (in the event of a grant of permission) including the design envelope and environmental constraints.

3.4 SCADA SYSTEM

A SCADA system will be provided that will allow for remote monitoring of the site by Irish Water's operations staff. The system will raise all alarms to the control centre and will allow staff to remotely monitor system performance and tank levels.

3.5 REFERENCES

Fossitt J.A. (2000) *A Guide to Habitats in Ireland.* Published by The Heritage Council, Kilkenny.

4 PLANNING AND POLICY

4.1 Introduction

This chapter provides an overview of the national, regional and local planning and development policies relevant to the proposed development.

4.2 National Planning Policy and Guidance

4.2.1 Project Ireland 2040: National Planning Framework (NPF)

This document is published by the Department of Housing, Planning and Local Government. It is an overarching policy and planning framework for the economic, social and cultural development of the nation up to 2040.

The NPF was published in conjunction with a 10year investment plan with a single vision - Project Ireland 2040, which means the Framework is full supported by government investment.

The NPF is an overarching guidance document which guides regional, spatial and economic strategies and local development plans. It identifies national strategic outcomes, including for the sustainable management of water, as well as strategic investment priorities. Urban wastewater is marked as a principal pressure on Ireland as is the need for adequate treatment and capacity to avoid direct discharges. A key short-term priority is urban wastewater treatment compliance and remedial actions. National Policy Objective 63 states: *"Ensure the efficient and sustainable use and development of water resources and water services infrastructure in order to manage and conserve water resources in a manner that supports a healthy society, economic development requirements and a cleaner environment."*

The proposed development of new infrastructure for Ballyhack/Arthurstown/Duncannon complies with the NPF objectives in that it will be provide infrastructure for secondary treatment of wastewater which is currently untreated to discharge into the Barrow, Nore, Suir Estuary which will help improve the water quality in the area.

4.2.2 National Development Plan 2018-2027 (NDP)

The NDP was published together with the NPF in February 2018. It is the national plan which sets out investment priorities for guiding national, regional and local planning and investment decisions.

The NDP prioritises investments in high-quality infrastructure and ear marks €8.5 billion for Irish Water over the period. The Plan recognises that the water and wastewater infrastructure in the country is fragmented , as is the need for investment for updated modern infrastructure.

The NDP states the following: *"Investment in our country's water services is critical in meeting the needs of our growing economy across the regions, of our people and their health and the protection and enhancement of the quality of our environment and ensures public health."*

The proposed development of new infrastructure for Ballyhack/Arthurstown/Duncannon complies with the NDP objectives in that it will be provide infrastructure for secondary treatment of wastewater which is currently untreated to discharge into the Barrow, Nore, Suir Estuary which will help improve the water quality in the area.

4.2.3 Irish Water Services Strategic Plan - A Plan for the Future of Water Services 2015-2020

This is established under Section 33 of the Water Service (No. 2) Act 2013, was published by Irish Water in 2015 and sets out the strategic delivery of water services up to 2040. The Plan outlines current and future challenges affecting the provision of water services and the priorities that need to be met in both the short and medium term.

The Plan identifies that many wastewater agglomerations do not have sufficient levels of wastewater treatment and untreated discharges are currently discharging from the agglomerations, which is not compliant with the UWWT Directive.

Compliance with the UWWT Directive is a priority for Irish Water and the Plan recognises the requirement for substantial upgrades to the wastewater treatment network in Ireland. The following responsibilities for wastewater are outlined:

"Our responsibilities for wastewater commence when effluent reaches the public wastewater network. We are responsible for its transfer to wastewater treatment plants, its treatment and the subsequent discharge of the treated effluent back into the water environment. We are also responsible for the treatment and disposal of the sludge that is generated from both our water and wastewater treatment plants."

In addition, the following specific objectives are outlined in the Plan:

- WW1: Manage the operation of wastewater facilities in a manner that protects environmental quality;
- WW2: Manage the availability and resilience of wastewater services now and into the future; and
- WW3: Manage the affordability and reliability of wastewater services.

The proposed development is in compliance with the objectives outlined in the Strategic Plan by providing for the effective management and provision of wastewater treatment within the

Ballyhack/Arthurstown/Duncannon agglomerations which are currently lacking sufficient wastewater infrastructure.

4.2.4 Irish Water Business Plan – Transforming Water Services in Ireland to 2021

This document was published in 2015 to provide a framework for the delivery of efficient water and wastewater services on a national level.

The Plan identifies a number of national issues with the fragmented water and wastewater network and key deliverables for the improvement of infrastructure and customer services.

The Plan outlines that there are 43 agglomerations that do not comply with the secondary treatment requirements of the UWWT Directive and 10 discharge into waters classified as sensitive under the UWWTD and do not meet the requirements. Compliance with the UWWT Directive is a key target by 2021.

The proposed development is in compliance with the Business Plan by providing secondary wastewater treatment to be compliant with the UWWTD within the Ballyhack/Arthurstown/Duncannon agglomerations which currently discharge untreated wastewater into the Barrow, Nore Suir Estuary.

4.3 Regional Planning Policy and Guidelines

4.3.1 Regional Planning Guidelines for the South-East Region 2010-2022

This document sets out the strategic policy for the South-East region (South Tipperary, Waterford, Kilkenny, Carlow and Wexford) over a 12 year period up to 2022. It provides a regional context to the National Spatial Strategy and individual development plans.

The Guidelines implement the National Spatial Strategy, while providing greater detail and establishing a regional development and spatial framework that can be used to strengthen Local Development Plans at county and local levels. The Guidelines prioritise value for money strategic investments and establish a coordinated approach with government agencies and stakeholders.

The following Strategic Goals and Policies are relevant to the proposed development:

- B8 - Basing all settlement growth on sound principles of Water Management through implementation of the Water Framework Directive, as set out in the River Basin District Management Plans for the river catchments in the region.
- B9 - Developing water services and other social infrastructure to a standard sufficient to support the sustainable development of critical mass at selected locations.
- D10 - Encouraging effective management of flood risk in the region in accordance with the Assessment and Management of Flood Risk Regulations, 2010, Guidelines on the Planning System and Flood Risk Management, 2009 and promoting the co-ordination of flood risk

management in conjunction with implementation of the Water Framework Directive and River Basin Management Plans.

- D13 - Supporting implementation of the Water Framework Directive.
- PPO 5.23 - The Regional Authority will support the full implementation of the Water Framework Directive, River Basin Management Plans and associated Programme of Measures in conjunction with each local authority.
- PPO 5.24 - The Regional Authority will support implementation of the Water Services Investment Programme in the South-East Region, recognising the strong urban structure of the region.
- PPO 8.5 - Planning Authorities should devise strategies for managing development and other activities in order to achieve the objectives of the South East and South West River Basin Management Plans and associated Programme of Measures. Local authorities should ensure that common approaches are taken to the protection of surface, ground, coastal and estuarine water bodies. These approaches should, inter alia, ensure that –
    - The impact of developments on water bodies outside as well as inside the jurisdiction of the individual authorities is considered when decisions on discharges and water extraction are being made;
    - Developments do not interfere with the attainment of the standards required by the Water Framework Directive; and
    - Joint actions are taken to positively address the attainment of the standards required by the Water Framework Directive.
- PPO 8.7 - It is an objective of the Regional Authority to encourage and support a co-ordinated approach for protection and enhancement of the region's flood plains, wetlands and watercourses for their biodiversity and flood protection values.
- PPO 8.8 - It is an objective of the Regional Authority to prepare a Waterway Corridor Study for the Barrow, Nore and Suir in conjunction with the relevant public bodies.

The proposed development complies with the strategic objectives and recommendations of the Regional Planning Guidelines regarding the need for investment in wastewater treatment and surface water management in order to support the delivery of the economic and settlement strategies.

4.4 Local Policy and Guidance

4.4.1 Wexford County Development Plan 2013 – 2019

The Wexford County Development Plan (CDP) sets out the overall strategy for planning and sustainable development with County Wexford. Through the policies and objectives contained in the CDP provides a direction for future development in the County.

The main vision set out in the CDP is for the county as "Green-Smart-Sustainable". The Plan supports this vision and the strategies and objectives in the Plan seek to develop a county:

- Where people want to live, work and play
- Which offers high quality sustainable employment opportunities and residential developments
- With high quality urban and rural environments supported by excellent sustainable physical and social infrastructure
- Which values its natural environment, built and cultural heritage
- Which offers visitors a range of high-quality experiences

The following is a strategic aim of the CDP:
"Protect and develop the county's water and wastewater infrastructure, integrating their provision with the county's overall land use strategies whilst having regard to environmental responsibilities and complying with European and national legislation."

Core Strategy

It is an obligation under the Planning and Development (Amendment) Act 2010 to include a Core Strategy in development plans. The purpose of a Core Strategy is to present a medium to long term evidence-based strategy for the spatial development of the county. It must show that the development objectives in the Plan, are consistent as far as practicable, with national and regional development objectives set out in the National Spatial Strategy and Regional Planning Guidelines.

The Core Strategy will:

a) Set out the vision of the county and the strategic aims to deliver this vision.
b) Provide details on how the Plan and the Housing Strategy are consistent with the NSS and the SERPGs.
c) Take account of any policies of the Minister in relation to national and regional population targets.
d) Set out the Settlement Strategy and Settlement Hierarchy for the County and allocate population targets for the towns, villages and rural areas in the hierarchy.
e) Provide details of the quantum and potential housing yields of existing residential zoned land in the county and proposals to align the existing quantum of land with the population targets.
f) Provide details of the national and regional network and the inter-urban and commuter rail routes in the county.
g) Provide detail on rural areas in the accordance with the Government's Sustainable Rural Housing Guidelines.
h) Provide information to show that the retail objectives in the Plan comply with the Retail Planning Guidelines.
i) Set out the objectives for achieving the Settlement Strategy.

Water Infrastructure

The CDP recognises the importance of a high quality water and wastewater infrastructure for the long-term development of the County and that population growth has put pressure on water and wastewater facilities. In this regard, the CDP commits to:

- Providing adequate water supply and wastewater infrastructure which will support economic development, in particular, industrial and commercial
- Meeting EU and national standards for drinking water and wastewater infrastructure
- Preserving and protecting water resources as a key element of environmental policy
- Addressing the issue of climate change in water management
- Managing and mitigating the risk and consequences of flooding on water and wastewater infrastructure

The proposed development is compliant with the County Development Plan as it upgrades the wastewater treatment facilities in the County and help achieve compliance with the WFD.

5 POPULATION & HUMAN HEALTH

5.1 INTRODUCTION

This chapter examines the potential impacts that the proposed Arthurstown agglomeration may have on the population and health of residents of the area, during both the construction and operational phases. Where a negative impact can be foreseen it is reduced or removed by way of practical mitigation measures.

The effect of a development on population and human health is also known as the Socio-Economic Impact and as such includes the following broad areas of investigation: -

- Population
- Employment
- Settlement Patterns and Land Use
- Health and Safety
- Tourism

5.2 EXISTING ENVIRONMENT

5.2.1 Population

Ireland saw a rapid population growth in the early part of this century with improved standards of living and infrastructure growth. Despite the worsening economic situation in the country since 2008, the 2016 Census showed an increase in population from the 2006 Census. The country has seen a population surge since 1956 from 2,898,264 to 4,761,865 (40% increase) as per the 2016 Census as shown in Figure 5.1.

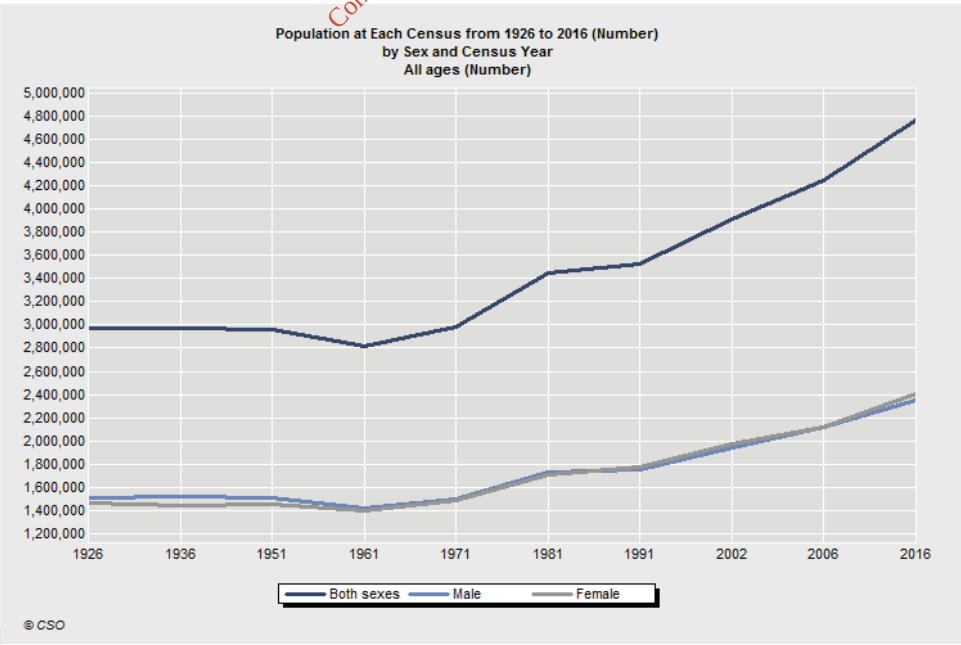


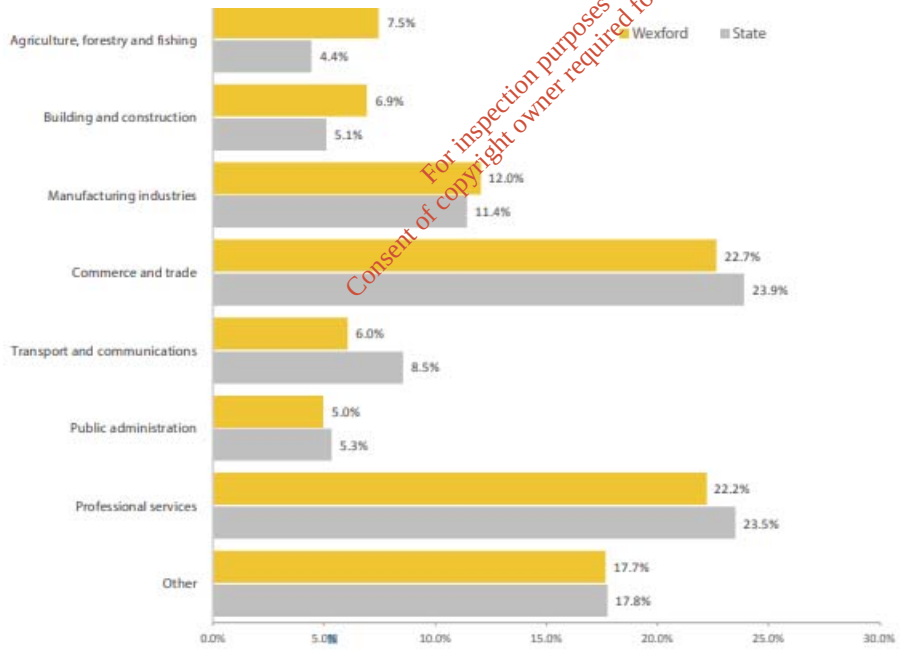
Figure 5.1 - Population Trend in Ireland 1926 – 2016 (CSO, 2016)

The population of County Wexford was 149,722 at the time of the 2016 Census, a 3% increase on the 2011 figure of 145,320. The population was at its lowest in 1966 at 60,463 and has generally grown at an increasing rate since. This represents 3.1% of the State total (4.76 million), 9.4% of the Southern Regional Assembly (1.6 million) and 25.7% of the South-East Strategic Planning Area (SPA) (581,615). Over a 20 year period (1996 to 2016), Wexford experienced a 43.4% (+43,351) increase in its population base - the fifth highest rate in the State. The more recent growth rate (2006 to 2016) of 13.6% is the seventh highest in the state. The rate of growth has progressively slowed in the last number of years with the growth between 2011 and 2016 (+3%) ranking as the 13th highest rate of growth - below the State average of 3.8%. Wexford, as a county, is the 13th most densely populated county in the State with a density figure of 63.12 persons per square km.

5.2.2 Employment

In 2016, the unemployment rate in Wexford was 16.6% (11,478 persons out of a labour force of 69,237). The national average unemployment rate was 12.9%. Relative to other local authorities, Wexford has the 14th highest number of the labour force 'At Work' in the State and the 5th lowest rate. The total number of people employed in each broad occupational group in the County is given below:

Figure 5.2 – Workers by Industry in County Wexford (CSO and AIRO, 2016)



The Commerce and Trade and Professional Services sectors both employ high numbers in County Wexford. Employment in rural areas is mainly related to agriculture, whereas the towns host most of the manufacturing industries.

Since the beginning of the recent economic recession, live register figures showed a dramatic increase in unemployment in Wexford. These figures, presented in Figure 5.3, show a marked increase in the numbers of people on social welfare payments, particularly in the years from 2008 to 2010. The Live

Register figures for County Wexford increased by approximately 300% between 2008 and 2011, from 6,834 in February 2006 to 19,565 in February 2011. Since its peak in 2011, live register figures have improved. Figures from the Central Statistics Office show that there were 10,737 people in County Wexford on the Live Register at the end of February 2018. This figure is a decrease of almost 45% since its peak in 2011 and an improvement of almost 14% on the same period last year when there were 12,511 people on the live register.

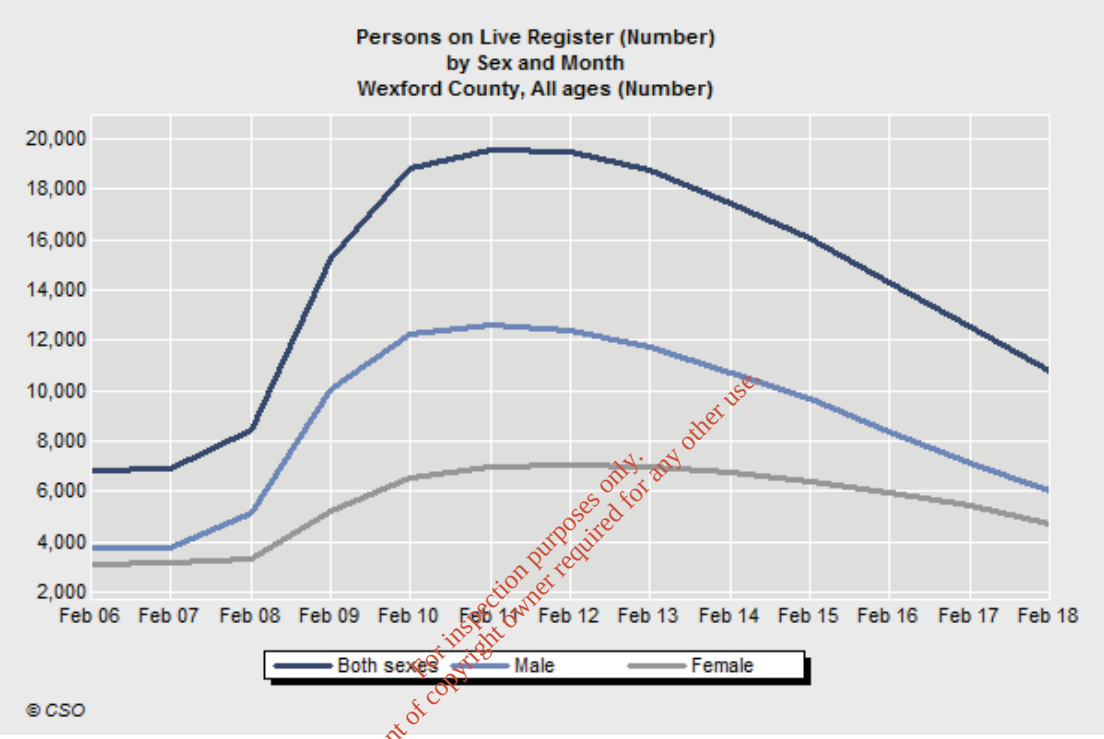


Figure 5.3 Live Register Figures in Co. Wexford from Feb 2006 – Feb 2018 (CSO, 2018)

The Live Register figures for February 2018 show that 7% of the total population of County Wexford are unemployed.

Table 5.1 lists the Live Register figures for County Wexford between February 2006 and February 2018 and breaks these figures down to the four County offices in Enniscorthy, Gorey, New Ross and Wexford Town. The live register figures in the New Ross social welfare office, the closest social welfare office to Arthurstown shows that the number of people unemployed almost trebled between February 2006 and February 2011, but has since come down, although is still higher than in 2006.

Table 5.1 Live Register figures for County Wexford and local offices 2006 – 2018 (CSO)

Region	Feb-06	Feb-07	Feb-08	Feb-09	Feb-10	Feb-11	Feb-12	Feb-13	Feb-14	Feb-15	Feb-16	Feb-17	Feb-18
Enniscorthy	1728	1738	2166	3856	4473	4765	4756	4636	4460	4129	3707	3187	2786
Gorey	1193	1236	1547	3192	4066	4256	4186	4007	3795	3572	3218	2893	2433

New Ross	1256	1255	1490	2671	3373	3565	3438	3250	2935	2748	2426	2172	1854
Wexford	2655	2639	3256	5545	6880	6979	7084	6842	6272	5614	4949	4259	3664
Wexford County	6832	6868	8459	15264	18792	19565	19464	18735	17462	16063	14300	12511	10737

5.2.3 Settlement Patterns

Wexford has a high rural population, with approximately 60% of the population living in rural areas (outside of towns of less than 1,000 population). Of the urban based population, the largest population centre is Wexford Town, which was one of the most populated towns at the time of the 2011 census, with a population of over 20,188, followed by Enniscorthy with 11,381 and Gorey with 9,822. The preliminary population of Ballyhack in 2016 was 1,237. Net migration for Wexford from the 2011-2016 census noted a negative migration of 1,311 persons, yet the natural increase in persons in Wexford County was 5,596 persons.

5.2.4 Population Health and Safety

From results of the 2016 census 84% of persons in County Wexford stated they were in very good or good health, while 0.4% of persons stated they were in very bad health.

Any development project, in its construction phase in particular, has the potential to affect health and safety of workers and the public. During its operational phase, the proposed development will treat wastewater currently being discharged untreated into Waterford Harbour at Arthurstown. This has the potential to improve the health of the population in Arthurstown and the surrounding area by having effluent treated prior to discharge meaning waters around the coast will be cleaner than is currently the case.

5.2.5 Land Use

The site of the proposed WwTP and access road is currently located on a greenfield site, utilized for intensive grazing and has been greatly modified. The site of the proposed WwPS at Ballyhack is located on an existing hardstanding area at Ballyhack Harbour (currently used as a carpark). The site of the proposed WwPS at Arthurstown is on an existing gravelled area which is occasionally used for carparking at the harbour. The proposed WwPS at Duncannon is located on the site of a derelict building at Duncannon pier. The sites of the proposed Wastewater Rising main and Wastewater Gravity Pipelines are primarily in existing asphalt roads with some being laid in improved agricultural grassland. The proposed final effluent pipeline from the proposed WwTP to the outfall at Arthurstown runs along an access track and across an existing roadway. However, the Arthurstown agglomerations infrastructure is considered to be temporary in nature and fully reversible. Following the operational phase, the infrastructure can be removed and the land can be reinstated to its current condition. Roadways will all be reinstated to the appropriate standards.

5.2.6 Tourism

County Wexford is an important area for tourism, given its relatively mild climate and extra days of sunshine compared to more northern counties. Tourism is generally for visiting the coast and associated amenities. Other attractions include the Irish Agricultural Museum and Gardens, Hook Lighthouse, Dunbrody Famine Ship, John F. Kennedy Park, Wexford Wildfowl Reserve and Wells House and Gardens[3]. The Plan also states that *"The maintenance, improvement and in some cases extension of existing piers and harbours is essential in coastal and estuarine areas, as these structures are needed to facilitate the activities of fishing and tourism"* and "*The Council recognises the importance of safeguarding and developing these facilities".*

Arthurstown is the closest village to Celebrity Chef, Kevin Dundon's, Dunbrody Country House Hotel. Arthurstown noticeably increased in size during Ireland's Celtic Tiger years with the addition of several holiday homes.

Also, in the area, Wexford's Coastal Pathway (Slí Charman), which was established in 1993, extends for 221km from Kilmichael Point in the North East corner of the county to Ballyhack in the South-West. The Duncannon Fort is a bastioned fortress located on the side of the Hook Peninsula, at Duncannon.

[3] https://www.wexfordchamber.ie/wexford/tourism-attractions/

5.3 POTENTIAL IMPACT OF DEVELOPMENT

5.3.1 Population

Chapter 4 provides an overview of the national, regional and local planning and development policies relevant to the proposed development.

The project will indirectly, and in the long term improve the standard of living in the region by virtue of providing a wastewater treatment prior to discharge into Waterford Harbour. These improvements support the Project Ireland 2040: National Planning Framework (NPF) outlined above in Section 4.2.1 above outlining where the National Policy Objective 63 states: *"Ensure the efficient and sustainable use and development of water resources and water services infrastructure in order to manage and conserve water resources in a manner that supports a healthy society, economic development requirements and a cleaner environment."* Improvements could also attract increased visitor numbers and residents by improving the standard of water quality in the Eastern Celtic Sea area.

5.3.2 Employment

The employment provided by this development in the construction and operational phases is not likely to greatly affect the overall regional or county employment profile. Irrespective of this, the provision of employment in the area, particularly at construction stage, must be seen as a positive impact.

5.3.3 Health and Safety

Physical health and safety concerns are twofold: -

- Construction workers and members of the public during construction
- Members of the public and employees of the developer during operation

There is the risk on all construction sites of accidents resulting in serious injury and/or death. Members of the public and employees of the contractors and developer on site may be exposed to potentially dangerous situations. With the establishment of a Health and Safety Plan for the construction phase, potential accidents can be avoided and mitigated against.

Off site, construction related traffic might also pose a danger to the public on narrow roads in poor weather conditions. The adherence to the rules of the road and general good driving practice will reduce the severity of this impact. In general, there are no specific safety considerations in relation to the operation of wastewater treatment infrastructure. There may be a requirement for maintenance works on all elements of the infrastructure during the operational phase and in this case the potential impacts will be the same as those during construction with the same mitigation measures being implemented.

The proposed development has the potential to improve the health of the local population by treating currently untreated effluent being discharged into the harbour. This is a positive effect of the proposed development.

5.4 MITIGATION MEASURES

Although no negative impact of significance has been established, there are a number of measures, which will be implemented for the safety of workers and the public:

- The contractor will be appointed as the Project Supervisor for the Design Process (PSDP) and Project Supervisor for the Construction Stage (PSCS) and will prepare the Safety File for the works.
- The contractor will be required to comply with all relevant health and safety regulations including the Safety, Health and Welfare at Work Act 2005, the Safety, Health and Welfare at Work (Construction) Regulations 2013 (S.I. No. 291 of 2013) and the Safety, Health and Welfare at Work (General Application) Regulations 2007 (S.I. No. 299 of 2007) and any amendments thereof as well as any other regulations or approved codes of practice pertinent to the proposed Works.
- Access to the Site by unauthorised persons will be prevented.
- The contractor will be required to put in place appropriate traffic management for the proposed works. The contractor will be required to consult with any statutory or other authority concerned and implement a traffic management system for all construction activity which may affect the use of the public highways or roadways.
- The contractor will complete a detailed traffic management plan.

5.5 CONCLUSION

Overall, the proposed development can be said to have the potential for a minor positive impact in terms of employment generation and a very minor negative impact in terms of land take. The improvement of wastewater infrastructure by Irish Water is in line with National Planning Policies and Guidance. There will be a short-term negative impact on traffic on the local roads during the laying of the pipelines.

5.6 REFERENCES

Central Statistics Office (CSO) Census 2011 www.cso.ie
Central Statistics Office (CSO) Live Register www.cso.ie
Central Statistics Office (CSO) Census 2016 www.cso.ie
The Management of Waste from National Road Construction Projects (2017) Transport Infrastructure Ireland

6 FLORA & FAUNA

6.1 INTRODUCTION

6.1.1 Background

This study comprises an ecological appraisal as part of an environmental assessment for the proposed upgrade works for the Ballyhack/Arthurstown/Duncannon agglomeration, Co. Wexford. Emphasis is placed on identification and assessment of habitats (according to Fossitt, 2000) and species of conservation value.

An Appropriate Assessment (AA) Screening and Natura Impact Statement (NIS) for the scheme have addressed potential impacts on European sites. They are presented separately to this report. The Screening Report concluded that significant effects could be ruled out on all European sites except for River Barrow and River Nore SAC. This is the only European site that is in the vicinity of the proposed upgrade works that had an appropriate impact transfer pathway. On further examination within the Appropriate Assessment, the proposals were considered not to impact the integrity of any European site.

6.1.2 Relevant Legislation and Policy Guidance

The most relevant legislation is as follows:

- Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna
- Council Directive 2009/147/EC on the Conservation of Wild Birds
- The Water Framework Directive (WFD) 2000/60/EC provides a framework for the protection and improvement of rivers, lakes, marine and ground waters in addition to water-dependent habitats.
- European Communities (Bird and Natural Habitat) Regulations 2011 (S.I. No. 477) and 2015 (S.I. No. 355)
- Wildlife Act (1976). Wildlife Act, Ireland, 22 December 1976, No. 39 of 1976
- Wildlife Amendment Act (2000). Wildlife Amendment Act, Ireland, 18 December 2000, No. 38 of 2000.
- Flora (Protection) Order, 2015 S.I. No. 356/2015

6.2 METHODOLOGY

6.2.1 Desk Study

A review of available mapping and aerial photography was undertaken using Bing maps, Google Earth, the website of the National Parks and Wildlife Service (NPWS), and the National Biodiversity Data Centre (NBDC).

6.2.2 Benthic Surveys

Marine benthic surveys were carried out by Aquafact International Services Ltd., in December 2017 and the results were used to inform this assessment as well as the NIS.

6.2.3 Rare and Protected Flora Fauna

The National Parks and Wildlife Service (NPWS) website (http://webgis.npws.ie/npwsviewer/) was consulted and personal communication was made with Jochen Roller, GIS Consultant, NPWS to identify records of rare and protected flora in the vicinity of the proposed wastewater infrastructure (consulted March 20th, 2018).

The NPWS data search returned records of several *Trilfolium* species, namely *T. glomeratujm, T. dobium* and *T. micranthum, T. ornithopodioides* and *T. striatum*at Ballyhack. Other species of note included in the area is *Torilis nodosa.*

6.2.4 Site Investigations

The site of the proposed infrastructure was visited by Dr. Monica Sullivan (Jennings O'Donovan) and Dr. Paul Lynas (AECOM) on 14 and 15 February 2018 and a walkover survey conducted. Whilst, the time of year meant it was out of season for most flowering plants, it was possible to identify most species vegetatively and was satisfactory to identify all the relevant constraints to the proposals and all the potential impacts on the surrounding species and habitats.

During this visit the habitats within and surrounding the proposed development locations were assessed. Potential faunal habitat was also assessed. From this baseline survey, potential impacts of the proposed works on the floral habitats present and the fauna in the area were predicted.

6.2.5 Impact Assessment Methodology

The evaluation and assessment within this report has been undertaken with reference to relevant parts of the 2018 Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine developed by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2018)[4].

The guidance recognises that it is not a prescription about exactly how to undertake an ecological impact assessment (EclA); rather, they *"provide guidance to practitioners for refining their own methodologies*". It is however recognised as current best practice for ecological assessment.

[4] https://cieem.net/wp-content/uploads/2019/02/Combined-EclA-guidelines-2018-compressed.pdf

6.2.5.1 *Important Ecological Features*

Ecological features can be important for a variety of reasons and the rationale used to identify them is explained. Importance may relate, for example, to the quality or extent of designated sites or habitats, to habitat/species rarity, to the extent to which they are threatened throughout their range, or to their rate of decline.

6.2.5.2 *Evaluation: Determining Importance*

The importance of an ecological feature should be considered within a defined geographical context. The following frame of reference has been used in this case, relying on known/published accounts of distribution and rarity where available, and professional experience:

- International (European)
- Ireland
- Regional (Leinster)
- County (Wexford)
- Townland (Ballyhack, Mersheen, Duncannon)
- Local (intermediate between the Site and Townland)
- Site (WwTP, WwPS and Rising Mains)

6.2.5.3 *Impact Assessment*

Where appropriate, the impact assessment process involves:

- Identifying and characterising impacts
- Incorporating measures to avoid and mitigate (reduce) these impacts
- Assessing the significance of any residual effects after mitigation
- Identifying appropriate compensation measures to offset significant residual effects
- Identifying opportunities for ecological enhancement

It is good practice for the EcIA to make clear both the potential significant effects without mitigation and the residual significant effects following mitigation. This process of assessment without mitigation helps to identify necessary and relevant mitigation measures that are proportionate to the size, nature and scale of anticipated impacts.

The assessment only needs to describe those characteristics of impacts that are relevant to understanding the ecological effect and determining the significance. It should consider, as appropriate and necessary in each case: direct, indirect, secondary and cumulative impacts and whether the impacts and their effects are short, medium, long-term, permanent, temporary, reversible, or irreversible. The assessment of impacts then takes into account the baseline conditions to describe how the baseline conditions will change as a result of the project and associated activities.

6.2.5.4 *Significant Effects*

The CIEEM guidance (2018) sets out information in paragraphs 5.25 through to 5.29 about the concept of ecological significance.

Significant effects are qualified with reference to an appropriate geographic scale, and the scale of significance of an effect may or may not be the same as the geographic context in which the feature is considered important.

The nature of the identified impacts on each assessed feature is characterised. This is considered, along with available research, professional judgement about the sensitivity of the feature affected, and professional judgement about how the impact is likely to affect the site, habitat, or population's structure and continued function. Where it is concluded that an effect would be likely to reduce the importance of an assessed feature, it is described as significant. The degree of significance of the effect takes into account the geographic context of the feature's importance and the degree to which its interest is judged to be affected.

6.2.5.5 *Mitigation*

Where significant impacts have been identified, the mitigation hierarchy has been taken into account, as suggested in the 2018 EcIA Guidelines, which sets out a sequential approach of avoidance of impacts where possible, application of mitigation measures to minimise unavoidable impacts and then compensation for any remaining impacts. Once avoidance and mitigation measures have been applied, along with any necessary compensation measures, and opportunities for enhancement incorporated, residual impacts have then been identified.

6.3 RECEIVING ENVIRONMENT

6.3.1 General Description of the Site

The WwTP Site is located in the townland of Mersheen on the southern outskirts of Arthurstown. According to the Heritage Council Guide by Fossitt, 2000, which broadly sets out a standard scheme for identifying habitats of Ireland, there are nine different habitat types outlined within the boundaries of the development (Figure 6.1). The WwTP site itself is on improved agricultural grassland (GA1: Fossitt, 2000), adjacent to a low-lying bramble hedgerow (WL1: Fossitt, 2000) and a mixed broadleaved/conifer woodland (WD: Fossitt, 2000) Figure 6.1, Figures 6.2-6.4.

Figure 6.1 Proposed WwTP Site at Arthurstown situated within the improved grassland with woodland beyond.

The proposed WwPS at Duncannon is located on an existing hardstanding area at Duncannon pier. The site of the proposed WwPS at Ballyhack is located on an existing hardstanding area at Ballyhack Harbour, currently used as a carparking area. The sites of the proposed Wastewater rising main and Wastewater gravity pipeline are generally along mixed habitats, including existing asphalt roads (BL3) and improved agricultural grassland (GA1).

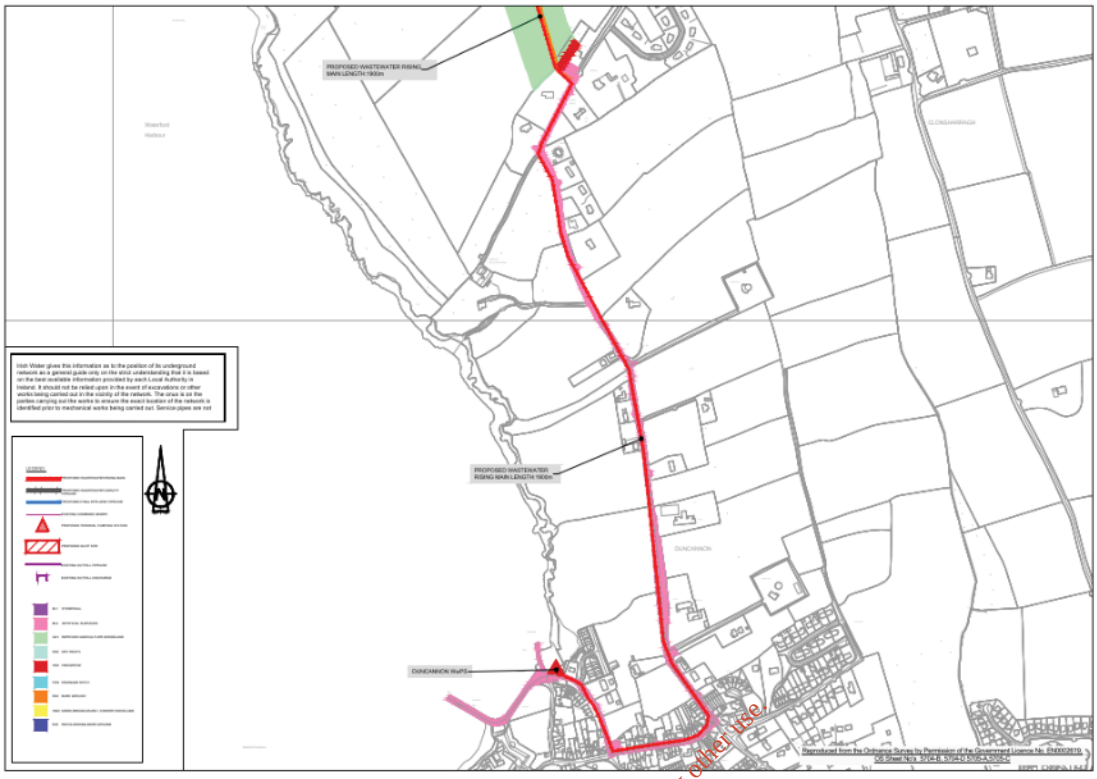


Figure 6.2 Habitats along the proposed route, north of Duncannon.

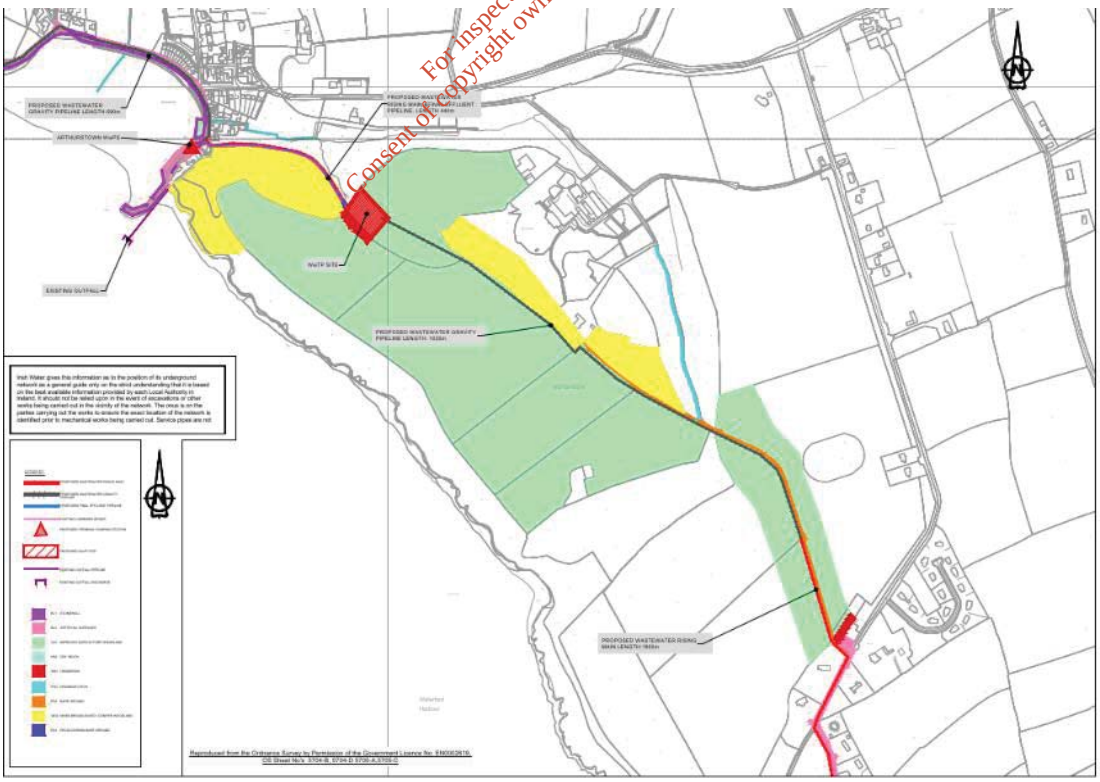


Figure 6.3 Habitats along the route, south of Arthurstown.

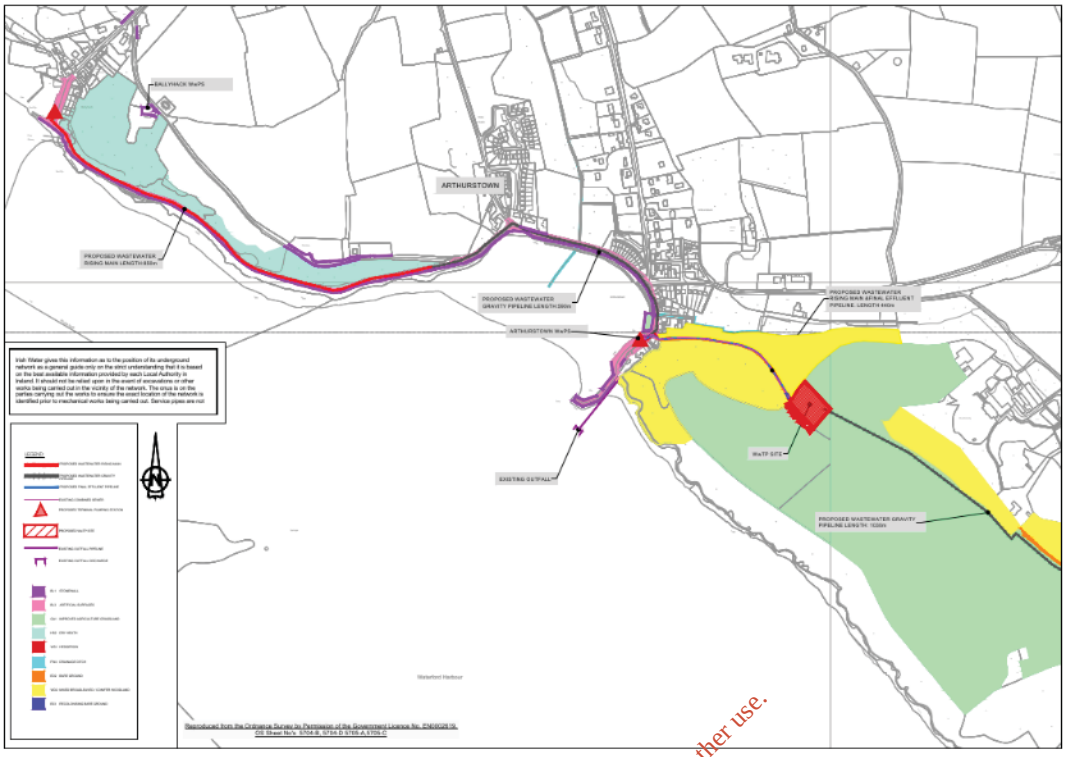


Figure 6.4 Habitats along the proposed route between Arthurstown and Ballyhack.

Figure 6.5 Location of Proposed WwPS at Arthurstown

Figure 6.6 Location of Proposed WwPS at Duncannon

Figure 6.7 Location of Proposed WwPS at Ballyhack

6.3.2 Protected Sites

Protected sites within 15km of the proposed development infrastructure were identified as part of the NIS. These are outlined below:

Table 6.1: Natura 2000 Network within the zone of influence

European Site	Distance from Proposed Development	Is there a hydrological link between the Project Site and European Site?	Does the Project Site have the potential to affect Qualifying Interests of European Site?	Are Qualifying Terrestrial Habitats sufficiently buffered from Direct/Indirect Impacts?	Does this European Site occur within the Sphere of Influence of the Project Site?
River Barrow and River Nore SAC	**Arthurstown:** existing outfall is within the boundary of this SAC. **Ballyhack:** The proposed pumping station at Ballyhack and sections of the proposed rising main to Arthurstown are within the	Yes. The proposed pumping station at Ballyhack, the existing outfall at Arthustown and sections of the rising main from Ballyhack PS to Arthurstown are within the boundary of the River Barrow and River Nore SAC.	Yes. The proposed development could potentially impact on the qualifying species, Sea Lamprey, Twaite Shad, Salmon and Otter of this SAC and invertebrate populations of designated marine communities.	No. European Dry heath is adjacent to the R733 roadway where the pipeline is to be laid between Ballyhack and Arthurstown and may be impacted by the roadworks.	Yes.

European Site	Distance from Proposed Development	Is there a hydrological link between the Project Site and European Site?	Does the Project Site have the potential to affect Qualifying Interests of European Site?	Are Qualifying Terrestrial Habitats sufficiently buffered from Direct/Indirect Impacts?	Does this European Site occur within the Sphere of Influence of the Project Site?
	boundary of this SAC. **Duncannon:** The proposed pumping station outfall is within the boundary of this SAC. **WwTP site:** The proposed Wastewater Treatment Plant site is in very close proximity to the boundary of this SAC (0.3km to the west).	Aquatic Habitats such as: Estuaries, Mudflats and sandflats not covered by seawater at low tide have the potential to be affected.	Potential impacts on the qualifying species may arise in the form of disturbance and pollution of marine habitats which support these species within the SAC. Yes, dry heath, grasslands and other floral species and bryophytes and lichens of importance may be affected by the laying of the pipelines.		
Lower River Suir SAC	6.0km north-west	No. The project site is in a separate sub-catchment with no hydrological link.	No. It is highly unlikely, that the project could affect the qualifying species of this European site.	Yes. Terrestrial habitats are highly unlikely to be affected by the proposed development. There is no hydrological link to the aquatic habitats.	No.
Tramore Dunes and Backstrand SAC	11.5km south-west	No. The project site is in a separate sub-catchment with no hydrological link.	No. It is highly unlikely, that the project could affect the qualifying species of this European site.	Yes. Terrestrial habitats are highly unlikely to be affected by the proposed development.	No.

European Site	Distance from Proposed Development	Is there a hydrological link between the Project Site and European Site?	Does the Project Site have the potential to affect Qualifying Interests of European Site?	Are Qualifying Terrestrial Habitats sufficiently buffered from Direct/Indirect Impacts?	Does this European Site occur within the Sphere of Influence of the Project Site?
Hook Head SAC	10.7km south-east	Yes. The proposed development is in the Curraghmore sub-catchment and Hook Head SAC lies within the same coastal catchment. However, Hook Head SAC is located 10.7km south-east of the proposed development and is not connected to the proposed development by any surface waters. All surface waters from Hook Head SAC flow into the inlet of Doornoge Bay.	No. It is highly unlikely, that the project could affect the qualifying species of this European site.	Yes. Terrestrial habitats are highly unlikely to be affected by the proposed development.	No.
Bannow Bay SAC	7.0km east	No. The project site is in a separate sub-catchment with no hydrological link.	No. It is highly unlikely, that the project could affect the qualifying species of this European site.	Yes. Terrestrial habitats are highly unlikely to be affected by the proposed development.	No.
Tramore Back Strand SPA	11.5km south-west	No. The project site is in a separate sub-catchment with no hydrological link.	No. It is highly unlikely, that the project could affect the qualifying species of this European site.	Yes. Terrestrial habitats are highly unlikely to be affected by the proposed development.	No.
Bannow Bay SPA	7.4km south-east	No. The project site is in a separate sub-catchment with no hydrological link.	No. It is highly unlikely, that the project could affect the qualifying species of this European site.	Yes. Terrestrial habitats are highly unlikely to be affected by the proposed development.	No.

European Site	Distance from Proposed Development	Is there a hydrological link between the Project Site and European Site?	Does the Project Site have the potential to affect Qualifying Interests of European Site?	Are Qualifying Terrestrial Habitats sufficiently buffered from Direct/Indirect Impacts?	Does this European Site occur within the Sphere of Influence of the Project Site?
Keeragh Islands SPA	14.6km south-east	No. The project site is in a separate sub-catchment with no hydrological link.	No. It is highly unlikely, that the project could affect the qualifying species of this N2K site.	Yes. Terrestrial habitats are highly unlikely to be affected by the proposed development.	No.

6.3.3 Habitats

6.3.3.1 BL3: Artificial Surfaces

Much of the rising main will be laid within existing roadways (length 3,780m, approx. 80% of overall pipelines). This habitat is classified as artificial surface and of little ecological significance. The SAC extends from the marine habitat at Ballyhack across the roadway to the 'Dry Heath' habitat. The roadway is within the designated boundary of the SAC, but the hardcore section of the roadway is not of ecological importance and does not support species of ecological significance.

6.3.3.2 GA1: Improved Agricultural Grassland

A proportion of the works will be located within grassland habitat. The site of the WwTP (footprint measuring 4300m^2) and the 1,030m of gravity pipeline from Duncannon to the WwTP will be within this habitat. Once these pipes are laid, the grassland will be returned to its original condition pre development.

The grassland habitat includes well drained, intensively managed and highly modified agricultural grassland. It has been reseeded and fertilised and is heavily grazed. Horses were grazing on site in February. The overall flora is species-poor, with limited grasses interspersed with dandelion (*Taraxacum* spp), Creeping buttercup (*Ranunculus repens*), plaintains (*Plantago* spp.) Nettles (*Urtica dioica*) Thistles (*Cirsium* spp.) and docks (*Rumex* spp) amongst others recorded With this type of intensively managed improved agricultural grassland, despite the time of year, no other species would have been expected. The residual impact on this habitat will be a permanent reduction of 4300m^2 grassland to provide the footprint for the WwTP and site security measures.

Adjacent to the WwTP is a dense bramble hedgerow (WL1), delineating the WwTP site boundary (Figure 6.1).

6.3.3.3 WL1: Hedgerow

A bramble (*Rubus fruiticosus*) hedgerow forms the property boundary southwest of the WwTP site. It is adjacent to the proposed WwTP and approximately 1.5 m high and varies in dimension as it runs eastwards, but generally over a metre wide with ivy (*Hedera helix*) and *Galium aparine*. Overall this hedgerow is low-lying with no mature trees. Hedgerow habitats are adjacent to much of the development, along roadways and in the fields. This habitat will not be reduced, and vegetation will remain intact. Hedgerow habitat will also be discussed in relation to birds in Section 6.3.4.

6.3.3.4 BL1: Stone wall and GS2: Grassland

In 1987 and 1990 T.G.F. Curtis and R. Fitzgerald surveyed and recorded plants of significance along a secondary road close to Ballyhack. The specific road which they surveyed runs mainly parallel to the route and is situated well above the proposed scheme. One of the surveyed sites occurs over 50m from the route and the other over 150m.

The recorders noted the presence of *T. glomeratum* in two locations, on a wall and also a rocky outcrop by the ruins in the village. The exact location of these plants and other important species were investigated during this survey. NPWS outlined and submitted to Jennings O Donovan the original datasheet entered by the above authors and exact locations were determined.

Both sites support a rich diversity of plants of significance, including a range of *Trilfolium* species, namely *T. glomeratujm, T. dobium* and *T. micranthum, T. ornithopodioides* and *T. striatum*. Other species of note include *Torilis nodosa*. A group of rock-dwelling species also occur at these sites including English Stonecrop (*Sedum anglicum*), Sheep's-bit (*Jasione montana*) and Wild Madder (*Rubia peregrina*). These rocks also support good lichen and moss assemblages with *Ramalina subfarinacea* and *Hedwigia ciliata*.

6.3.3.5 HH2: Dry heath corresponds to the broader Annexed habitat 'European Dry heaths (4030), links with Annex I

The northern boundary of the coastal road from Arthurstown to Ballyhack is adjacent to this habitat. Dry heath habitat supports flora of significant interest close to the road from Arthurstown to Ballyhack. The habitat includes limestone rocky outcrops that tend to rise quickly from the roadside. Hazel (*Corylus avellane*), blackthorn (*Prunus spinosa*), gorse (*Ulex europaeus*) and bramble (*Rubus fruitcosus*) were notably interspersed throughout the flora along the roadway. According to the NPWS this section of dry heath occurs on free- draining nutrient poor soils and is often characterised by gorse and open acid grassland areas. NPWS note that this area is a characteristic coastal dry heath habitat at Ballyhack. Several rare plants occur within the SAC including two species listed in the Red Data Book (Curtis and McGough, 1988). The species occurring on the site are listed in NPWS NHA Survey

Site Notes 1997/98. A brief overview of the principal characteristics of the dry heath habitat at Ballyhack is given in the NPWS Site Synopsis for SAC 002162 (2016).

According to NPWS, this small area of excellent dry coastal heath at Ballyhack is interspersed with patches of rock and of dry lowland grassland and has a high species diversity. Notably there is an excellent range of Clover (*Trifolium*) species including the legally protected clustered clover, a species known only from one other site in Ireland. These species are those noted in the previous section as the minor, secondary road delineates the northern most boundary of the dry heath habitat.

Irish Status of 4030

The area in Ireland covered by this habitat is 630.74km^2. In Ireland specifically, non-intensive sheep grazing (A04.02.02) and burning (J01.01) are the highest ranking pressures on this habitat type with non-intensive sheep grazing (A04.02.02) posing the greatest threat. The assessment of conservation status concluded for Irelands 4030 habitat, that Specific structures and functions (incl. species) status was 'Bad' and future prospects also classified 'Bad'. The overall assessment of Conservation Status was 'Bad'.

6.3.3.6 FW4: Watercourses Drainage Ditch/FP2: Springs

Three minor watercourses will be crossed in the laying of the pipeline infrastructure for this development. A minor watercourse/drain will be crossed on the eastern section of the gravity fed pipeline *en route* to the WwTP from Duncannon. This narrow drain at Blackhill can be classified as a drainage ditch, habitat FW4 and was developed to enhance drainage. IFI recommended adhering to all guidelines laid out by the NRA in *Guidelines for the crossing of watercourses during the construction of national road schemes* and also a document produced by IFI in 2016 entitled *Guidelines on protection of fisheries during construction works in and adjacent to waters*.

The other two watercourses exist along the gravity fed pipeline from Ballyhack to Arthurstown, R733 and are best classified as springs FP2. They are small local features. The 1.3km, isolated Ballyhack 13 River will be crossed during the laying of a 590m gravity fed pipeline to Arthurstown. The watercourse flows in from the north, and is not directly connected to the SAC as a tributary, but flows directly into the marine SAC after being piped under the roadway. Similarly, the small stream/drain flowing into Arthurstown from the east is an isolated, short stream, < 50 cm wide and discharges into the marine SAC at the end of the Arthurstown harbour wall on the south end of the village. This stream is also piped underground before discharging directly into the harbour. All pipelines will be laid under the culverts of respective watercourses.

6.3.3.7 ED2: Bare Ground

The majority of the 300m access road to the WwTP and the access track at Blackhill can both be classified under this habitat type. The tracks/roadways are largely unvegetated due to trampling and vehicular movement. Vegetation cover does not exceed 50%, with small plants emerging where there is less traffic (pedestrian or otherwise), including dandelion (*Taraxacum* spp.), ragwort (*Senecio* spp.), Greater plaintain (*Plantago major*), pineappleweed (*Matricaria discoidea*) and *Poa annua* grass. Pipelines will be laid along these access routes which do not support flora of any great significance. The latter end of the WwTP access road is restricted to 4 wheel drive motorised traffic due to large stands of dense tall sedges (*Carex pendula*), with coltsfoot (*Tussilago farfara*) and *R. fruiticosa* gaining foothold along the perimeter; vegetation cover is >80%. This final section transitions into what can be classified as **Recolonising bare ground ED3.**

Figure 6.8 Recolonising bare ground ED3 habitat, at western entrance to WwTP site.

6.3.4 Species

6.3.4.1 Birds

The hedges and trees on the boundary of the WwTP site are considered likely to support a typical assemblage of breeding farmland birds. Species seen or heard during the surveys include the common raven (*Corvus corax*), Eurasian jackdaw (*Corvus monedula*), hooded crow (*Corvus cornix*), magpie

(*Pica pica*), house *sparrow* (*Passer domesticus*), dunnock *(Prunella modularis*), robin (*Erithacus rubecula*) and blackbird (*Turdus merula*). Since the WwTP is within the general area of lowland farmland, it is important to acknowledge lowland birds which may utilise this area, including a diverse mix of species that include waterfowl, game birds, raptors, waders and many passerine species. While some grassland habitats will be temporarily disturbed due to the laying of the pipelines, these habitats will be promptly returned to their original status, thus continuing to potentially provide suitable pastures for many of these birds including curlew, lapwing, redshank, snipe and black-tailed godwits amongst others, which may utilise this area to nest and/or forage.

Given that the habitats recorded within the WwTP site, at the WwPS sites and along the routes of the rising main are typical of many of the surrounding fields and field boundaries it is unlikely that the breeding bird assemblage would be of importance at more than the site level.

A solitary bar-tailed godwit (*Limosa lapponica*), several black-headed gulls (*Larus ridibundus*), herring gulls (*Larus argentatus*) and the great black-backed gull (*Larus marinus*) were noted at Arthurstown. A great cormorant (*Phalacrocorax carbo*) was seen at Duncannon. Other birds noted along the coastline during this survey in February included wintering Brent geese (*Branta bernicla*) at Ballyhack.

Nationally important numbers of golden plover and bar-tailed godwit are found during the winter along this coastline. Wintering flocks of migratory birds are seen along the Barrow Estuary in Waterford Harbour.

6.3.4.2 *Mammals: Bats*

Bats and their roosts are protected by Irish and EU law because all species have declined and some are threatened or endangered. Bat roosts are protected, irrespective of whether or not they fall within the boundaries of an SAC.

Bats are likely to frequent all linear corridors, especially the hedgerows along roadways (Figure 6.2) and the waterways. Nine bat species are known to frequent the area from Ballyhack to Duncannon, each species with slight variation in habitat requirements 29 (NBDC). NBDC data showed more favourable numbers were often located north of Arthurstown to Ballyhack, e.g. whiskered bat (*Myotis mystacinus*) numbering 32-44 bat passes as opposed to 10-20 for Arthurstown south towards Duncannon. Similarly, Natterer's bat (*Myotis nattereri*) numbers are greater in the most northerly section of the development area with 49-75 bat passes as opposed to 14-26 south of Arthurstown and also Leisler's Bat (*Nyctalus leisleri*) 38-46 passes as opposed to 19-29 (NBDC).

Bat survey data held by NBDC within close proximity to the development route are more than likely feeding on invertebrates (principally flying insects) with most species seeking out their prey in areas that have good vegetation cover, including mature trees (woodland or forestry), hedgerow and scrub. Bats also frequently feed close to water as wetlands tend to support large insect communities. The

bats may be utilising the natural corridors within the proposed development, such as flying along the hedgerows (along roadways) and woodland edges (close to the gravity main from Duncannon to the WwTP and also the woodland close to the access road to the WwTP).as well as small lanes (access lane to WwTP – west side), minor roads (roads where rising main will be laid) and waterways (small streams/drains in the area), both to find and catch food and to commute between feeding areas and roosts and between alternative roosts. The woodland areas mentioned above adjacent to the development area, or in close proximity, will not be altered in any way and no infringement or habitat reduction will occur on these important sites for local bats. Hedgerows and areas of good vegetative cover will also not be disturbed along the roadways. This will be important and essential for much of the ecological requirements for maintaining favourable conditions for bats in the area.

Figure 6.9 Mature treeline hedgerow (WL1) adjacent to grassland habitat (GA1) where a gravity fed main will be laid to the WwTP.

6.3.4.3 Mammals: Badgers

The Eurasian badger has been given legal protection under the Wildlife Act and is listed in Appendix III of the Bern convention as a species in need of protection.

No signs of badger, such as setts, footprints or worn tracks were noted within the WwTP site during the field survey. Badgers are omnivorous, feeding on earthworms, other invertebrates, fruits and roots, as well as on carrion and crops. Badgers may be occurring within the wider habitats of the development

site, for example along hedgerows, in the adjacent small woodlands, especially when adjacent to good foraging habitat such as the grazed grasslands near the new WwTP. Over half of badger setts in Ireland are found along hedgerows. No hedgerows will be removed during this project, thus maintaining optimum favourable conditions for this mammal.

6.3.4.4 Mammals: Otters

Otter are a Qualifying Interest of the River Barrow and River Nore SAC 002162 and have been addressed in detail in the NIS. They will not be discussed further in this document.

6.3.4.5 Mammals: Red squirrels and Pine martens

The mixed woodland located close to the site of the WwTP at Arthurstown has the potential to provide habitat for both red squirrels and pine martens. However, during the site visit, no dens or dreys were noted and no evidence of either species was found.

6.3.4.6 Invertebrates

No suitable habitat (devil's bit scabious) was identified for Ireland's only European protected butterfly species, the marsh fritillary. There was also no habitat for Ireland's only nationally protected butterfly; small blue. Kidney vetch, the larval food plant of small blue, is a plant of calcareous grassland and is not likely to be frequently present within the proposed development site. There was no known habitat for any other invertebrates of conservation interest within the ZoI of the proposed development site.

6.3.4.7 Amphibians, reptiles and other species

No amphibians, reptiles or other notable species were found during the site visit and no other suitable habitat for any such species was found in the immediate vicinity of the pipeline route or the associated infrastructure. They will not be discussed further in this document.

6.3.5 Invasive Species

Japanese knotweed is located along the access track at Arthurstown, as shown in the Invasive Species Report in Appendix B. The invasive species is within 10m of the route of the pipeline excavation. Its root system may impinge on the sewerage network in the future. A Japanese knotweed Management Plan has been developed and a contractor secured to deliver the first phase of the plan during Spring 2019.

6.4 POTENTIAL IMPACTS OF THE DEVELOPMENT

The following design principles and "designed-in" mitigation have informed the assessment of impacts:

- The construction phase of the Project is envisaged to last 12-18 months but the timing of the construction is to be confirmed.

- Within the Project design and operation, standard good practice pollution control measures will be employed, and these are set out in the NIS.

Taking the above into account, the principal potential impacts of the development are outlined in the following Construction Phase.

Operation of the proposed development will not result in any increase in surface water movement to the watercourses and will not give rise to any pollutants that could enter the air or watercourses.

During the operational phase, a limited section of agricultural land will be taken out of production and any disturbance caused by installation of the rising main will be reinstated after the pipes have been laid. The impact overall will be minor taking into account the limited permanent loss (WwTP footprint) of agricultural land during the construction phase.

The proposed development will treat wastewater, both domestic and commercial, which is currently being discharged into Waterford Harbour untreated. Secondary treatment of this effluent prior to discharge will have a definite positive impact on the marine environment in the local area.

6.4.1 Construction and Operation Phase Impacts

Given that surface water management measures and pollution control measures form part of the design it is unlikely that the Project will give rise to emissions to the air or to watercourses.

Impacts on protected sites are not anticipated provided mitigation measures outlined in the NIS are implemented. Impacts on protected sites are therefore screened out of this assessment and are not considered further.

***Impacts on* Watercourses and FP2 Springs**

Watercourse crossing pipelines will be laid beneath the culverts using either trenchless or open cut methods. If open cut methods are used to lay the pipelines, temporary dams will be placed in the culverts and flows will be over-pumped for the duration of the works. When the pipeline works have been completed the culverts will be reinstated. Mitigation measures, as outlined later and in the NIS, will be implemented for works at the watercourse crossings. There will no significant impact to any of the three watercourses outlined in Section 6.3.3.6 above.

***Impacts on* BL3 Artificial Surfaces**

Development will occur within these areas but as the habitat does not support any protected or notable species or important invertebrates, no impacts will be experienced.

***Impacts on* GA1 Improved Agricultural Grassland**

Less than 0.4ha will be lost to the footprint of the WWTP at Arthurstown. During the early site-strip stage for hard standing and access roads for the WwTP, some of the agricultural land will be lost for the lifetime of the proposed WwTP. The laying of rising mains in the agricultural field from Duncannon to the WwTP will be temporary with full installation and original habitat completely restored post construction. The installation of the rising mains on public roads will require trenching which will be backfilled with the original excavated material where possible. All roads will be restored to their original, or an improved state post construction. There will be no long lasting adverse impact on GA1 habitat due to the laying of the pipelines and there will be no impact of any species of ecological significance which use the habitat to feed from or commute through.

***Impacts on* WD2 Mixed broadleaf woodland**

The site will be accessed by an existing access road that runs from the Strand Road in Arthurstown to the proposed WWTP site through the woodland habitat. The existing road is approximately 3.5m wide and has a gravel surface. The road is shown in Figures 6.10 and 6.11. The following works will be undertaken on the road within the woodland:

- New bitumen pavement; the depth of construction will be 600mm and the road will drain to a permeable area on the verge. The new road will be 3.5m wide with occasional passing places.
- Two new pipelines with diameters approximately 150 and 250mm. The depth of construction of the pipelines will be 1.5 to 2m. the pipelines will be in the centre of the road. 7no. new manhole chambers will be constructed on the pipeline.
- A timber post and wire fence will be constructed on each side of the road, along Irish Water's land ownership boundary.

Figures 6.10 and 6.11 show that the trees are located some distance away from the road itself. No tree felling will be required to accommodate the works. Branches however may have to be lopped or trimmed. An ecological specialist will be required to check for any nests prior to any such works being carried out. Due to the shallow depth of road construction and the location of the pipelines in the centre of the road, it is not anticipated that any tree roots will be affected by the works. There will be no adverse impact to the woodland as part of the project.

Figure 6.10 Access Road to WwTP Site

Figure 6.11 Access Road to WwTP Site

***Impacts on* WL1 Hedgerow**

There will be no loss of or damage to hedgerows during the construction/operation phase and all construction and operational access will be through existing farm gates and access tracks. In conclusion, there will be no significant effect on hedgerow habitats as they will not be disturbed throughout the development of the WwTP and its related infrastructure. Section 40 of the Wildlife Act 1976, as amended by Section 46 of the Wildlife (Amendment) Act 2000, restricts the cutting, grubbing, burning or destruction by other means of vegetation growing on uncultivated land or in hedges or ditches during the nesting and breeding season for birds and wildlife, from 1 March to 31 August. The contractor will comply with the Wildlife Act and ensure no hedgerow or branch trimming occurs within this window.

***Impacts on* BL1 Stone wall and GS2 Grasslands**

The stone wall (BL1) and grassland (GS2) will not be impacted and there will be no significant effect on these habitats.

***Impacts on* HH2 Dry heath**

No HH2 habitat will be lost or impacted during the construction or operation phase of this project. The laying of the rising main adjacent to habitat HH2 will have no significant effect on this habitat.

***Impacts on* ED2 Bare Ground and ED3 Recolonising bare ground**

This habitat does not support any protected or notable species or important invertebrates, no impacts will be experienced.

***Impacts on* Otter**

No otter holts or otter evidence is being lost or disturbed as part of this project. Evidence of otter was not recorded within any part of the proposed development infrastructure sites. The proposed WwTP site will be enclosed by a perimeter fence which will result in the exclusion of any otter. Given that no evidence was found of otter using the WwTP site and otter may continue to move freely throughout surrounding habitat, no significant impact is expected to this species.

***Impacts on* Badger**

No badger setts are being lost or disturbed as part of this project. Evidence of badger was not recorded within any part of the proposed development infrastructure sites. The proposed WwTP site will be enclosed by a perimeter fence which will result in the exclusion of any badgers. However, any badgers will still be able to move freely around the edge of the WwTP site in all directions. Badger movement may be temporarily restricted during operation as they may be required to avoid security fencing around construction areas. Given that no evidence was found of badger using the WwTP site and badger may continue to move freely throughout surrounding habitat, no significant impact is expected to this species.

Impacts on Bats

No structures or trees suitable for bat roosts are being demolished/felled as part of this project. Construction hours are anticipated to be 08:00 to 18:00. No lighting will be required during the operational phase. There will be no lighting or security cameras required along the route of the rising mains. Therefore, no lighting impacts on bats are anticipated. All hedgerows throughout the site development area are to be maintained, providing suitable habitat for bats to navigate and provide potential foraging of related invertebrates and possible roosting sites. Bats are not expected to be affected by any element of the proposed infrastructure. Where branches are deemed to interfere with the passage of plant machinery to the proposed WwTP, then it will be the requirement of the contractor to secure a bat specialist to ensure no bats are roosting in these branches prior to works being carried out.

***Impacts on* Pine marten and squirrel**

No dens or dreys are being lost or disturbed as part of this project. Evidence of pine marten and red squirrel was not recorded within any part of the proposed development infrastructure sites. The proposed WwTP site will be enclosed by a perimeter fence which will result in the exclusion of any such species. Given that no evidence was found of these species using the WwTP site and that they may continue to move freely throughout surrounding habitat, no significant impact is expected to either pine marten or red squirrel.

***Impacts on* Amphibians, reptiles and other species**

No amphibians, reptiles or other notable species were lost or disturbed as part of this project. Evidence of these species was not recorded within any part of the proposed development infrastructure sites. The proposed WwTP site will be enclosed by a perimeter fence which will result in the exclusion of them. Given that no evidence was found of such species using the WwTP site and that they may continue to move freely throughout surrounding habitat, no significant impact is expected to amphibians, reptiles or other notable species.

***Impacts on* invertebrates**

No notable invertebrates will be disturbed as part of this project. Evidence of them was not recorded within any part of the proposed development infrastructure sites and they may continue to move freely throughout surrounding habitat and site, no significant impact is expected to any invertebrate species.

Impacts on Birds

There will be no loss of hedgerow/treeline habitat, although there will be a loss of a small amount of agricultural land for the WwTP footprint. Birds will be able to continue to use trees and shrubs in the area but may temporarily avoid those in close proximity to human and vehicular disturbance for the duration of the construction phase. Overhanging branches of trees may require trimming prior to the development of the access road and the passing of machinery to the WwTP site. Section 40 of the Wildlife Act 1976, as amended by Section 46 of the Wildlife (Amendment) Act 2000, restricts the cutting, grubbing, burning or destruction by other means of vegetation growing on uncultivated land or in hedges or ditches during the nesting and breeding season for birds and wildlife, from 1 March to 31 August. Overhanging branches will be required to be checked by a qualified ecologist to check for nests prior to any trimming or lopping being carried out. This will not impact the bird population in the wider area. Therefore, there is no envisaged impact on birds as a result of this development.

No construction or operation works will occur within the marine habitat of the SAC. Birds in close vicinity to construction works may be temporarily disturbed and move to other similar habitat types which are less disturbed while works are ongoing. Disturbed birds may include those along the coastline where coastline roadworks and PS are undergoing construction, birds utilising hedgerows, grasslands and trees immediately adjacent to works. All such habitats are plentiful in the area and will

provide alternative sites for disturbed birds during this temporary construction phase. Birds will therefore not be affected by the operational phase of the development.

Impacts on Invasive species

Japanese knotweed located close to the access roadway to the WwTP in Arthurstown is subject to a Management Plan to commence in late Spring/early summer. This plan aims to eradicate the Japanese knotweed from this site completely if successfully implemented. The site investigation survey identified this invasive species. The IAS Management Plan will impact on this species by eradicating it from the site.

Impacts on the Marine Environment

The EPA monitor several locations throughout Waterford harbour, up to and including the Nore estuary. The trophic status of waters from the 2010-2012 survey indicate that the uppermost Nore estuary to below Duncannon is 'intermediate', transitioning to 'unpolluted' below Duncannon and outward into the bay. BOD samples were <2 mg/l for waters in the vicinity of the three coastal sites, Ballyhack, Arthurstown and Duncannon in 2010-2012. Notable improvements were recorded in the Middle Suir Estuary, where BOD levels decreased since the last assessment (down from 6.1 to 2.5 mg/l BOD), which may reflect the provision of secondary wastewater treatment for Waterford City which was commissioned in 2010.

The estuary and mudflats are aquatic dependent habitats and as such could be potentially impacted by a substantial increase in nutrient levels. The benthic fauna survey carried out (available in Appendix C) shows that the existing discharges do not currently have a significant impact on the benthic fauna in the estuary. The proposed discharge will be a combined discharge from three agglomerations but since secondary level treatment will be provided the water quality of the discharge will be vastly improved over the existing discharge. The proposed discharge will therefore not have a significant impact on benthic habitats in the vicinity of the discharge.

Ecological status from Ballyhack to Duncannon and out into the lower estuary is classified as 'moderate' with conditions improving further out into the outer bay, achieving 'good' status. Bathing water quality for Duncannon in 2009 had 'poor water quality' that was non-compliant with EU Mandatory Values (Figure 2.6). Water quality improved however, in 2016 reaching 'sufficient' status. Dunmore east located 9.2 km downstream of Duncannon and on the western side of the harbour had 'excellent' bathing water quality status in 2016.

Secondary treatment of the sewage is expected to improve the quality of effluent currently entering the harbour. No significant effects are expected on the marine environment. A water quality assessment was carried out to assess the impact of the proposed discharge on the overall water quality of the estuary, this report is included in Appendix E. This report was undertaken based on the

discharge of primary treated effluent and showed that such a discharge would not have a significant impact on the overall water quality of the estuary or on its WFD ecological status. The proposed discharge will receive secondary level treatment so the water quality assessment carried out provide a conservative assessment.

A Waste Water Discharge Licence application will be made to the EPA before construction commences and the discharge will be monitored by Irish Water in accordance with the licence requirements to ensure that the emission limit values are met by the works.

6.5 Construction Phase Mitigation

Much of the infrastructure works involve roadways and thus should adhere to the National Roads Authority's (NRA's) Series of Environmental Assessment and Construction Guidelines. Of particular significance in this instance are the following documents:

- Guidelines for Assessment of Ecological Impacts on National Road Schemes (Rev. 1, 2006),
- A Guide to Landscape Treatments for National Road Schemes (2006)
- Best Practice Guidelines for the Conservation of Bats in the Planning of National Roads Schemes (2006)
- Guidelines for the Treatment of Bats during the Construction of National Roads Schemes (2005)
- Guidelines for the Treatment of Badgers Prior to the Construction of National Road Schemes (2008)
- Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes (2006)
- Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post Construction of National Road Schemes (2006)
- Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes (2006) and
- Guidelines on the Management of Noxious Weeds and Non-Native Invasive Plant Species on National Road Schemes (Revision 1, December 2010)

All works in proximity to watercourses shall follow the best practice guidance outlined in the following documents:

TII/NRA "Guidelines for the crossing of Watercourses During Construction of National Road Schemes" (2008)

Shannon Regional Fisheries Board (SRFB) "Protection and Conservation of Fisheries Habitat with Particular reference to Road Construction" (2009)

Inland Fisheries Ireland requirements publication "Guidelines on protection of fisheries during construction works in and adjacent to waters" (2016)

6.5.1 Mitigation by Avoidance and Prevention

Roads and Construction Sites

The following mitigation measures will be taken:

- Materials will be segregated and carefully managed after arrival on site.
- Materials will be segregated where possible, e.g. sub-soils and top soil.
- Ordering, storage and handling procedures of required materials will be reviewed regularly and inventories monitored by the Contractor at each location.

Birds

Although ground nesting birds are not expected to be present, this cannot be entirely ruled out. Construction activities on the site of the proposed WwTP site will be timed to avoid the bird nesting season, or alternatively, if this is not possible, a pre-construction check for nesting birds will take place by a suitably experienced ecologist.

No cutting, grubbing, burning or destruction by other means of vegetation growing on uncultivated land or in hedges or ditches during the nesting and breeding season for birds and wildlife will occur, from 1 March to 31 August. The contractor will comply with the Wildlife Act and ensure no hedgerow or branch trimming occurs within this window. An ecologist will be required to check for any nests prior to any such works being carried out.

Bats

Where branches are deemed to interfere with the passage of plant machinery to the proposed WwTP, or elsewhere within the footprint of the works, a suitably qualified bat specialist will be required to assess the branches/trees for roosting sites for bats, prior to any interference with the tree. It will be the requirement of the contractor to secure a bat specialist to ensure no bats are roosting in these branches.

Any bat and any tree or part thereof that is identified as a bat roost, is afforded legal protection by the Wildlife Acts, 1976 and 2000 and the EU Habitats Directive (under S.I. 94 of1997). To proceed with the felling of the tree, it is necessary to obtain a licence from the NPWS.

Tree-felling/branch lopping should ideally be undertaken in the period late August to late October/early November. During this period bats are capable of flight and may avoid the risks of tree-felling/branch lopping if proper measures are undertaken.

Timing of Survey: Immediately prior to felling, the trees should be examined for the presence or absence of bats, and/or other bat activity. This survey should include a visual inspection of the tree during daylight hours followed by a night time detector survey (see Guidelines for surveying trees for

bats (section 3.3.3) in the NRA publication Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes (National Roads Authority, 2005). The survey should be carried out from dusk through the night till dawn.

Where an autumn examination of a tree or part thereof has shown that bats have not emerged or returned to a tree, it is safe to proceed with the felling of the tree the following day, once the appropriate tree-felling licence, if required, has been secured. Such an inspection confirms the status of the tree only at the time of inspection and where there is a delay of one day or greater, the tree must be re-assessed.

In areas where bats are known to exist, tree-felling should not be undertaken in June, July and early August, in order to ensure that breeding populations of bats are protected.

Felling during the winter months is to be avoided as this creates the additional risk that bats may be in hibernation and thus unable to escape from a tree that is being felled. Additionally, disturbance during winter may reduce the likelihood of survival of bats as their body temperature is low and disturbance may cause them to consume too much body fat.

Badgers

Badgers create new setts regularly. A survey of the proposed footprint and outlying boundary of 100m is required no more than 10-12 months in advance of the construction. This will ensure that there will be sufficient time to comply with all licensing requirements (where setts are found) and that the necessary actions are undertaken to protect the badger populations prior to the commencement of construction. The survey should be supplemented by a further inspection of the development area immediately prior to site clearance, to ensure that no new setts were established in the intervening period.

Otters

Pre-construction otter surveys should be undertaken prior to the commencement of any works in order to identify any changes in otter activity since the original ecological survey was carried out. Otter surveys can be undertaken in conjunction with badger surveys and there are no seasonal constraints, but any dense vegetation can reduce success in the identification of otter holts or couches. A pre-construction survey is important to ensure that no new holts have been created in the intervening period. The pre-construction survey should be conducted no more than 10-12months in advance of construction. This will ensure that there will be sufficient time to comply with all licensing requirements and that the necessary actions can be undertaken to protect otter populations prior to the commencement of construction. The survey should be supplemented by a further inspection of the development area immediately prior to site clearance. Where more than 36 months has elapsed between the time of grant approval (where successful) and the initiation of the construction phase, an

appropriate level of resurvey will be required as the baseline data may have altered during the intervening period.

Amphibians

While no amphibians were encountered during the site walkover, they may have become established within the footprint of the site. A suitably qualified ecologist will survey the site and any drain or pool within the affected corridor width which could be considered an actual or potential breeding site for amphibians.

Amphibians present within the proposed development will be removed (under licence from NPWS (Wildlife and Amendment Acts 1976/200) prior to construction proceeding and placed into alternative suitable habitats in the locality.

Where practical in the context of construction, water levels will be maintained in any drains used, or potentially used, by frogs.

Habitat reinstatement will re-create, as far as is practicable, the former channels and drain systems (if noted on site), so that frogs may use these, post-construction.

Where frogs or amphibians have been noted during survey walkovers, post-construction monitoring will be conducted to ensure that identified frog breeding sites have been satisfactorily restored and continue to serve as breeding sites.

Receptor sites for translocated amphibians are not identified at this stage. Such sites may be outside of the corridor and cannot realistically be considered at this stage. However, where amphibians are found, mitigation measures will concentrate on the creation of alternative sites within the corridor and especially on the restoration of drains after construction; so, in practice, amphibian breeding sites during construction, where impacted, will be restored and will serve as frog sites in years following habitat restoration. The translocation of frogs is a common practice and wildlife licences are obtained from NPWS. In the instance of frog breeding sites being potentially impacted on site, detailed proposals will be agreed with NPWS prior to construction/disturbance taking place.

Frog and newt are protected species under current Irish Wildlife legislation. Best practice mitigation measures will ensure continuance of these species on site after construction.

Biosecurity: Invasive Species

An IAS Management Plan has been prepared in relation to the treatment of the identified stand of Knotweed along the access road to the WwTP in accordance with the following guidance:

National Roads Authority TII/NRA (2010). Guidelines on management of noxious weeds and non-native invasive plant species on national roads.

Environment Agency (UK) (2013). The Knotweed Code of Practice: Managing Japanese Knotweed on Development Sites (Version 3, amended in 2013).

The following measures address potential impacts associated with the construction phase of the project:

- Good construction site hygiene will be employed to prevent the introduction and spread of problematic invasive alien plant species (e.g. Himalayan Balsam, Japanese Knotweed etc.)
- Biosecurity measures will be undertaken to prevent the importation of invasive species from contaminated areas into the study area.
- There will be the requirement for the importation of small quantities of fill material as part of the grading of the finished pumping station development. The source of any such fill material will be inspected to prevent soils from contaminated areas being imported.
- Any soil and topsoil required on the site will be sourced from a stock that has been screened for the presence of any invasive species and where it is confirmed that none are present.
- Any proposed planting and landscaping associated with the proposed development shall avoid the use on invasive shrubs such as Rhododendron.
- Any construction vehicles coming from known contaminated areas will be required to have undergone the 'check, clean, dry' system or be completely hosed down and inspected to eliminate the possibility of further spreading of the invasive species.
- The entire footprint of the site (and an outer 7m boundary) will be evaluated for invasive alien species, where a new growing season has passed since the previous survey has been undertaken.

The Waste Management Acts requires that waste must be transferred only to a body that is duly authorised by the Acts to receive it. This applies to most forms of waste movement from one party to another, including waste taken off site from road developments. This is an obligation under Section 32 of the Acts, which explicitly requires that waste is only transferred to a person authorised to undertake the collection of the waste or its recovery or disposal. An authorisation can take the form of a waste collection permit, a waste or industrial emissions licence, a waste facility permit or a certificate of registration. Local authorities are automatically authorised to collect waste under Section 32 of the Acts, albeit that any disposal or recovery facility operated by them has to be subject to a waste licence, industrial emissions licence or certificate of registration.

6.6 CONCLUSION

Overall the impacts of the proposed development in the absence of mitigation are considered to be minor at the site level or neutral. Mitigation by avoidance is proposed for breeding birds and to prevent the importation of invasive species during construction. Pre-construction surveys are required for otters, badgers, nesting birds, bats, amphibians and invasive species. Residual impacts of the

development will be minor in the case of agricultural land; a small amount of land will be permanently lost for the proposed development.

Table 6.2: Matrix of Impacts / Mitigation / Residual Impacts

Ecological Feature	Construction Phase Impacts	Operational Phase Impacts	Mitigation Measures	Residual Impacts
Protected sites	None	None	None	None
Agricultural land	Small loss, negative, significant at site level	None	No further measures proposed	Minor WwTP footprint
Treelines and hedgerows	Based on current baseline survey. None	None	Dependent on requirements of plant machinery. Pre-construction survey required (see measures for birds and bats).	None
Bats	Based on current baseline survey. None	None	Dependent on pre-construction and site clearance survey. Dependent on requirements of plant machinery.	None
Badgers	Based on current baseline information. None	None	Dependent on pre-construction and site clearance survey detail. Fencing around construction to avoid access to site.	None
Otters	Based on current baseline information. None	None	Dependent on pre-construction and site clearance survey detail.	None
Nesting birds	Dependent on timing, temporary disturbance, significant at site level.	None	Pre-construction survey required. Avoid nesting season	None
Amphibians	Dependent on pre-construction and site clearance survey detail.	None	Dependent on pre-construction and site clearance survey detail.	None

Ecological Feature	Construction Phase Impacts	Operational Phase Impacts	Mitigation Measures	Residual Impacts
	Based on current baseline information. None			
Invasive Alien Species	Elimination of IAS on site	None	Implement Management Plan for all/any IAS species within 7m of the footprint of works	IAS eliminated from footprint of works
Enhancement measures	N/A	N/A	N/A	N/A

6.7 REFERENCES

Action plan for lowland farmland birds in Ireland 2011-2020. BirdWatch Ireland, Unit 20, Block D, Bullford Business Campus, Kilcoole, Co. Wicklow, Ireland.

Bat Mitigation Guidelines for Ireland. Irish Wildlife Manuals No. 25 NPWS 2006.

Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes. National Roads Authority. St Martin's House, Waterloo Road, Dublin 4

CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Chartered Institute of Ecology and Environmental Management, Winchester.

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NPWS Irish Wildlife Manual No. 25 (2006) Bats Mitigation Guidelines for Ireland by Kelleher & Marnell

National Roads Authority (2006). Guidelines for the Treatment of Badgers prior to the Construction of National Road Schemes. Dublin: National Roads Authority

The Management of Waste from National Road Construction Projects (2017). Transport Infrastructure Ireland.

Websites

www.npws.ie
http://www.biodiversityireland.ie/
https://www.google.ie/maps
http://www.bing.com/maps/

7 HYRDOGEOLOGY & HYDROLOGY

7.1 INTRODUCTION

7.1.1 Objectives

The primary objectives of the assessment include:

- Undertake a study of soils, water and general conditions at the proposed site.
- Identify likely positive and negative impacts of the proposed development on soils, surface water and groundwater during construction and operational phases of the development; and
- Identify mitigation measures to avoid, remediate or reduce significant negative impacts.

7.2 METHODOLOGY

7.2.1 Desk Study

A desk study has been undertaken for the proposed development. This involved collating all relevant geological, hydrological, hydrogeological and meteorological data for the area. This included consultation with the following:

- Environmental Protection Agency database (www.epa.ie);
- Geological Survey of Ireland - National Draft Bedrock Aquifer map;
- Geological Survey of Ireland - Groundwater Database (www.gsi.ie);
- The Department of Communications Marine and Natural Resources - Exploration and Mining Division website (www.minex.ie);
- Met Éireann Meteorological Databases (www.met.ie);
- National Parks & Wildlife Services Public Map Viewer (www.npws.ie);
- Catchments Mapviewer (www.catchments.ie);
- Bedrock Geology 1:100,000 Scale Map Series, Sheet 19 (Geology of Carlow-Wexford). Geological Survey of Ireland (GSI, 1996);
- OPW Indicative Flood Maps (www.flooding.ie).
- Environmental Protection Agency – “Hydrotool” Map Viewer (www.epa.ie);
- CFRAM Preliminary Flood Risk Assessment (PFRA) maps (www.cfram.ie); and,
- Department of Environment, Community and Local Government on-line mapping viewer (www.myplan.ie).

7.2.2 Site Investigation

A walkover survey of the site and the surrounding area was undertaken on 14th and 15th February 2018. Water flows and drainage patterns were recorded during the survey.

7.3 RECEIVING ENVIRONMENT

7.3.1 Geology

The area of the proposed development at Ballyhack is underlain by the Brownstown Head Member (Templetown Formation) comprised of interbedded red conglomerates, sandstones and mudstones; the coarser lithologies are dominant near the base. The area of the proposed development at Arthurstown is underlain by the Arthurstown Member (Campile Formation) comprised of a sub-regular cyclically alternating siltstone-mudstone sequence. Distinctive red and green colour banding occurs in zones up to 10m thick. Quartz-greywacke siltstones compose 50% of the formation, and occur in beds of 2-210mm. The area of the proposed development at Duncannon is underlain by the Booley Bay Formation comprised of repetitively interbedded grey siltstone and mudstone succession with fine sandstones and paraconglomerates up to 30m thick also occurring and bedrock outcrop present in the area.

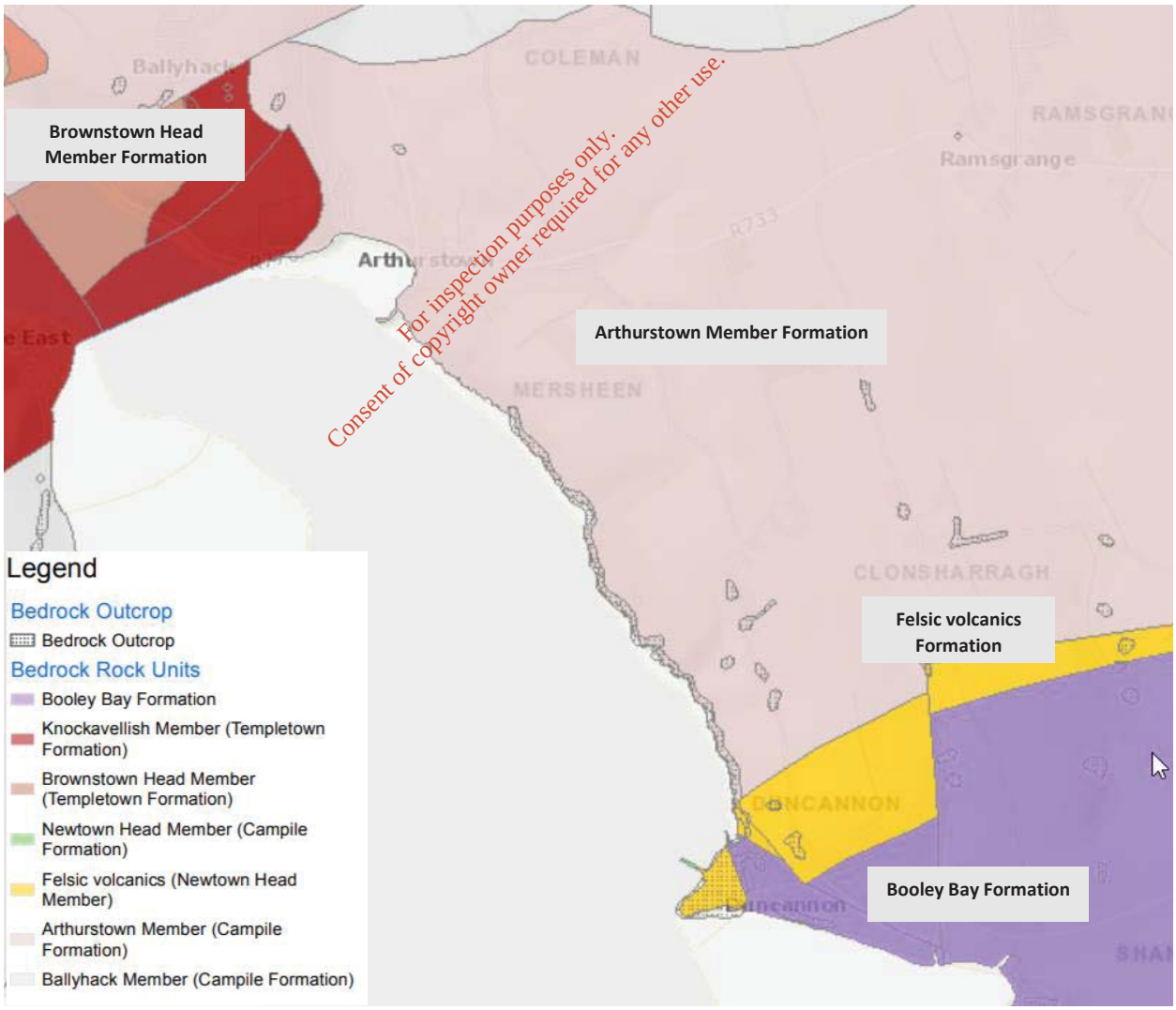


Figure 7.1 – Site Geology, Bedrock 100k, Reproduced from GSI Online Mapping (Copyright Ordnance Survey Ireland – License No. EN 0002618)

Consultation with Geological Survey Ireland indicated that an area at Duncannon pier is a geological heritage area. It is described as sequences of tuffs, volcaniclastic breccias, lahars, lavas and intrusives emplaced in fossil – bearing Caradocian mudrocks. It also contains graptolitic shales.

Figure 7.2 Geological Heritage Site Reproduced from GSI Online Mapping (Copyright Ordinance Survey Ireland – License No. EN 0002618)

Soils

The WwPS site at Ballyhack is underlain by marine/estuarine silts and clays. The WwPS sites at Arthurstown and Duncannon are on made ground. The route of the pipeline is predominately underlain by well-drained mineral soils. The soils in the area of the proposed WwTP at Mersheen Townland is underlain by deep well drained mainly acidic soils.

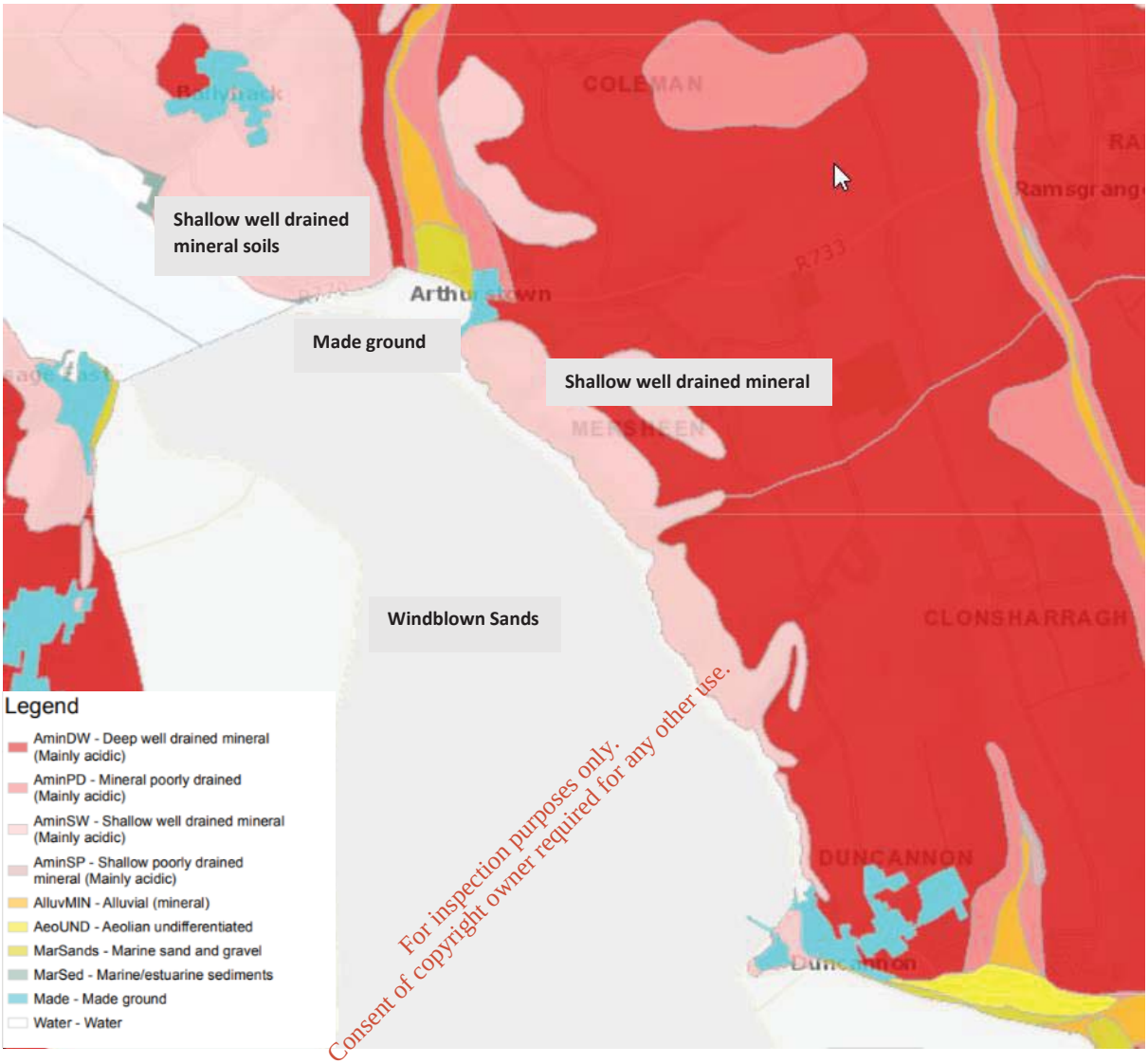


Figure 7.3 – Teagasc Soils

7.3.2 Regional Hydrogeology

Aquifer Classification

The EPA Mapviewer was consulted to identify the aquifers at the infrastructure sites. Groundwater vulnerability for the area is classed as Extreme to Rock at or near surface, or karst, with the Arthurstown harbour reach showing high vulnerability.

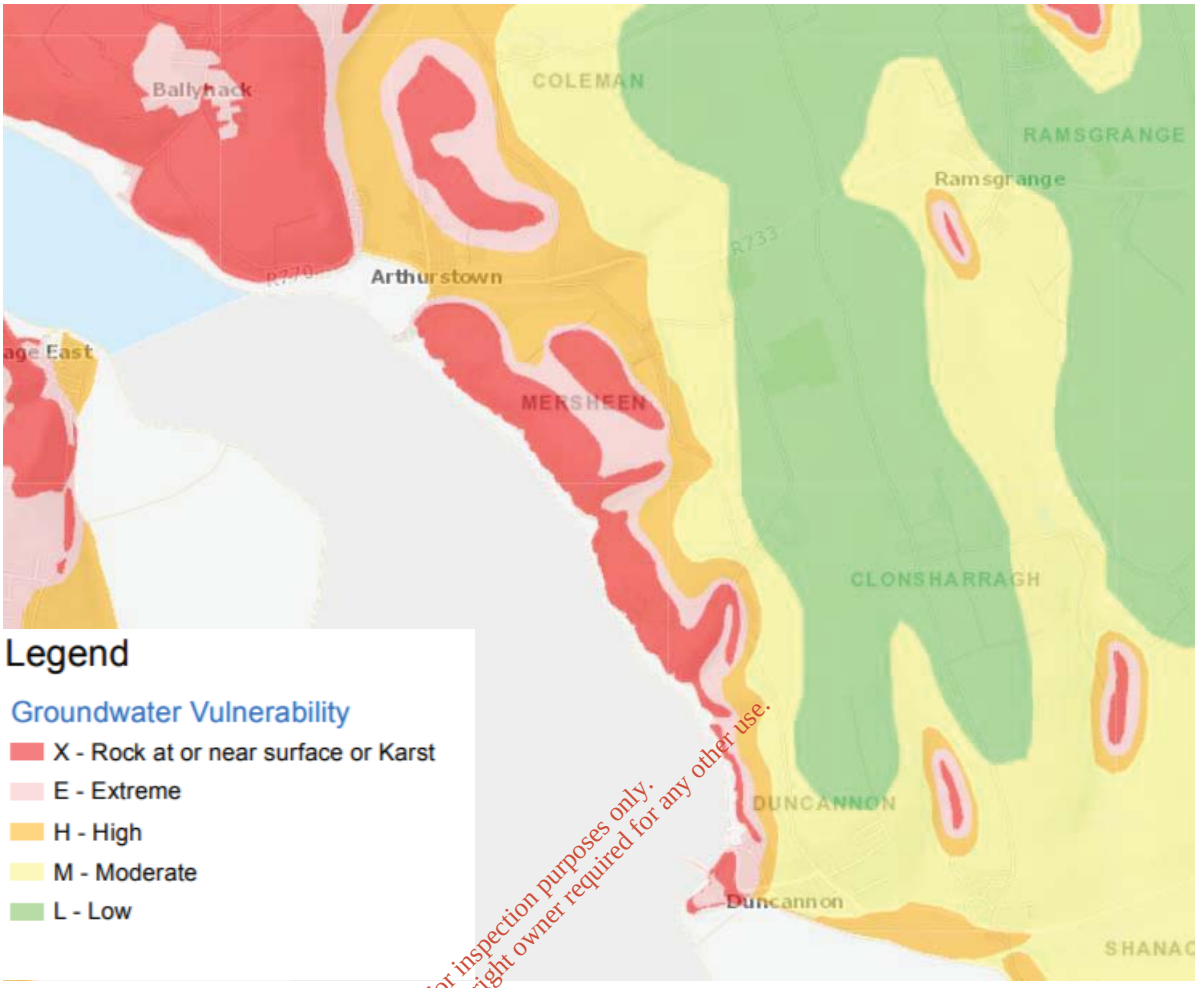


Figure 7.4 Aquifers (EPA)

Water Resources

Consultation of the national well database compiled by the GSI (www.gsi.ie) indicates that the closest well to the proposed development sites is located approximately 1.4km east of Arthurstown in the townland of Ramsgrange. The well (GSI Code: 2611SWW201) is classed as a borehole 5.5m deep and used for agricultural and domestic use.

7.3.3 Local Hydrology

Consultation with the national catchments data[5] shows that the site lies wholly within the main catchment of the Ballyteige-Bannow and the Curraghmore 13_010 river sub-basin. This catchment includes the area drained by all streams entering tidal water between Greenore Point and Railway Bridge, Great Island, Co. Wexford, draining a total area of 654km². There are no large urban centres in the catchment. The only urban centres in this catchment are Lady's Island, Kilmore Quay, Bridgetown, Wellingtonbridge, Duncannon, and Campile. The total population of the catchment is

[5] https://www.catchments.ie/data/#/catchment/13?_k=hzw4pd

approximately 26,593 with a population density of 41 people per km². The catchment has an undulating topography and is underlain by a series of volcanic and metamorphic rocks.

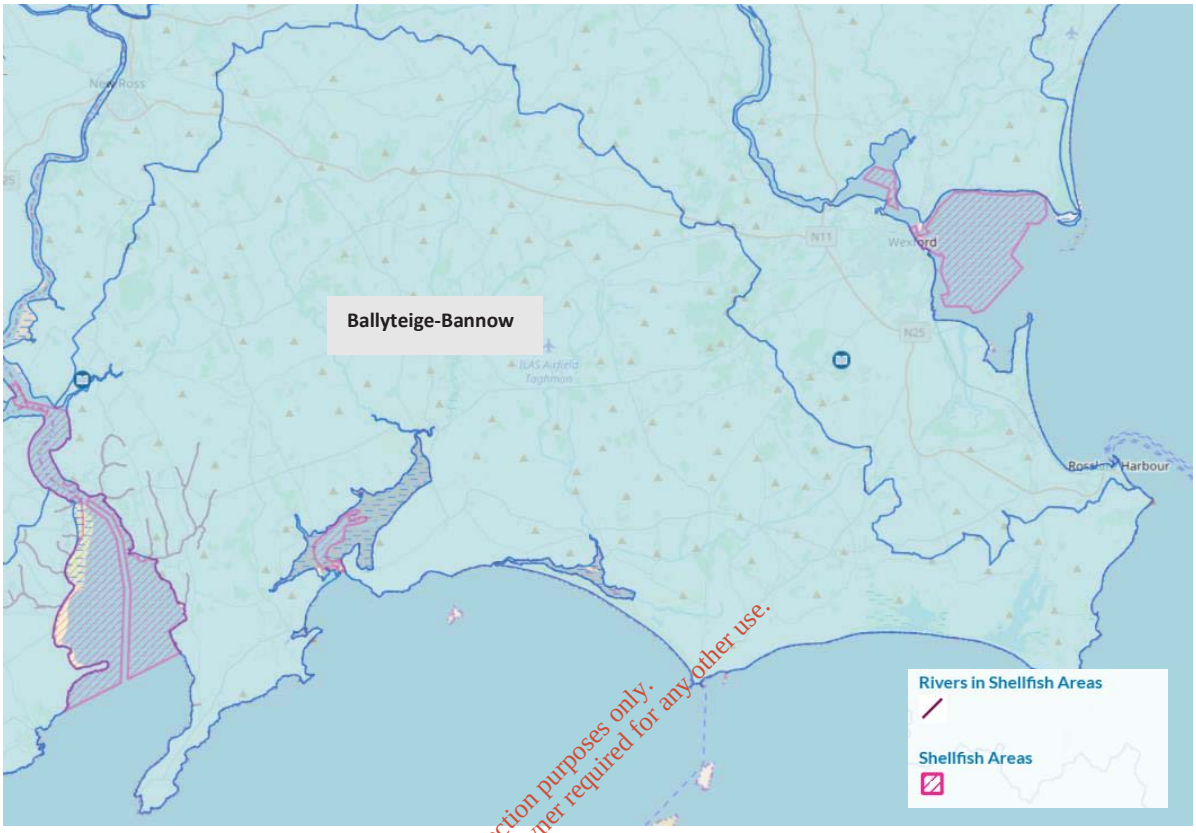


Figure 7.5 River catchments

7.3.4 Flooding

From a review of the OPW flood maps[6], there is a high probability of flooding of flooding in the estuary to just south of Ballyhack. There is no probability of flooding at Arthurstown or Duncannon. This is shown graphically in Figure 7.6.

[6] http://www.floodinfo.ie/map/floodmaps/

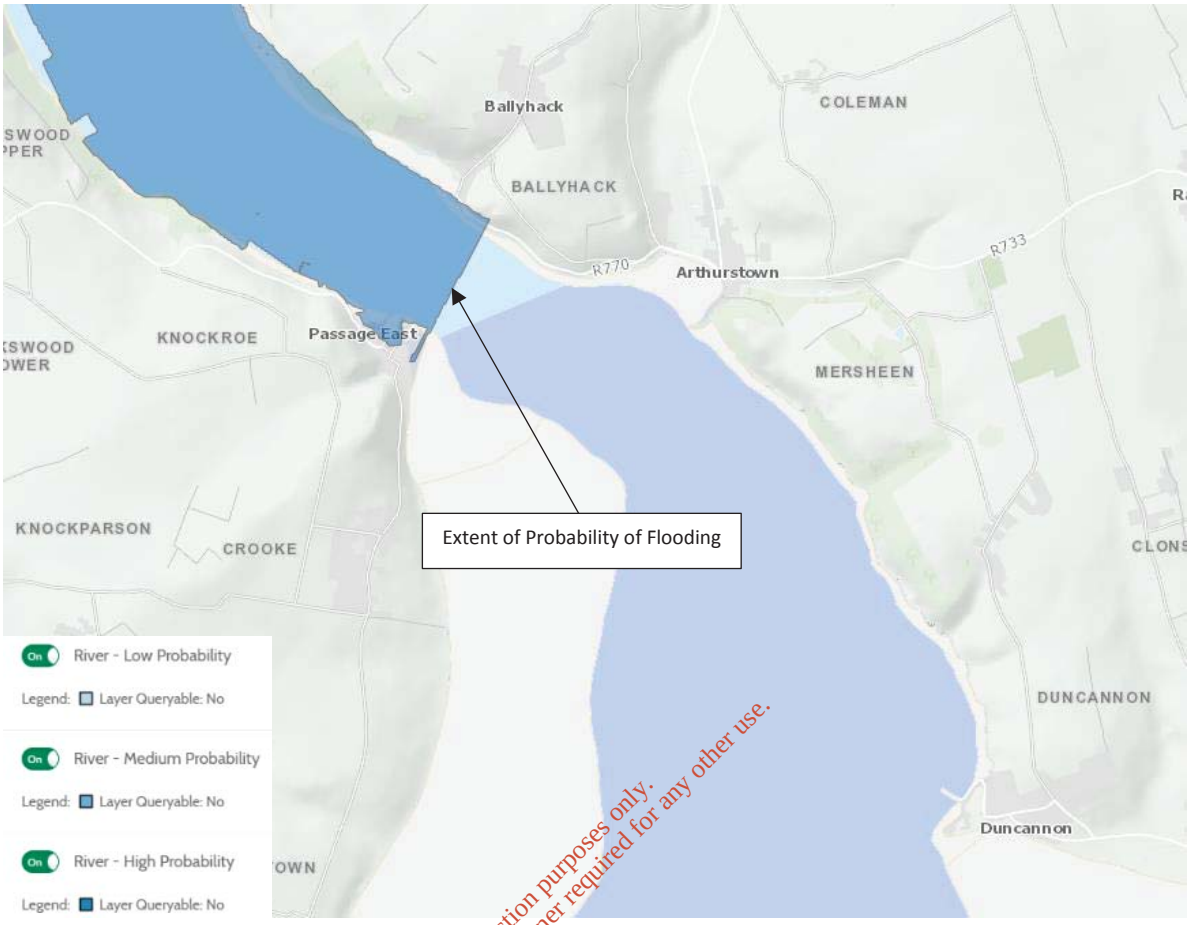


Figure 7.6 Flood Extent

7.3.5 WFD Status

The EPA[7] classifies the Barrow Nore Suir Estuary as a Transitional Waterbody and measures the levels of pollutants. The most recent water quality status report shows the following:

- The overall status of the waterbody is 'Good'.
- Its biological status is 'Good'.
- Chemical status of 'Good'.
- Hydromorphological status of 'High'.
- Nutrient conditions are classed as 'Moderate'.
- Phytoplankton status is 'Good'.
- Supporting Chemistry conditions are classed as 'Good'.

Table 7.1 shows the status of the waterbody in terms of its status with regard to a number of pollutants.

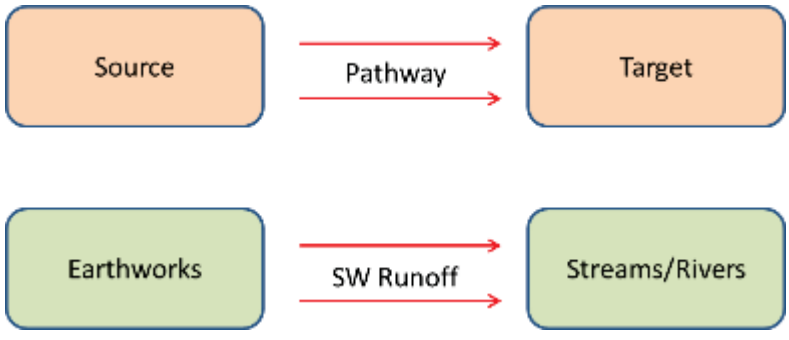
[7] https://gis.epa.ie/EPAMaps/

Table 7.1 WFD Status of the Barrow Nore Suir Estuary

European Code	Concentrations
Name	Barrow Nore Suir Estuary
Status	Good
Period for WFD Status	SW 2010-2015
Bio Status	Good
Chemical SW Status	Good
Dissolved Oxygen	High
Fish Status	Good
General Conditions	Good
Hydromorphological Conditions	High
Nutrient Conditions	Moderate
Other Nutrient Conditions	Moderate
Other Oxygenation Conditions	High
Oxygenation Conditions	High
Phytoplankton Status	Good
Specific Pollutant Conditions	Pass
Supporting Chemistry Conditions	Good

7.4 POTENTIAL IMPACTS OF THE DEVELOPMENT

The conventional source-pathway-target model (see below, top) was applied to assess potential impacts on downstream environmental receptors as a result of the proposed Arthurstown development.



7.4.1 Likely Construction Impacts and Mitigation Measures

The likely impacts of the proposed development and mitigation measures that will be put in place to eliminate or reduce them are outlined as follows:

Changes to Site Runoff Volumes

Sensitive Receptors

Sensitive receptors in this case include the Coleman Stream located near the entrance to the proposed WwTP in Mersheen Townland, Arthurstown and the public road at the site entrance.

Potential Impacts

It is a recognised development requirement that surface-water needs to be controlled to the pre-development runoff rate. This prevents any increase in runoff and minimises any increased flooding risk downstream on the Coleman Stream or on the public road at the site entrance.

The proposed WwTP is on land used for agricultural purposes. The access road and hardstanding around the WwTP will be constructed from aggregate and will not be surfaced with bitumen materials. A large portion of the road and hardstanding will be of single sized stone, therefore, the pore spacing will permit infiltration.

The WwPS's will be constructed on existing hardstand areas and so will not increase runoff. Rising mains will be mostly constructed under existing hardstanding areas and so will not increase runoff in these areas. The pipeline to be constructed will be underground will not lead to an increased level of runoff. Where rising mains are laid in fields, the natural habitat will be returned to its original state and runoff will not be altered.

Mitigation Measures

There will be approximately 300m of new access road constructed to access the proposed WwTP site. The road will be approximately 3.5m wide and will be finished with bitumen surface. So that any water runoff from the road is attenuated during construction, a swale will be constructed on the downslope side of the road. This will attenuate runoff during construction and allow the present greenfield runoff rate to be maintained on site.

Earthworks (removal of vegetation cover, excavations) resulting in suspended solids entrainment in surface waters)

Sensitive Receptors

Sensitive receptors in this case include the Coleman Stream, the Ballyhack 13 River and the Barrow, Nore, Suir Estuary which is a designated SAC and a shellfish water. The River Barrow and River Nore SAC is designated for a number of species namely, Desmoulin's Whorl Snail; Freshwater Pearl Mussel, White Clawed Crayfish, Sea, Brook and River Lamprey, Twaite Shad, Salmon, otter, Killarney Fern and Nore Pearl Mussel (refer to the NIS for the scheme for further information).

Potential Impacts

Construction phase activities, including access road construction and trenching for the rising mains, will require earthworks resulting in removal of vegetation cover and excavation of mineral soils. Potential sources of sediment laden water include:

- Drainage and seepage water resulting from WwTP, access road and pipeline trench excavations; and
- Side cast excavated material providing a point source of exposed sediment.

These activities can result in the release of suspended solids to surface watercourses, in this case the Coleman Stream and the Ballyhack 13 River. This could result in an increase in the suspended sediment load, resulting in increased turbidity which in turn could affect the water quality and fish stocks of Barrow, Nore, Suir Estuary. However, given the dilution capacity of the estuary and the scale of the works, this is unlikely to be a significant impact.

Mitigation Measures

As stipulated in the Contract Documents, a Construction Environmental Management Plan (CEMP) will be produced by the appointed contractor to outline best practice construction methods to minimise impacts on water quality. Controlling potential pollution sources by using small working areas, placing side cast material on upstream side of trench, covering side cast materials during wet periods and cessation of excavations during prolonged wet periods, will reduce the potential for sedimentation to occur. Where feasible, trenches will be excavated during dry periods and side cast materials will be stored appropriately prior to being reinstated. All construction workers will be given a toolbox talk addressing the environmental aspects prior to commencement of construction.

Silt fences will be emplaced at appropriate locations down-gradient of all construction areas where there is a risk of sediment release to a watercourse, i.e. between construction areas and the watercourse crossings. Silt fences are effective at removing heavy settleable solids. These will act to prevent the entry of sand and gravel sized sediment, released from excavation of mineral soils, and entrained in surface water runoff, into the drainage canal. Inspection and maintenance of these silt fences during the construction phase is critical to their functioning to their stated purpose. They will remain in place throughout the entire construction phase.

Potential Release of Hydrocarbons during Construction and Storage

Sensitive Receptors

Sensitive receptors in the area include the Coleman Stream near the WwTP and the Barrow, Nore, Suir Estuary which is an SAC and a designated shellfish area.

Potential Impacts

Accidental spillages from refuelling of construction plant with petroleum hydrocarbons is a significant pollution risk to groundwater, surface water and associated ecosystems, and to terrestrial ecology.

The accumulation of small spills of fuels and lubricants during routine plant use can also be a pollution risk. Hydrocarbon has a high toxicity to humans, and all flora and fauna, including fish, and is persistent in the environment. It is also a nutrient supply for adapted micro-organisms, which can rapidly deplete dissolved oxygen in waters, resulting in death of aquatic organisms. This is particularly important given the proximity of the SAC and designated shellfish area. However, given the scale of the works and the dilution potential of the estuary waters, this is not anticipated to be a potentially significant impact, due to the relative scale of the works proposed.

Mitigation Measures

On-site refuelling will take place at a specific designated refuelling area, likely to be located in the Contractor's Temporary Compound in the field where the WwTP is to be constructed. This refuelling area will be bunded appropriately for the volume of fuel usage for the time period of the construction and fitted with an appropriate oil interceptor.

Fuel storage on-site should be minimised. Should temporary storage of any fuel, oil or chemicals be required on site during construction, this storage area will be bunded appropriately for the fuel storage volume for the duration of construction and fitted with a storm drainage system and an appropriate oil interceptor.

The machinery and plant used will be regularly inspected for leaks and will be fit for purpose.

An emergency plan for the construction phase to deal with any accidental spillages will be produced by the appointed contractor. Spill kits will be available to deal with accidental spillage, both inside and outside the designated refuelling area. Drip trays will be used to collect leaks from fuel pumps or from standing plant.

Groundwater & Surface Water Contamination from Wastewater Disposal

Sensitive Receptors

Receptors potentially affected by wastewater disposal are the Coleman Stream, the Barrow, Nore, Suir Estuary which is an SAC and a designated shellfish area and the underlying aquifer.

Potential Impacts

Toilet facilities will be installed at the WwTP for the permanent works. Release of effluent from on-site temporary wastewater treatment systems will have the potential to impact on groundwater and surface waters. Though in reality any potential release would be minor in nature and given the dilution capacity of the estuary, any impact would not be significant.

Mitigation Measures

A self-contained portable toilet, located in the Contractor's Temporary Compound, with an integrated waste holding tank will be used, maintained by the providing contractor, and removed from site on completion of the construction works or as required.

Water supply for the site office and other sanitation will be brought to site and removed from the site after use to be discharged at a suitable off-site treatment location/wastewater facility.

No water will be sourced on the site and no wastewater will be discharged at the site during construction.

Release of Cement Based Products

Sensitive Receptors

Sensitive receptors are the Coleman Stream, the Ballyhack 13 River and the Barrow, Nore, Suir Estuary which is an SAC and a designated shellfish area.

Potential Impacts

Concrete and other cement-based products are highly alkaline and corrosive and can have significant negative impacts on water quality if released into watercourses. They generate very fine, highly alkaline silt (pH 11.5) that can physically damage fish by burning their skin and blocking their gills. A pH range of ≥ 6 ≤ 9 is set in S.I. No. 293 of 1988 Quality of Salmonid Water Regulations, with artificial variations not in excess of ± 0.5 of a pH unit. Entry of cement-based products into surface water runoff, and hence to surface watercourses or directly into watercourses represents a risk to the aquatic environment, particularly given the proximity of the SAC. Batching of wet concrete for the WwTP, WwPS's foundations and wash out of transport and placement of machinery are the activities most likely to generate a risk of cement-based pollution.

Mitigation Measures

No batching of wet-cement products will occur on-site. Concrete delivery will be via Ready-mixed supply and where possible, emplacement of pre-cast elements will take place.

No washing out of any plant used in concrete transport or concreting operations will be allowed on-site.

Where concrete is delivered to site, only the chute needs be cleaned, using the smallest volume of water possible. This will be carried out in a designated concrete washout area to be located at the Contractor's Temporary Compound. No discharge of cement contaminated waters will be permitted on-site or directly to any artificial drain or watercourse. Chute cleaning water is to be tanked and removed from the site to a suitable, non-polluting, discharge location.

Where feasible, the weather forecast will be followed so that concrete pours will take place on dry days.

Provide that the concrete pour site is free of standing water and have plastic covers available in case of a sudden rainfall event.

A minimum 10m wide buffer zone (5m for drainage ditches) will be emplaced on any drainage ditches for the duration of the construction phase and no in-stream works will be permitted.

7.4.2 Rising and Gravity Mains

For the proposed rising main works, the following measures will be observed:

- A working wayleave of 3m will be maintained along the existing roadway.
- No instream works will be permitted.
- Trenching works shall not take place at periods of high rainfall and shall be scaled back or suspended if heavy rain forecast.
- Plant will travel slowly across bare ground at a maximum of 5km/hr. If wheel rutting is observed, then bog mats or rolling road will be employed where required.
- Silt fencing will be erected between works areas and watercourse crossings.
- Any excess construction material shall be removed from the works areas and disposed of in a fully licensed landfill.
- No re-fuelling of machinery will take place within 50 metres of any watercourse.
- Machinery will be checked and cleaned before going on site to prevent any introduction of alien invasive plant species (e.g. Japanese knotweed) to the site.
- All construction workers will be given a toolbox talk addressing the environmental topics especially those concerning the QI of the SACs prior to commencement of construction.
- Where plant is required to track across vegetated areas, a 4m wide access corridor will be marked with timber posts and all plant and machinery will remain within this to reduce impacts on vegetation and habitats.
- Locally excavated material will be reinstated immediately following construction to allow recovery of any potential groundwater level change as quickly as possible.
- Temporary stockpiles will be restricted to less than 2m in height. Stockpiles will be located as far as possible from drainage ditches, mature trees, hedgerows and surface water drains.
- Re-fuelling of construction equipment and the addition of hydraulic oil or lubricants to vehicles/equipment will take place in designated bunded areas within the main construction compound located on the WwTP site where possible, and not along the pipeline routes.
- If it is not possible to bring machinery to the refuelling point, fuel will be delivered in a double-skinned mobile fuel bowser.

- A drip tray will be used beneath the fill point during refuelling operations in order to contain any spillages that may occur.

For on-site sanitation, the following measures will be employed:

i) A self-contained port-a-loo with an integrated waste holding tank will be used, maintained by the providing contractor, and removed from site on completion of the construction works.

ii) Water supply for the site office and other sanitation will be brought to site and removed after use from the site to be discharged at a suitable off-site treatment location.

iii) No water will be sourced on site or discharged to the site.

7.4.3 Operational and Cumulative Impacts

Currently, there is a Wastewater Discharge Licence (WWDL) for the Duncannon agglomeration and discharge certificates for Arthurstown and Ballyhack agglomerations. The proposed development will be subject to a WWDL via an application to the EPA.

The operation of the proposed development will lead to improved water quality in the estuary by providing secondary treatment to wastewater which is currently discharged untreated from the Ballyhack/Arthurstown/Duncannon agglomerations.

Water Quality

Sensitive Receptors

The treated wastewater from the proposed WwTP at Arthurstown will discharge into Waterford Harbour which is part of the River Barrow and River Nore Estuary which is a designated SAC and a designated shellfish area. There is a Bathing Water Area south of Duncannon which has 'Good Water Quality' currently.

Potential Impacts

There is a potential impact from combining the three separate discharges at Arthurstown, Ballyhack and Duncannon into a single treated discharge at Arthurstown. The combined p.e. is estimated at 1875. Table 7.2 shows the predicted 10-year summer loadings from the Arthurstown outfall after wastewater from the agglomerations has been combined to the secondary treatment plant. The reductions applied to Biological Oxygen Demand (BOD) and Suspended Solids (SS) of 90% were obtained from the UWWTD definition of secondary treatment and have been specified for the works. The reductions applied to Total Nitrogen (TN) and Total Phosphorus (TP) of 20% are typical for wastewater treatment plants are equivalent to the reductions applied in the Water Quality Report carried out by Limnos Consultancy which is contained in Appendix D. For comparison purposes the predicted 10-year summer loadings of the three individual outfalls at Ballyhack, Arthurstown and Duncannon under a 'no treatment' scenario are also shown. This represents what would be discharged at each of the outfalls if treatment was not provided.

Table 7.2 shows that the combined discharge at Arthurstown will have a lower Biological Oxygen BOD and SS content than an untreated discharge of wastewater generated in the Arthurstown agglomeration only.

Table 7.2 shows that the combined discharge will have higher TN and TP content than an untreated discharge of wastewater generated in the Arthurstown agglomeration only. A Water Quality Report was carried out by Limnos Consultancy that examined the effect of the TN and TP at the Arthurstown discharge, this report is contained in Appendix D. The Limnos report was based on a discharge with just primary treatment however the same reductions in TN and TP apply to secondary treatment also. The PE used in the Limnos report was 1865, whereas current calculations set the 10-year PE at 1875; this variation of 0.5% is considered insignificant.

Table 5 of the Limnos report shows that status quo of the summer TN concentration in the estuary 0.3500mg/l, adding the Arthurstown discharge the predicted TN concentration is 0.3502mg/l; this equates to an increase of just 0.057% which is considered insignificant. Table 5 shows that there would be no discernible increase in TP levels. The Limnos report also modelled Chlorophyll levels and found that there would be no discernible increase in these either.

Table 7.2 shows that the combined discharge would yield 6,899kg TN and 821kg TP per year but that the existing untreated discharges that yield a total of 8623kg TN and 1027kg TP would be removed. The Limnos Report shows that the total N and P loadings to the estuary from other sources was estimated to be 16,000 tonnes N and over 200 tonnes P per year. The report concludes *'The model suggests that proposed discharge is unlikely to have any impact on the existing WFD ecological status of the Barrow Nore Suir Estuary.'*

Regarding the Duncannon Bathing Water, the bathing water area is located close to the current outfall at Duncannon and the proposed outfall will be at Arthurstown further north such that dilution will be increased and will provide increased levels of treatment for the wastewater discharge. Table 7.2 shows that the proposed discharge at Arthurstown will have significantly lower BOD and SS content that the current discharge at Duncannon. Table 7.2 also shows that the proposed discharge will have lower TN and TP content than the sum of the existing TN and TP discharges from Duncannon and Arthurstown. Hence the improved water quality of the discharge and the increased dilution will have a positive effect on the quality of the bathing water.

Table 7.2: Design Discharges for Arthurstown, Ballyhack & Duncannon

10-year summer loadings	Biological Oxygen Demand (BOD)	Suspended Solids (SS)	Total Nitrogen (TN)	Total Phosphorus (TP)
	kg/year	kg/year	kg/year	kg/year
Total of three untreated discharges	41062.5	47906.3	8623.1	1026.6
Ballyhack untreated	5891.1	6873.0	1237.1	147.3
Arthurstown untreated	8935.2	10424.4	1876.4	223.4
Duncannon untreated	26236.2	30608.9	5509.6	655.9
Proposed combined discharge after secondary treatment	4106.3	4790.6	6898.5	821.3

Mitigation Measures

The proposed development will be subject to a WWDL via an application to the EPA. The application will be made on the basis of a new WwTP providing secondary treatment. This is in accordance with the Urban Wastewater Treatment Directive (UWWTD) which states that an agglomeration with a PE of 2,000 to 10,000 discharging into an estuary is required to have secondary treatment. The existing and future PEs for the agglomeration are outlined in Section 2, Table 2.1.

The proposed development will be designed to comply with the concentrations outlined in Table 7.3 which is in line with Articles 4 and 5 of the UWWTD.

Table 7.3: Design Discharges for Arthurstown, Ballyhack & Duncannon

Parameters	Concentrations	Minimum Percentage Reduction	Reference Method of Measurement
Biochemical oxygen demand (BOD5 at 20^0 C) without nitrification	25mg/l O_2	70-90 40 under Article 4 (2)	Homogenised, unfiltered, undecanted sample. Determination of dissolved oxygen before and after 5-day incubation at 20 ^{0}C+/-1 ^{0} C, in complete darkness. Addition of a nitrification inhibitor.
Chemical Oxygen Demand (COD)	125mg/l O_2	75	Homogenised, unfiltered, undecanted sample Potassium dichromate.
Total Suspended Solids	35mg/l 35 under Article 4 (2) (more than 10,000 p.e.)	90 90 under Article 4 (2) (more than 10,000 p.e.)	- Filtering of a representative sample through a 0,45 µm filter membrane. Drying at 105 ^{0} C and weighing. - Centrifuging of a representative sample (for at

	60 under Article 4 (2) (2,000-10,000 p.e.)	70 under Article 4 (2) (2,000-10,000 p.e.)	least five minutes with mean acceleration of 2,800 to 3,200 g), drying at 105 ^{0} C and weighing.

7.5 CONCLUSION

Provided the mitigation measures outlined in above are fully implemented, it is likely that the proposed development will have a significantly positive impact on the water quality of the receiving surface water. The works is not expected to have any significant impact on groundwater quality in the area during construction and/or operation.

8 AIR & ODOUR

8.1 INTRODUCTION

Background

This chapter outlines the assessment of potential effects of the proposed Ballyhack/Arthurstown/Duncannon agglomerations development upon air quality. Air quality effects could potentially be derived during construction from plant and machinery and during operation from the processes at the WwTP infrastructure which will take the form of odours experienced at receptors in the local area.

Relevant Legislation & Odour Criteria

The proposed development of a new WwTP and associated infrastructure will be required to comply with the legislative requirements of the S.I. No. 787 of 2005 – The European Communities (Waste Water Treatment) (Prevention of Odours & Noise) Regulations. This Statutory Instrument requires that any waste water treatment plant is operated and maintained so that it avoids causing a nuisance through odours or noise.

An odour unit is a measure of the concentration of a mixture of odorous compounds. It is determined by means of olfactometry. Odour unit values are determined by a standard method given in BS EN13725; 2003 on olfactometry. An odour unit as defined by the standard is 1 European odour unit (1 ou/m^3). The limit of detection of an odour by an average human nose is 1 ou/m^3.

For many WwTPs in Ireland, odour dispersion modelling results have been compared against an odour annoyance criterion whereby no critical receptor shall be exposed to a concentration of more than 5 ou_E/m^3 (as a 98th percentile of maximum 1 hour odour concentrations). The current UK Environmental Permitting Regulations (EPR) regime, defined in the Environment Agency's (2011) H4 Odour Management guidance document, applies a set of benchmark odour criteria for the most offensive (1.5 ouE./m^3), moderately offensive (3.0 ouE./m^3) and least offensive (6.0 ouE./m^3) sources of odours. Guidance is provided within the H4 document to help an assessor classify the appropriate benchmark criteria, see Table 8.1. The key considerations include:

- Examples of the most stringent odour benchmarks relate to processes that involve decaying animal or fish remains, involving septic effluent or sludge and biological landfill odours;
- Any odours, which do not obviously fall into the more offensive or less offensive categories are regulated under the moderately offensive category;
- Ranking is based on the odour not the activity;
- Ranking is based on the unmodified odour and the character or offensiveness may be changed by changing the hedonic score, e.g. treating the odour stream, or the odour character may change with distance;

- Ranking may be different for odours from different parts of the process; and
- Benchmarks may be influenced by local factors. “For example, if the local population has already become sensitised, it may be prudent to reduce the benchmark by say 0.5.”

The guidance allows limits to be set based on the offensiveness of the odour and allows adjustments for local factors such as proximity to sensitive receptors and population density. A summary of the indicative limit criteria for various industrial sectors is given in Table 8.1.

Table 8.1: Indicative Odour Criteria for Various Industrial Sectors

Industrial Sectors	Relative Offensiveness of Odour	Indicative Criterion
Processes involving decaying animal or fish remains Processes involving septic effluent or sludge Biological landfill odours	Most offensive	1.5 ou_E/m^3 as a 98th percentile of hourly averages at the worst-case sensitive receptor
Intensive livestock rearing Sugar beet processing Fat frying (food processing) Well aerated green waste composting	Moderately offensive	3.0 ou_E/m^3 as a 98th percentile of hourly averages at the worst-case sensitive receptor
Brewery, confectionery, coffee roasting, bakery	Less offensive	6.0 ou_E/m^3 as a 98th percentile of hourly averages at the worst-case sensitive receptor

For this scheme odour values of 2 ou/m^3 will be regarded as a slight odour and values of 5 ou/m^3 indicate a recognisable odour level likely to result in a complaint.

8.2 METHODOLOGY

Emission Rate

The rate of production of a pollutant emission is best quantified as an emission rate. For a chimney or vent, this is equivalent to the odour concentration (ou_E/m^3) multiplied by the air flow rate (m^3/s). It is the mass of odorous pollutant emitted from a source per second and is expressed in ou_E/s. For an area source such as the settlement, aeration and storm tanks, etc., this is the mass of odorous pollutant emitted per m^2 of surface area per unit time (ou_E/m^2/second).

The proposed tanks and processes on the site have the potential to be significant odour sources depending on the effectiveness of the operations at the proposed WwTP. At design stage, the Contractor will undertake a baseline odour assessment desk study to determine if dispersion modelling is required. Mitigation measures will be implemented if results show an odour nuisance at sensitive receptors.

It will the responsibility of the appointed Contractor to design and provide effective odour treatment systems so that unacceptable levels of odour from wastewater and sludge treatment are not released and levels of gas concentrations in personnel spaces are below occupational exposure limits as per the COSHH Regulations 2005 and Health & Safety Note EH40/2005.

Irish Water have requirements for the project in terms of odour that the appointed contractor must adhere to. These are as follows:

- At the WwTP and WwPSs site boundaries, emissions levels will not exceed 5 ou/m^3 on a 98th percentile one hourly average basis.
- At the nearest receptors, odour emissions levels will not exceed 2 ou/m^3 on a 98th percentile one hourly average basis as a result only of emissions from the WwTP, WwPSs or rising main discharge vent.

8.3 RECEIVING ENVIRONMENT

Receptors in the area of the proposed WwTP are dispersed in nature. The main population centre of Arthurstown village is located approximately 400m to the west-southwest of the proposed WwTP. Receptors in Arthurstown village are likely to be less affected due to the prevailing winds being from a south-westerly direction. Receptors in the area are as follows:

- The closest house to the proposed WwTP is located approximately 111m to the north and Dunbrody House is approximately 290m to the northeast. The closest house in Arthurstown village itself is approximately 250m from the WwTP boundary to the northwest. Receptors in the vicinity of the WwTP are shown on Figure 8.1 and Drawing No. UTWE-AEC-ART-DR-CE-1050 in Appendix A.
- The closest receptor to the WwPS at Ballyhack is a row of houses approximately 13m to the east and a bar and shop approximately 14m to the east. These are shown on Figure 8.2 and Drawing No. UTWE-AEC-ART-DR-CE-1053 in Appendix A.
- The closest receptor to the Duncannon WwPS is located approximately 16m to the east. This is shown on Figure 8.3 and Drawing No. UTWE-AEC-ART-DR-CE-1051 in Appendix A.
- The closest sensitive receptor to the Arthurstown WwPS is located approximately 21 to the east. This is shown on Figure 8.4 and on Drawing No. UTWE-AEC-ART-DR-CE-1052 in Appendix A.
- There are numerous receptors along the routes of the proposed Rising Mains and Gravity Pipelines.

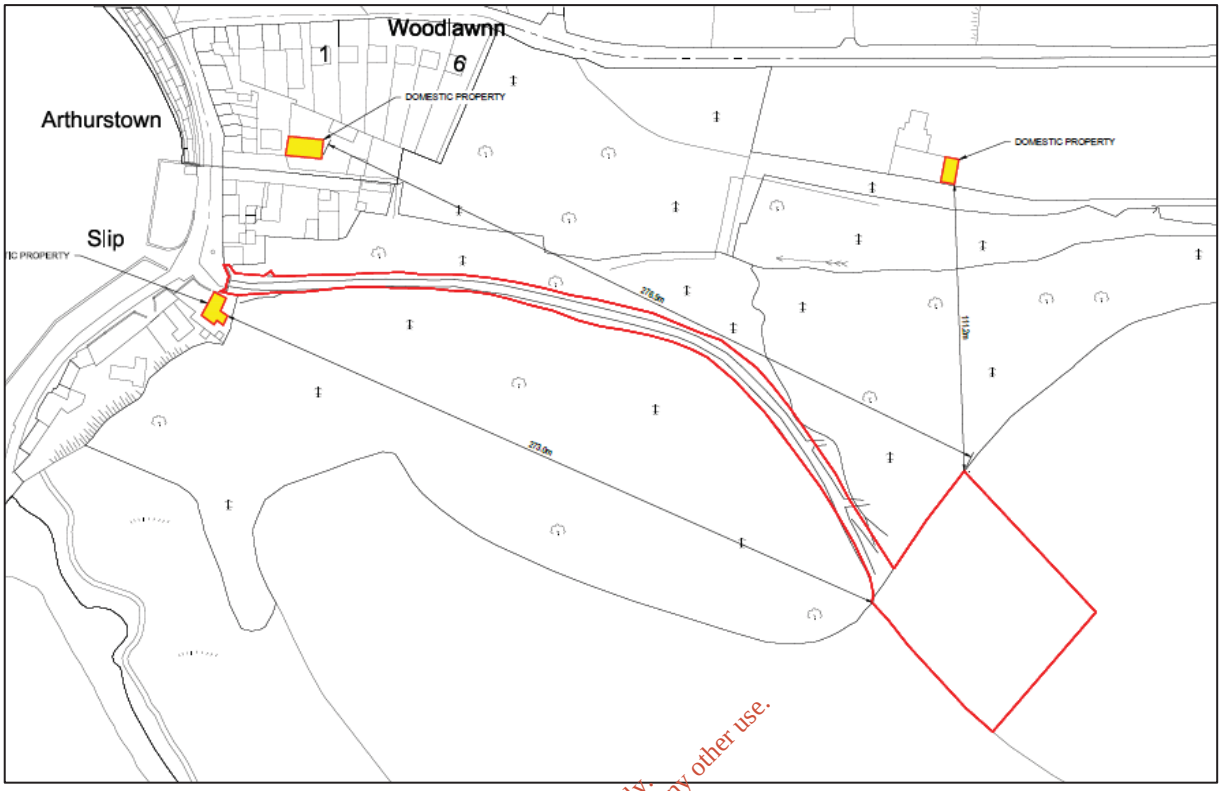


Figure 8.1 – Receptors in the WwTP Area

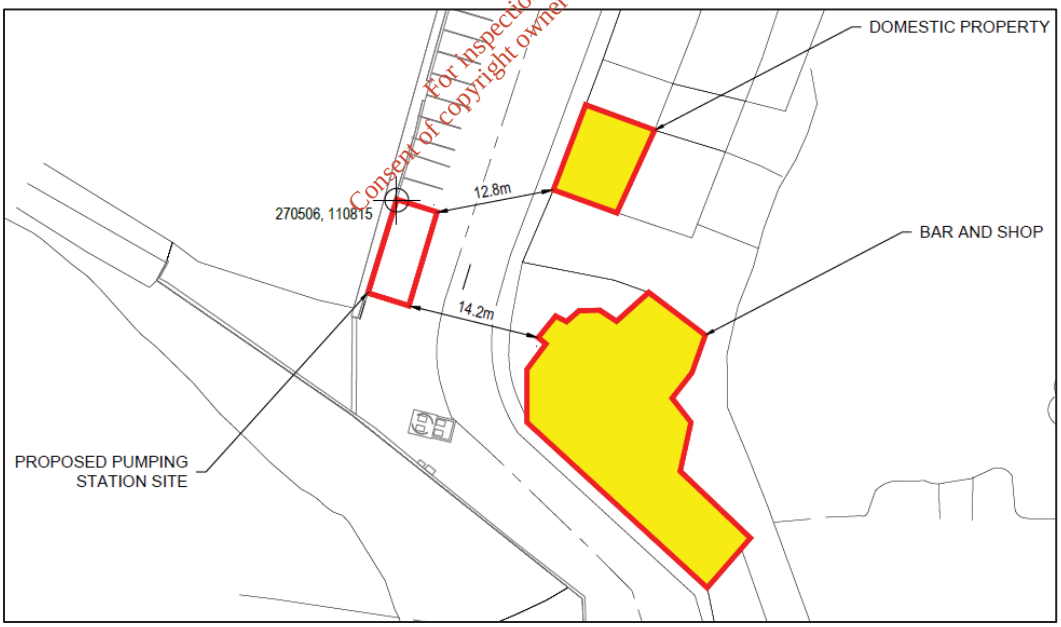


Figure 8.2 – Receptors at the Ballyhack WwPS

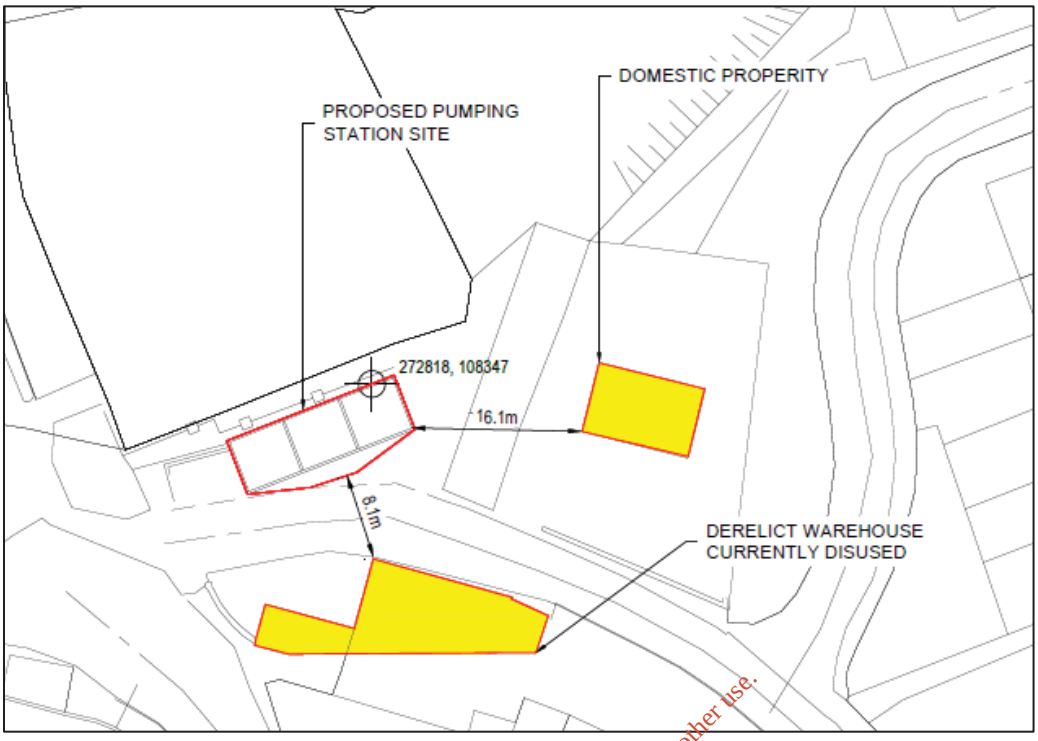


Figure 8.3 – Receptors at the Duncannon WwPS

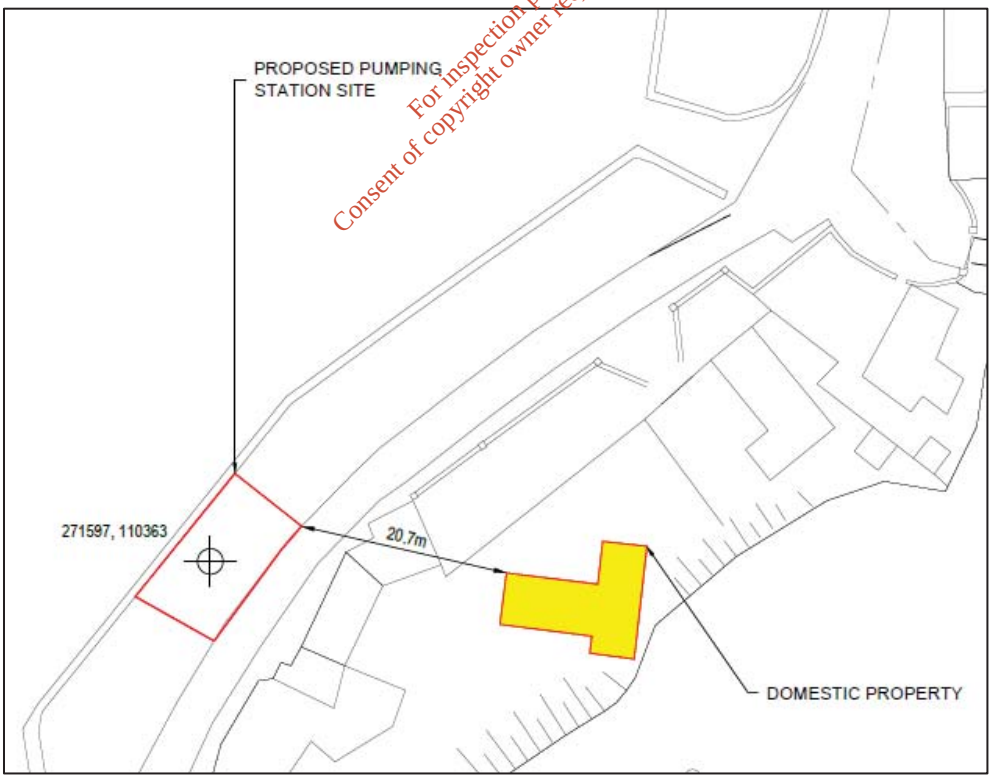


Figure 8.4 – Receptors at the Arthurstown WwPS

8.4 POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT

Construction Phase

A primary source of emissions to air from construction-phase activities is considered to be fugitive dust generation and release, arising during site clearance, the importation of construction materials and the actual construction works. The construction phase will generate vehicle movements during the import and export of construction materials. Construction phase traffic will include HGV movements and other construction plant. Significant dust impacts due to construction dust emissions are unlikely during the construction phase due to the relatively small scale of the proposed development. Significantly adverse dust impacts are more likely to occur where a sensitive receptor is located close to a dust generating activity for prolonged periods of time and where effective mitigation measures are not implemented. Construction dust could potentially cause temporary local impacts via nuisance at houses in proximity to the works. Excavation, earth moving and backfilling have the potential to generate dust, especially in dry and windy weather conditions. Dust could potentially be deposited within 200m of the site. However, the majority of dust deposition occurs within the first 50m. The extent of dust generation depends on the type of dust (soils, peat, sand, gravel, silts) and on local climatic factors, rainfall, wind speed and direction. There will be numerous sensitive residential and commercial receptors in proximity to the proposed pipeline routes.

Table 8.2: Typical Dust Dispersion[8].

Source		Potential Distance for Significant Effects		
Scale	**Description**	**Soiling**	**PM_{10}**	**Vegetation Effects**
Major	Large construction sites, with high use of haul roads	100m	25m	25m
Moderate	Moderate sized construction sites, with moderate use of haul roads	50m	15m	15m
Minor	Minor construction sites, with limited use of haul roads	25m	10m	10m

[8] Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes - Transport Infrastructure Ireland (2011)

Operational Phase

It is possible there will be some odour nuisance during operation of the proposed WwTP at sensitive residential receptors in the area, without mitigation measures. However, the closest sensitive receptor to the WwTP is located c.116m away as identified in Section 8.3.

At design stage, the Contractor will undertake a baseline odour assessment desk study to determine if dispersion modelling is required. Mitigation measures will be implemented if results show an odour nuisance at sensitive receptors. Mitigation measures (if needed) will be implemented so that the odour limits outlined in Section 8.1.

As a minimum, to mitigate the risk of odour from the site the sludge pumping stations and sludge storage tank will be covered and provided with odour control to reduce the potential level of odours emanating from the site. Further odour control measures will be installed by the contractor as required to limit odours to the specified levels.

The WwPSs will consist of a single chamber designed to accommodate the working volume of the pump and emergency storage requirements. They will contain a static screen to a storm overflow. They will contain 2 no. submersible foul pumps (duty and standby). It is proposed to mitigate the risk of odour by fitting all pumping stations with cover slabs and installing odour control on vents.

The rising mains are relatively short in length and have been assessed as posing no issues with septicity. Air vents on rising mains will be fitted with odour control measures.

8.5 MITIGATION MEASURES

Construction Phase Mitigation

It is recommended that a dust minimisation plan be formulated for the construction phase of the project, as construction activities are likely to generate dust emissions. The potential for dust to be emitted depends on the type of construction activity being carried out in conjunction with environmental factors including levels of rainfall, wind speeds and wind direction. The potential for impact from dust also depends on the distance to potentially sensitive locations and whether the wind can carry the dust to these locations. The majority of any dust produced will be deposited close to the source and any impacts from dust deposition will typically be within one hundred metres of the construction area.

The implementation of a dust minimisation plan during the construction phase of the project will include measures such as:

- Appropriate hard surface roads will be swept to remove mud and aggregate materials from their surface while any unsurfaced roads should be restricted to essential site traffic only.

- Any site roads with the potential to give rise to dust will be regularly 'dampened down', as appropriate, during dry and/or windy conditions (also applies to vehicles removing or delivering material with dust potential to and from the site).

- Public roads outside the site WwTP and WwPS sites will be regularly inspected for cleanliness and cleaned as necessary.

- Public roads along which rising mains are to be laid will be inspected and cleaned as needed on a regular basis.

- Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind.

- Water misting or sprays will be used as required if particularly dusty activities are being carried out or are necessary during dry or windy periods.

- All vehicles which present a risk of spillage of materials, while either delivering or removing materials, will be loaded in such a way as to prevent spillage on to the public roads.

At all times, these procedures will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movements of materials likely to raise dust will be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations.

Operational Phase Mitigation

The appointed Contractor will be required to conduct a desktop baseline odour assessment to determine if air dispersion modelling is required. Mitigation measures will be implemented if the desktop study and/or dispersion modelling (if required) results show an odour nuisance at sensitive receptors. Mitigation measures (if needed) will be implemented so that the odour limits outlined in Section 8.1 and in line with the Irish Water requirements in Section 8.2.

The following odour control measures will be included as a minimum by the appointed contractor:

- WwTP
  - Sludge tank: passive odour control sized to achieve 1 air change per hour when the tank is empty. An activated carbon filter will be contained in a vent stack. The tank will be covered with a roof.
  - Sludge pumping stations: high and low level vents will be located in the wet well and be fitted with passive activated carbon filter contained in a mushroom vent at ground level. The pumping stations will be covered with roofs.

- Provision will be made at the sludge tank and pumping stations for a future active odour control system.

- Wastewater Pumping Stations: passive odour control on wet well vents
- Rising main discharges: activated carbon filter vents will be contained in vent stacks at rising main discharge locations.

8.6 RESIDUAL IMPACTS OF THE PROPOSED DEVELOPMENT

Odour emissions from the proposed WwTP and WwPSs at the nearest sensitive receptor will be maintained below a 'slight odour' level of 2 ou_E/m^3 (as a 98th percentile of maximum 1 hour odour concentrations). Mitigation measures as outlined above will reduce the potential for odour nuisances from the WwTP, WwPSs and Rising Mains. If odour emissions are predicted to be at or above nuisance levels detailed dispersion modelling will be undertaken by the appointed contractor and further mitigation measures will be implemented, so that no receptor will be exposed to odour concentrations greater than the adopted odour criterion.

8.7 CONCLUSION

Although the specifications of the plant to be used are not yet known due to the Design and Build nature of the contract the contractor will be required to design the plant to limit odour at the site boundaries and nearest sensitive receptors to the levels specified in this section. Odour levels will be monitored on a during the operation phase on a bi-annual basis and in the event of any complaints and any exceedances will be rectified to ensure that the maximum odour levels are complied with.

8.8 REFERENCES

S.I. No. 787 of 2005 – The European Communities (Waste Water Treatment) (Prevention of Odours & Noise) Regulations.

Department for Environment, Food & Rural Affairs (DEFRA) Odour Guidance for Local Authorities (March 2010)

Odour Control – a Concise Guide edited by FHH Valentin and AA North published by Warren Spring Laboratory (1980)

An Bord Pleanála (Reference Number: 29N.YA0010) - Dublin City Council, Planning Determination for the proposed Ringsend WwTP extension project (April 2012)

Environmental Protection Agency, Office of Environmental Enforcement (OEE), Air Dispersion Modelling from Industrial Installations Guidance Note (AG4)

Environmental Protection Agency, Odour Impact Assessment Guidance for EPA Licensed Sites (AG5)

Environment Agency - Additional guidance for H4 Odour Management, How to comply with your environmental permit

Environment Agency - Integrated Pollution Prevention and Control (IPPC), DRAFT Horizontal Guidance for Odour Part 1 – Regulation and Permitting

Environment Agency - Integrated Pollution Prevention and Control (IPPC), DRAFT Horizontal Guidance for Odour Part 2 – Assessment and Control

9 NOISE

9.1 INTRODUCTION

Background

The layout of the proposed WwTP and WwPSs drawings have been evaluated to identify if there are any potentially noisy operations which may have the potential to cause nuisance. WwTPs are not typically associated with noise nuisance complaints during the operational phase. The proposed development will be designed and developed to comply with Irish Water specifications and WHO Guidelines for Community Noise and as such, noise nuisance is not envisaged at any of the proposed work sites during the operational phase.

Relevant Legislation

The proposed development will be required to comply with the legislative requirements of the S.I. No. 787 of 2005 – The European Communities (Wastewater Treatment) (Prevention of Odours & Noise) Regulations. This Statutory Instrument requires that any wastewater treatment plant is operated and maintained so that it avoids causing a nuisance through odours or noise.

World Health Organisation Guidelines for Community Noise

The World Health Organisation (WHO) has published *Guidelines for Community Noise*, the outcome of a WHO expert task force meeting in April 1999. The WHO guidelines recommend a daytime limit of 50 – 55 dB(A) for outdoor living areas. The report states that "*to protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady continuous noise should not exceed 55 dB L_{Aeq} on balconies, terraces and in outdoor living areas. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50 dB L_{Aeq}. Where it is practical and feasible, the lower outdoor sound level should be considered the maximum desirable sound level for new development*". According to the WHO guidelines, noise impacts within dwellings include annoyance, speech interference and sleep disturbance. WHO considers that for bedrooms, the critical effect is sleep disturbance. Guideline values for bedrooms consider that the sleep disturbance criteria should be taken as internal noise levels of 30 dB L_{Aeq} or 45 dB L_{Amax} or external levels of 45 dB L_{Aeq} or 60 dB L_{Amax}. Table 9.1 shows the WHO Guideline noise levels applicable to residential properties.

Table 9.1: Guideline values for community noise in specific environments (World Health Organisation, 1999)

Specific Environment	Critical Health Effects	L_{Aeq} (dB)	Time Base	L_{Amax} (dB)
Outdoor Living Area during daytime	Serious Annoyance, daytime & evening Moderate Annoyance, daytime & evening	55 50	16 16	- -
Outside Bedrooms during night time	Sleep disturbance, window open (outdoor values)	45	8	60

9.2 RECEIVING ENVIRONMENT

Baseline noise effects at the proposed development infrastructure is predicted to be from the following:

- At the proposed WwTP site from traffic on the R733 running north, and from the existing wooded area to the west as well as noise from wave action at the Eastern Celtic Sea.
- At the proposed WwPS at Ballyhack is likely to come from wave action, noise from the boats in the harbour and traffic on the R733.
- At the WwPS at Arthurstown is likely from wave action, noise from the harbour and traffic on the R733.
- At the WwPS at Duncannon is likely from wave action, noise from the harbour and traffic on the R737.

Receptors in the area of the proposed WwTP are dispersed in nature. The main population centre of Arthurstown village is located approximately 400m to the west-southwest of the proposed WwTP. Receptors in Arthurstown village are likely to be less affected due to the prevailing winds being from a south-westerly direction. Receptors in the area are as follows:

- The closest house to the proposed WwTP is located approximately 111m to the north and Dunbrody House is approximately 290m to the northeast. The closest house in Arthurstown village itself is approximately 250m from the WwTP boundary to the northwest. Receptors in the vicinity of the WwTP are shown on Figure 8.1 and Drawing No. UTWE-AEC-ART-DR-CE-1050 in Appendix A.
- The closest receptor to the WwPS at Ballyhack is a row of houses approximately 13m to the east and a bar and shop approximately 14m to the east. These are shown on Figure 8.2 and Drawing No. UTWE-AEC-ART-DR-CE-1053 in Appendix A.
- The closest receptor to the Duncannon WwPS is located approximately 16m to the east. This is shown on Figure 8.3 and Drawing No. UTWE-AEC-ART-DR-CE-1051 in Appendix A.

- The closest sensitive receptor to the Arthurstown WwPS is located approximately 21 to the east. This is shown on Figure 8.4 and on Drawing No. UTWE-AEC-ART-DR-CE-1052 in Appendix A.

9.3 POTENTIAL IMPACTS OF THE DEVELOPMENT

There is potential for noise from the proposed WwTP and WwPS's to be audible and potentially cause a noise nuisance at the nearest receivers to the site, during both the construction and operation of the proposed development, including the effects of traffic noise during the construction phase.

The proposed WwTP and WwPS's will be designed to comply with the legislative requirements of SI No. 787 of 2005 and to be in line with Irish Water Specifications and the WHO Guidelines for Community Noise and therefore noise nuisance is not envisaged at the sites during the operational phase. The plant will be specified to comply with the WHO Guidelines and mitigation will be implemented as needed. It should be noted that it is not envisaged that the proposed WwTP will require any compressors or blowers as part of the plant. This type of equipment tends to emit higher noise emissions.

Construction Phase

The construction activities from the proposed development have the potential to generate a significant noise impact at the nearest noise sensitive receptors. However, any such construction noise impacts will be temporary. The significance of the noise impact of the various activities will depend on the duration of each activity, the particular sources of noise and the time at which the activity occurs.

Construction site noise can be assessed in terms of the equivalent continuous sound level and/or in terms of the maximum level. The level of sound in the neighbourhood that arises from a site depends on a number of factors and the estimation procedures need to take into account the following significant factors:

1. the sound power outputs of processes and plant;
2. the periods of operation of processes and plant;
3. the distances from sources to receptor;
4. the presence of screening by barriers, including vegetation;
5. the reflection of sound; and
6. soft ground attenuation.

Other factors such as meteorological conditions (particularly wind speed and direction) and atmospheric absorption can also influence the level of noise received.

During the construction phase it is anticipated that the proposed development will generate a significant number of HGV movements. During the peak construction period for such a development up to 10 - 15 HGV's may access the site daily, in addition to construction personnel vehicle movements during the morning and evening peak hour periods. Typical construction practices for the proposed development will include associated internal construction site traffic, comprised of contractors' vehicles, excavators, cranes, generators and other diesel-powered vehicles. This will result in the potential for noise impacts at noise sensitive receptors in the area due to the various construction activities.

Different types of construction activities can be categorised into different noise potential classes (high, medium, low). Activities, such as demolition, earth moving, excavations, stockpiling and rock breaking have a high noise potential. Medium risk activities include concrete batching, loading and unloading of vehicles and transport of materials. Low risk activities with regard to noise potential include shuttering, steelfixing and mechanical & electrical installations. The proposed development will involve the following construction practices likely to produce temporary noise impacts:

- Excavation / Infilling / Levelling — Excavator, dump truck & dozer
- Foundations & Tank Construction — Cement mixers & concrete vibrators
- General Construction — Masonry construction, services, drainage and surfacing etc.

Typical Noise Levels from Construction Works likely to take place during construction phase of proposed development are outlined below.

Table 9.2: Typical Noise Levels of Construction Activities

Activity	Plant	Typical L_{Aeq} at 10m
Site clearance/excavation Removal of waste/rubble	Lorries (drive by) Dozers HGV and tippers	70 dB 87 dB 84 dB
Infilling / Levelling	Dump truck Tracked or wheeled excavator/ Loader Dozer	82 dB 76 dB 81 – 89 dB
Foundations & Tank Construction	Compressor Water Pump Concrete Pour Place and vibrate concrete cycle Cement Mixers	81 dB to 80 dB to 86 dB 80 dB 74 dB
General Construction Works	Surfacing Internal fit/ bricklaying	to 85 dB 70 dB

Activity	Plant	Typical L_{Aeq} at 10m
Road works/landscaping	Surfacing/rolling	76 - 86 dB

For construction noise impact prediction purposes, it can be assumed that at any one stage in the construction of the proposed development, several activities may occur together but at different locations throughout the site. At this stage, a proposed construction phasing plan is not available. Therefore, it has been assumed that a noise level of ~80 - 85 dB LAeq at 10m from the various loudest typical construction activity sources may occur during the construction phase.

The majority of the major sources of noise nuisance will be throughout the initial stages of construction with plant operating intermittently throughout the day involved in site works and tank excavation construction at the proposed WwTP site. A noise impact as a result of the construction phase of the proposed development is likely to be perceptible at the nearby properties and noise sensitive receptors, but this will occur throughout daytime periods only and will be temporary. Construction activities will not occur during night-time hours and therefore construction noise will not be audible during these times.

In accordance with typical construction noise guidance, the following noise criteria should be implemented throughout the course of construction at this site where practical. However, due to the nature of parts of the proposed development i.e. laying rising main through Duncannon village and in residential areas, it may not be possible to achieve the below levels at all times.

Construction noise levels and durations that should be adhered to are outlined below.

Table 9.3: Proposed Construction Noise Level Limits (from Irish Water Specifications)

Monday to Friday (times and levels permitted)	Saturday (times and levels permitted)	Sunday
07:00 - 19:00 75 dB $L_{Aeq,12hr}$	08:00 - 13:00 75 dB $L_{Aeq,12h}$	No noise audible
19:00 - 22:0065 dB $L_{Aeq,1h}$*	13:00 - 22:00 65 dB $L_{Aeq,1h}$	No noise audible
22:00 - 07:00 No Works* No noise audible	22:00 - 07:00 No noise audible	No Works* No noise audible

*The exception being the pipeline along the shore road from Ballyhack to Arthurstown where a limit of 55 dB $L_{Aeq,1h}$ will apply.

If any rock breaking activities are required, then these will not be subject to the above limits. Local residents will be informed at least 3 days prior to any rock breaking activities and any concerns will be taken into account.

As the nearest residential properties will be in excess of approximately 100m from the nearest construction noise sources, a significant construction noise impact will be most unlikely at the proposed WwTP site. Works for laying the rising main will be temporary in nature and not likely to take place in any one location for an extended period of time. Appropriate mitigation measures have been outlined for the construction activities on site.

Operational Phase

Although there is potential for the operations at the proposed WwTP and WwPS's to generate noise which could cause nuisance to nearby sensitive receptors, the design and plant specifications will be specified so that noise levels are in compliance with SI No. 787 of 2005 and the WHO Guidelines and therefore noise nuisance is not envisaged at the various sensitive receptors such as dwellings in the vicinity of the proposed WwTP or WwPS's during the operational phase.

9.4 MITIGATION MEASURES

Construction Phase Mitigation

As per the Engineering Specifications for the proposed development, the Contractor will be obliged to undertake the following:

- Monitor the baseline noise environment at each site prior to construction and monitor noise emissions on affected site(s) and demonstrate achievement of the levels as set out in Table 9.3.
- Estimate and substantiate the equivalent noise levels and verify that the specified noise levels are achieved at all works on the Tests on Completion.
- Engage a specialist accredited noise surveyor to monitor noise levels during construction, particularly during activities likely to generate significant noise e.g. piling and at sensitive receptors.
- Noise measurements will be carried out in accordance with BS4142 and BS7445.
- Take steps to minimise vibration. No machinery which uses dropping of heavy weights for breaking up paving foundations will be permitted. Vibrations to be monitored using a vibrometer where instructed by the Employer's Representative. Vibrations from mechanical plant will not exceed 3.5mm/s peak particle velocity at the property boundary.

The contract documents will clearly specify that the Contractor undertaking the construction of the works will be obliged to take specific noise abatement measures and comply with the recommendations of BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on

Construction and Open Sites - Noise and the European Communities (Noise Emission by Equipment for Use Outdoors) Regulations, 2001. These measures will provide that:

- No plant used on site will be permitted to cause an ongoing public nuisance due to noise.
- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations.
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract.
- Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers.
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.
- Any plant, such as generators or pumps that is required to operate before 07:00hrs or after 19:00hrs will be surrounded by an acoustic enclosure or portable screen. No other plant will be allowed to operate before 07:00 or after 19:00 except for works on the pipeline between Ballyhack and Arthurstown.
- During the course of the construction programme, the contractor will be required to manage the works to comply with noise limits using methods outlined in BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites - Noise "Noise and Vibration Control on Construction and open sites", Annex B.

The following mitigation measures will also be employed to minimise construction noise impacts:

- Working hours during site construction operations will be restricted to daytime hours as follows:
  - 08.00 to 18.00 (Monday to Friday)
- An on-site speed limit will be enforced for all traffic. Drivers of vehicles will be advised of the speed limits through the erection of signs i.e. a typically recommended on site speed limit of 10 km/hr.
- Where practicable the use of quiet working methods will be selected and the most suitable plant will be selected for each activity, having due regard to the need for noise control.

- To this end, operators will use “noise reduced” plant and/or will modify their construction methods so that noisy plant is unnecessary. This will particularly important for works on the rising main which run close to residences in places.

- Mechanical plant used on site will be fitted with effective exhaust silencers.

- All plant will be maintained in good working order. Where practicable, machines will be operated at low speeds and will be shut down when not in use.

- If required, generators will be of the “noise reduced” variety and fitted with properly lined and sealed acoustic covers.

- In all cases engine and/or machinery covers should be closed whenever the machines or engines are in use.

- All pneumatic percussive tools will be fitted with mufflers or silencers as recommended by the equipment manufacturers. Where practicable all mechanical static plant will be enclosed by acoustic sheds or screens.

- Employees working on the site should be informed about the requirement to minimise noise and will undergo training on the following aspects:
  - The proper use and maintenance of tools and equipment
  - The positioning of machinery on-site to reduce the emission of noise to the noise sensitive receivers
  - Avoidance of unnecessary noise when carrying out manual operations and when operating plant and equipment
  - The use and maintenance of sound reduction equipment fitted to power pressure tools and machines

- Responsible Person - It is recommended that the Contractor should appoint a responsible and trained person who will be present on site to answer and act upon complaints and queries.

- Night-time Working - If there are items of plant (e.g. dewatering pumps and similar) in use during night-time hours they should be chosen, sited and enclosed such that levels at the nearest properties do not exceed the measured background noise levels.

- The TII/NRA Guidelines recommend that in order to ensure that there is no potential for vibration damage during construction, vibration from construction activities should be limited to the values set out in the table below. The Contractor will therefore be required to adhere to these levels set out below. Allowable vibration during road construction in order to minimise the risk of building damage. Allowable vibration velocity (Peak Particle Velocity) at the closest part of any sensitive property to the source of vibration, at a frequency of Less than 10Hz for

8mm/s and 10 to 50Hz 50 for 12.5mm/s and 50 to 100Hz (and above) for 20mm/s 8 mm/s 12.5 mm/s.

Operational Phase Mitigation

Given the nature of the proposed development and the distance of noise sensitive receptors from the main elements of infrastructure, there is potential for the operations at the proposed WwTP and WwPSs to generate noise which could cause nuisance to nearby sensitive receptors. However, the design and plant specifications will be specified so that noise levels are in compliance with SI No. 787 of 2005 and the WHO Guidelines and therefore noise nuisance is not envisaged at the sites during the operational phase. Noise complaints during operation are therefore not considered likely.

The following design requirements will be included from the Engineering Specifications for the proposed development:

- Noise levels from individual items of plant will be restricted to limits and practices under Health & Safety legislation, Regulations and Guidelines.
- In blower rooms, the maximum noise, noise will not exceed 85dB(A) at 1m from the blower enclosure with a preference for 80dB(A). This applies where 1, 2 or more blowers are in operation. The contractor will be obliged to provide a cost for plant to achieve the lower 80dB (A) limit.
- The maximum levels from other equipment (excluding blowers, MCC rooms and administration areas) will not normally exceed 65dB(A) at a distance of 1m.
- In MCC rooms, the maximum levels will be 60dB(A) except when any standby emergency generators are required.
- In administration areas, the maximum noise levels will be 50dB(A) except when any standby emergency generator is required.
- Noise levels at any building on any of the sites (within the site boundaries) will not exceed 60dB(A) at a distance of 1m from walls of the building or externally mounted plant.
- The noise levels at the site boundary will not exceed 45dB LAeq (60 mins) at 1m from the boundary. This excludes periods when emergency generators may be required.

9.5 RESIDUAL IMPACTS OF THE PROPOSED DEVELOPMENT

Noise levels from the operation of the proposed WwTP are not expected to be significant and mitigation measures can be implemented. Following mitigation, it is not considered that noise complaints will be received.

9.6 MONITORING

If any complaints are received during operation, then Irish Water will monitor noise levels at the affected receptor so that appropriate mitigation can be implemented.

9.7 CONCLUSION

The proposed Ballyhack/Arthurstown/Duncannon agglomeration development has the potential to lead to nuisance noise levels at sensitive receptors during the construction phase. However, this phase will be temporary in nature and operations will be limited to daytime hours. During the operational phase of the proposed development, there is potential for noise nuisance from the operation of plant at the proposed WwTP and WwPSs. However, the plant will be specified to comply with SI No. 787 of 2005 and the WHO Guidelines and therefore noise complaints are not considered likely.

9.8 REFERENCES

Guidelines for Community Noise, 1999 - World Health Organisation (WHO).

The World Health Organisation (WHO) Night Noise Guidelines for Europe, 2009.

British Standard 4142:1997: Method for rating industrial noise affecting mixed residential and industrial areas.

British Standard 5228: Noise Control on Construction and Open Sites – 1997, Part 1 and 2.

DEFRA – Update of Noise Database for Prediction of Noise on Construction and Open Sites.

ISO 1996-1:2003 Acoustics - Description, measurement and assessment of environmental noise - Part 1: Basic quantities and assessment procedures.

ISO 1996-2:2007 Acoustics - Description, measurement and assessment of environmental noise - Part 2: Determination of environmental noise levels.

10 LANDSCAPE AND VISUAL

10.1 INTRODUCTION

This chapter will assess the likely visual and landscape impacts of the proposed Arthurstown agglomerations wastewater treatment works, including construction works, and suggest mitigation measures where practicable to minimise adverse impacts.

10.2 RELEVANT LEGISLATION & GUIDANCE

2000 - European Landscape Convention

As a member of the Council of Europe, Ireland ratified the European Landscape Convention 2000, in March 2002. The ELC aims to promote landscape protection, landscape management and landscape planning. It aims to organise European wide co-operation on landscape issues.

2013 – Guidelines for Landscape and Visual Impact Assessment

The guidance is published by the Institute of Environmental Management and Assessment (IEMA) and the Landscape Institute in the United Kingdom and is generally used as the standard framework for undertaking landscape and visual assessments in Ireland.

2000 - DoEHLG Landscape Character Assessment Guidance

The Department of the Environment, Heritage and Local Government (DoEHLG) published The Landscape and Landscape Assessment Draft Guidelines 2000, in order to help Local Authorities to conduct their own landscape character assessment. The expectation of the DoEHLG was that all the information gathered at Local Authority level would be combined to produce a National Landscape Character Map. However, these guidelines still remain in Draft form eighteen years after they were issued by the department and as such have no formal status.

2000 - The Planning and Development Act

There is currently no legal definition of landscape in Irish law. There are, however, provisions in Irish law that relate to the preservation and conservation of the landscape under the Planning and Development Act 2000-2011 including Sections 10, 202 and 204.

Section 10 of the Planning and Development Act, 2000, requires Local Authorities to include objectives for the following in their Development Plans:

(2)(e) the preservation of the character of the landscape where, and to the extent that, in the opinion of the planning authority, the proper planning and sustainable development of the area requires it, including the preservation of views and prospects and the amenities of places and features of natural beauty or interest.

Wexford County Development Plan 2013-2019

The majority of the proposed development (the WwTP and Duncannon WwPS and the Rising and Gravity Mains between them) is located in an area designated as 'Coastal' in the Plan. The rest of the proposed development (Ballyhack and Arthurstown WwPS and the Rising and Gravity Mains to the WwTP) is located in the Barrow/Suir River Valley. The Plan has a number of objectives relating to landscape and visual elements relevant to the proposed development which are:

- *Objective L03 - To ensure that developments are not unduly visually obtrusive in the landscape, in particular in the Upland, River Valley and Coastal landscape units and on or in the vicinity of Landscapes of Greater Sensitivity.*
- *Objective L04 - To require all developments to be appropriate in scale and sited, designed and landscaped having regard to their setting in the landscape so as to ensure that any potential adverse visual impacts are minimised.*
- *Objectives L05 - To prohibit developments which are likely to have significant adverse visual impacts, either individually or cumulatively, on the character of the Uplands, River Valley or Coastal landscape or a Landscape of Greater Sensitivity and where there is no overriding need for the development to be in that particular location.*
- *Objective L09 - To require developments to be sited, designed and landscaped in manner which has regard to the site specific characteristics of the natural and built landscape, for example, developments should be sited, designed and landscaped to minimise loss of natural features such as mature trees and hedging and built features*

In relation to Coastal Areas, the Landscape Character Assessment (LCA) for County Wexford (Volume 3 of the CDP) states that "*The coastal areas of Wexford experience greater pressure for tourism and residential development. Developments in coastal landscapes need to show greater sensitivity as this landscape unit has a lesser capacity to absorb development."* Regarding River Valleys, the LCA states that *"The Slaney and Barrow River Valleys have similar characteristics to that of the Lowlands, but have a more scenic appearance due to the presence of the rivers and their associated riparian and woodland habitats. This unit is very sensitive to development."*

10.3 METHODOLOGY

An outline of the methodology used in this assessment is provided below.

Desk Study

Desk studies for this landscape and visual impact assessment report entailed the following:

- Review of project design and siting information
- Review of relevant landscape policies in the Wexford County Development Plan 2013 – 2019

Site Inspections

A site visit was undertaken on 14th and 15th February 2018 to gain an overall understanding of the area in which the proposed development infrastructure is to be located. This visit aided in the following:

- Sense of local landscape character, values and sensitivity
- Impression of the real context for the proposed development
- Identification of sensitive visual receptors from where the proposed development might be visible
- Estimation of likely landscape and visual impacts and classification of impact in relation to overall Significance
- Identification of mitigation measures that would assist in the visual and landscape integration of the proposed project

10.4 Impact Assessment Methodology

The assessment of the proposed development takes the character of the existing sites and general landscape into account, as well as the location of sensitive landscapes and visual receptors, the sensitivity of the sites and vulnerability to change.

Table 10.1 shows a matrix of the classification of visual effects which is derived from the EPA[9] and UK Landscape Institute Guidance.

Table 10.1: Matrix of Landscape Effects

		Existing Environment			
		High	**Medium**	**Low**	**Negligible**
Description of Impacts	**High**	Profound	Very Significant	Significant / Moderate	Moderate / Slight
	Medium	Very Significant / Significant	Significant / Moderate	Moderate	Slight / Not Significant
	Low	Significant / Moderate	Moderate / Slight	Slight / Not Significant	Not Significant / Imperceptible
	Negligible	Slight / Not Significant	Not Significant	Not Significant / Imperceptible	Imperceptible

Effects may be positive, neutral or negative/adverse. The significance of effects are outlined in Table 10.2 and the duration of effects are outlined in Table 10.3.

[9] EPA (2017) Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports (Draft August 2017)

Table 10.2: Significance of Effects

Imperceptible	A measurable effect without significant consequences
Not Significant	An effect with noticeable changes in the character of the environment without significant consequences
Slight	An effect causing noticeable changes in the character of the environment without affecting its sensitivities
Moderate	An effect that alters the character of the environment consistent with existing baseline trends
Significant	An effect which by its character, magnitude, duration or intensity changes a sensitive aspect of the landscape
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly changes the majority of a sensitive aspect of the environment
Profound	An effect which obliterates sensitive characteristics of the landscape

Table 10.3 Duration of Effects

Momentary	Seconds to Minutes
Brief	Up to one day
Temporary	Up to one year
Short-term	Between one and seven days
Medium-term	Between one and fifteen days
Long-term	Between fifteen to sixty days
Permanent	Over sixty days

Further aspects of effect such as magnitude (i.e. extent, frequency and context), probability (i.e. likely, indeterminable, worst-case), and type (i.e. cumulative, interaction, residual, indirect etc.) are considered in this assessment (where appropriate) and in accordance with the descriptions outlined in the EPA Guidance.

10.5 RECEIVING ENVIRONMENT

The site of the proposed WwTP is currently a relatively flat agricultural field, set back from the roadway and surrounded by mature woodland and hedgerows and will be screened from view (Photo 10.1). Characteristics aspects of the route are outlined in photos 10.2 to 10.6 below.

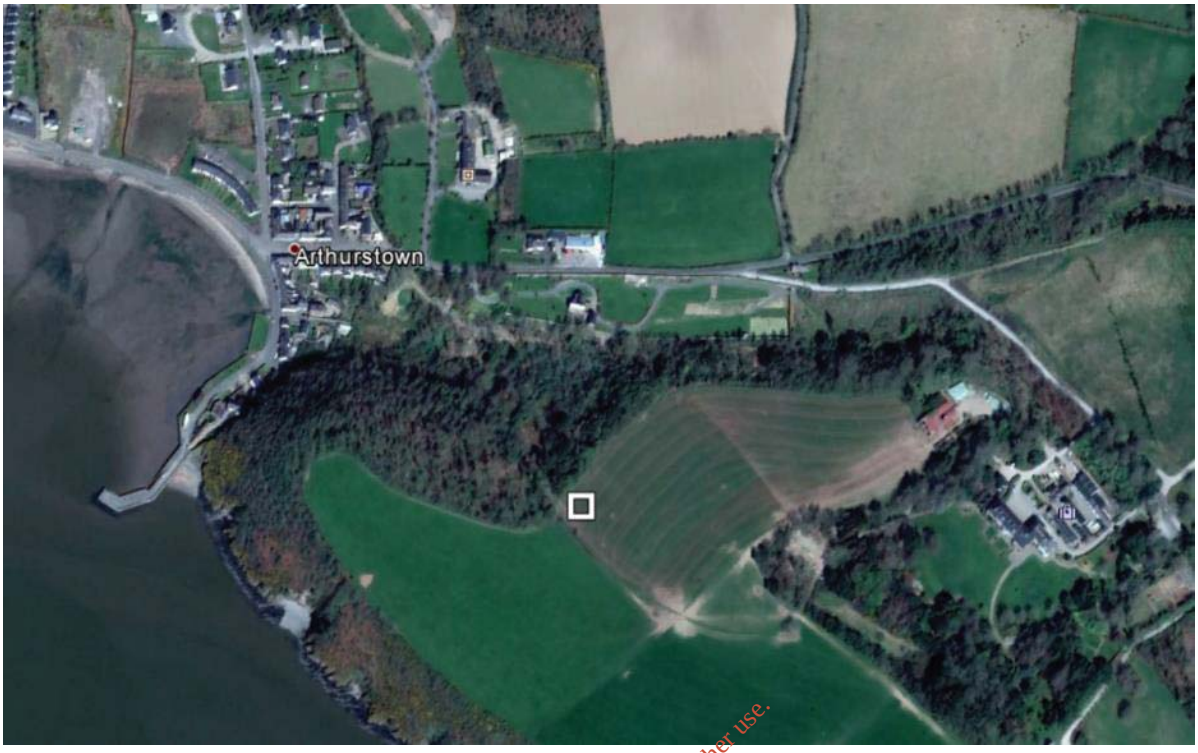


Figure 10.1 – Location of WwTP Site in Surrounding Landscape

Figure 10.2 – View from the Proposed WwTP looking East

Figure 10.3 – View of the Proposed WwTP site, looking West

The WwPSs will be constructed on existing hardstanding or gravelled areas and will be small structures. The above ground elements will consist of a kiosk with height up to approximately 2m and a telemetry pole with height up to 6m. The pipelines will be constructed under existing public roads and tracks (Photo 10.4), with a section laid underground on improved agricultural grassland and will not be visible in the landscape once laid.

Figure 10.4 – View of access track to the Proposed WwTP site, looking West

Figure 10.5 – View of improved agricultural grassland along gravity pipeline (1030m)

Figure 10.6 – Arthurstown to Ballyhack roadway where 850m of proposed rising main will be laid

10.6 POTENTIAL IMPACTS

Construction Phase

Impacts arising during the construction phase will be relatively short term in duration and would mostly arise from construction activity at the proposed WwTP, WwPS's and associated pipelines.

While the landscape where the proposed infrastructure will be constructed is generally classed as sensitive, many of the activities will be taking place on areas which are existing hardstanding areas, namely the WwPS's, the Rising Gravity Mains and the access road into the proposed WwTP. The proposed WwTP and part of the Gravity Mains from Duncannon to the WwTP will be constructed on greenfield areas. The key adverse visual and landscape impacts arising from the construction phase are likely to include the following:

- Visual disturbance associated with construction activity including operating machinery and equipment.
- Untidiness typically found on construction sites.

Due to the extent of topography, screening provided locally by the low-lying landscape and woodland tree cover, the visual presence of such works is likely to be medium in magnitude. Construction works are usually visually disruptive. Therefore, as works to the proposed WwTP are taking place on a greenfield site, the impact in this area will be moderate adverse but short-term. Works on the WwPS's will take place on existing brownfield sites, and therefore the impact is likely to be slight adverse. Trenching works for laying the pipelines will mostly take place on existing public roads and therefore, the effect in landscape terms will be slight adverse. Considering these assessments, the overall

Significance of impact of the construction phase is classified as slight-moderate adverse but short-term in nature.

Operational Phase

Operational Phase in the context of this report concerns the likely impact of the completed project post-construction but prior to implementation of mitigation measures.

The installation of the Treatment Tanks over ground, will be at a maximum height of approximately 6.5m. There is unlikely to be an effect as the plant will be screened by the surrounding presence of the wooded area which screens the proposed development from the west, north and east (as shown on Figure 10.1). There is no access to the coast to the south of the proposed WwTP. There will be a view of the WwTP from boats using the estuary, but this will not be out of context given the location of the infrastructure relative to Arthurstown village. Therefore, the visual impact is predicted to be slight. Figure 10.7 shows the proposed indicative layout of the WwTP at Arthurstown (excerpt from Planning Drawing UTWE-AEC-ART-DR-CE-2506).

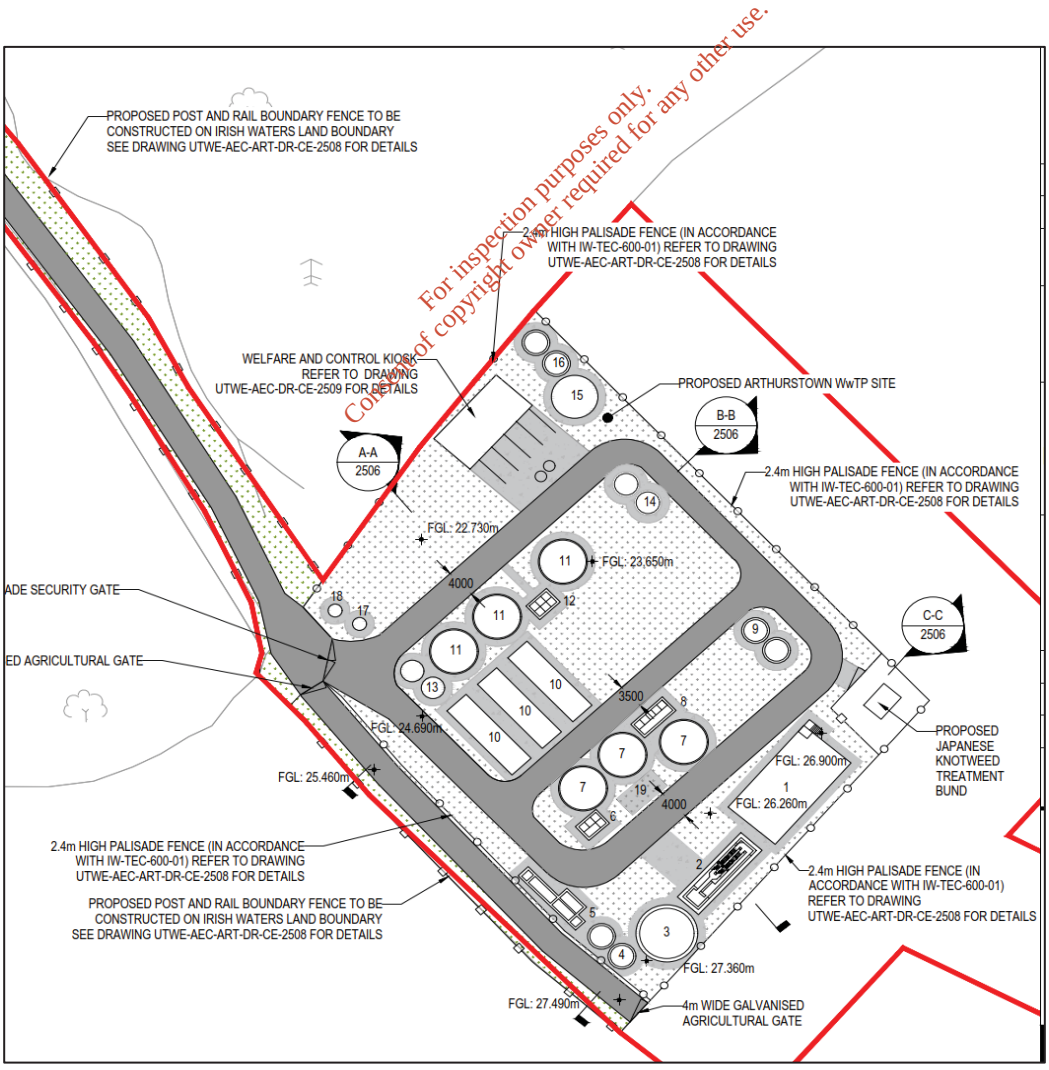


Figure 10.7 – Proposed Indicative Layout of WwTP (Excerpt from UTWE-AEC-ART-DR-CE-2506)

The proposed WwPSs will be constructed on existing hardstanding areas with the main plant being located below ground with only a small control kiosk and telemetry pole being located above ground. and so will not cause a significant effect on the landscape. The only above ground feature at Blackhill Service Reservoir will be a telemetry pole so will no cause a significant effect on the landscape. The pipelines will be laid c. 1.2m underground and all sites reinstated to previous use, with the only visible above ground feature being a number of vent stacks, so there will be an imperceptible impact from this infrastructure.

10.7 MITIGATION

Construction Phase Mitigation

Mitigation of landscape and visual impacts for the proposed project shall have regard to the approach as set out in the following NRA/TII guidance documents:

- Guidelines for the Creation and Maintenance of an Environmental Operating Plan
- A Guide to Landscape Treatments for National Road Schemes in Ireland
- Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post Construction of National Road Schemes
- Guidelines on the Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads.

The following mitigation measures will also be applied:

- Site machinery shall operate within the proposed development boundary of the WwTP and WwPS sites.
- Removal of trees or other local features will be avoided unless required for operational or health and safety reasons. Care will be taken not to undermine the roots of mature trees particularly along the access road to the WwTP, which might threaten their longevity.
- Storage areas will be located to avoid woodlands, trees, hedgerows and drainage patterns.
- The construction period at which works will be undertaken at the various site locations will be kept as short as possible. All works areas will be kept tidy as with waste material removed at regular intervals.
- It is not envisaged that there will be any tree/hedgerow removal required for the construction of the proposed infrastructure (refer to Section 6.5.1). Should any accidental damage occur to existing hedgerows or trees arising from the construction phase of the proposed development this will need to be rectified.

Construction compounds will be fully-decommissioned and reinstated to their pre-construction condition at the end of the construction contract.

Operational Phase Mitigation

The operational phase of the development should not have a visual impact as the proposed WwTP site is already well screened by existing vegetation. The Pumping Stations are located on existing developed areas and will therefore not have a significant visual effect.

The following measures will be applied:

- All construction materials and waste will be cleared from the site locations on completion of works.
- Conventional construction materials and finishes that help blend the structures into the local landscape will be used.
- The WwTP site will be maintained to a high standard. Existing landscape features like boundary hedgerows contained within the proposed WwTP site will be retained.
- Consideration shall be given by the Contractor to the location of infrastructure on the rising main such as air valves, scour valves and vent stacks to reduce the visual effects of these elements.
- The above ground control kiosks at the WwPS sites will be coloured green to match the general aesthetics of the surrounding areas.
- The telemetry pole at the Blackhill Service Reservoir Site will be located behind the existing building and in proximity to a number of existing poles in the site, such that visual impact will be reduced.

In addition to the measures outlined, should some localised mitigation measures be required at the proposed WwTP site, some guidance is given below on steps that could be taken. The aim of these localised mitigation measures will be to further integrate the proposed WwTP development into the surrounding landscape and provide screening to minimise the visual intrusion that may affect the existing visual amenity of the receptors. Additional localised mitigation measures can include the following:

- Provide additional shrub or tree planting within existing hedgerows if required for screening and to reduce visual impacts.
- Selection of native species of trees, shrubs and hedgerow species in keeping with the surrounding landscape to maintain and enhance the biodiversity as well as visual screening.

10.7.1 Revegetation

Hedgerow enhancement wherever required will generally be comprised of suitable local species and where required be composed to match existing planting. Species will include, but not be limited to; *Ilex aquifolium* (Holly), *Ligustrum vulgare* (Wild Privet), *Crataegus monogyna* (Hawthorn) and *Prunus spinosa* (Blackthorn). Any additional trees wherever required shall be native species like *Fraxinus excelsior* (Ash) and *Salix cinerea* (Grey Willow) and *Acer platanoides* (Sycamore)

10.8 RESIDUAL EFFECTS

Residual effects will occur when the development is operational and after the incorporation of all mitigation measures. Any likely predicted effects will be reduced to neutral at the end of the life cycle stage of the development.

10.9 CONCLUSIONS

This report demonstrates that the proposed development could be successfully accommodated and assimilated into the surrounding landscape and will not have a significant effect on the landscape and visual character of the area.

11 CULTURAL HERITAGE

An Archaeological assessment in the form of an Archaeological Screening Report has been completed by John Cronin & Associates in October 2017 and is included in Appendix E. The assessment found that the proposed works in Ballyhack village will extend close to the south end of the Zone of Notification surrounding Ballyhack Tower House (WX044-009001-), which is a National Monument in State Ownership (Nat. Mon. ref. 516) (Figure 8). The proposed works in Duncannon village will extend close to the north end of the Zone of Notification surrounding Duncannon Fort (WX044-015001) which is also a National Monument in State Ownership (Nat. Mon. Ref. 668). No direct impacts to either of these monuments is predicted.

A section of the proposed pipeline route along the roadway in Arthurstown village will extend through the National Monuments Service designated Zones of Notification surrounding two recorded monuments, a Stone sculpture (WX044-033001) and a Tomb effigial (WX044-03302), both of which have been inset into the inner face of the sea wall (Figure 7). No direct impacts to either of these monuments is predicted.

The general landscape around the proposed scheme contains a high number of recorded archaeological monuments dating from the Bronze Age onwards.

The proposed WwTP site is located within a green field area in the northern half of the field and there are no recorded archaeological sites within 100m of its proposed location. While there are no recorded archaeological sites in close proximity to the WwTP site and pipeline route the discovery of a prehistoric burial ground within the landholding has demonstrated the potential for unrecorded, sub-surface archaeological features to be uncovered during ground works within this area.

The report recommends while no direct works are proposed to either of the two National Monuments within the study area, the footprint of the scheme will extend close to the Zones of Notification surrounding both monuments. The National Monuments Service has been notified of the nature and extent of the proposed works in the environs of the monuments.

Similarly, while no direct impacts to either of the stone sculptures set into the Arthurstown sea wall are predicted, a notification of proposed works within the Zones of Notification around these recorded monuments was submitted to the National Monuments Service.

It was also recommended that a periodic archaeological watching brief of pipeline works along the existing roads be undertaken during the construction phase. It was also recommended that ground works in the public road within the environs of Duncannon Fort and Ballyhack Tower House should be subject to constant archaeological monitoring. The contractor will provide an archaeologist to complete the watching brief.

The screening report recommended a programme of pre-development archaeological testing to be carried out on the greenfield sites. The programme of testing was agreed with the Department of Culture, Heritage and the Gaeltacht. This pre-development testing was completed in February 2019 and the reports are included in Appendix E. The archaeological test trenching carried out in this study did not reveal any features or artefacts of archaeological significance. The results of the testing indicate that the proposed scheme will not impact on any archaeological features.

12 CONCLUSION

Currently there is untreated sewage entering Waterford harbour from the agglomerations of Ballyhack, Arthurstown and Duncannon. The proposed new WwTP and terminal pumping stations together with associated pipelines will greatly improve the quality of the receiving waters at Ballyhack Quay, King's Bay and Duncannon Quay.

The new WwTP discharge will be licensed and strict effluent limits will be applied to the waters before they are discharged into Waterford harbour.

Overall, no significant impacts are predicted in terms of socio-economic, hydrology or hydrogeology, flora and fauna, landscape and visual, odour, noise or cultural heritage. There will be a small impact during construction in terms of traffic movements on the local road network with an estimate increase of c. 15 HGV movements on the local roads and associated construction traffic. An existing entrance will be upgraded and used as an access to the WwTP site. The entrance provides good sightlines for vehicles exiting the site with the existing track being upgraded to allow traffic to enter and exit the site safely.

From a socio-economic perspective, the proposed development has potential for a minor positive impact in terms of employment and a minor negative impact in terms of land-take but no impact could be classed as significant.

There is potential for odour nuisances from the operation of the proposed WwTP. At design stage, the Contractor will undertake a baseline odour assessment desk study to determine if dispersion modelling is required. Mitigation measures will be implemented if results show an odour nuisance at any sensitive receptors.

There is potential for noise nuisance from the proposed development. However, the design and plant will be specified so that noise levels are in compliance with SI No. 787 of 2005 and the WHO Guidelines and therefore noise nuisance is not envisaged at the sites during the operational phase. Noise complaints during operation are therefore not considered likely.

In terms of Archaeology and Cultural Heritage, a programme of pre-development archaeological testing has been undertaken and a periodic archaeological watching brief of pipeline works along the existing roads be undertaken during the construction phase. Ground works in the public road within the environs of Duncannon Fort and Ballyhack Tower House will be subject to archaeological monitoring during construction works.

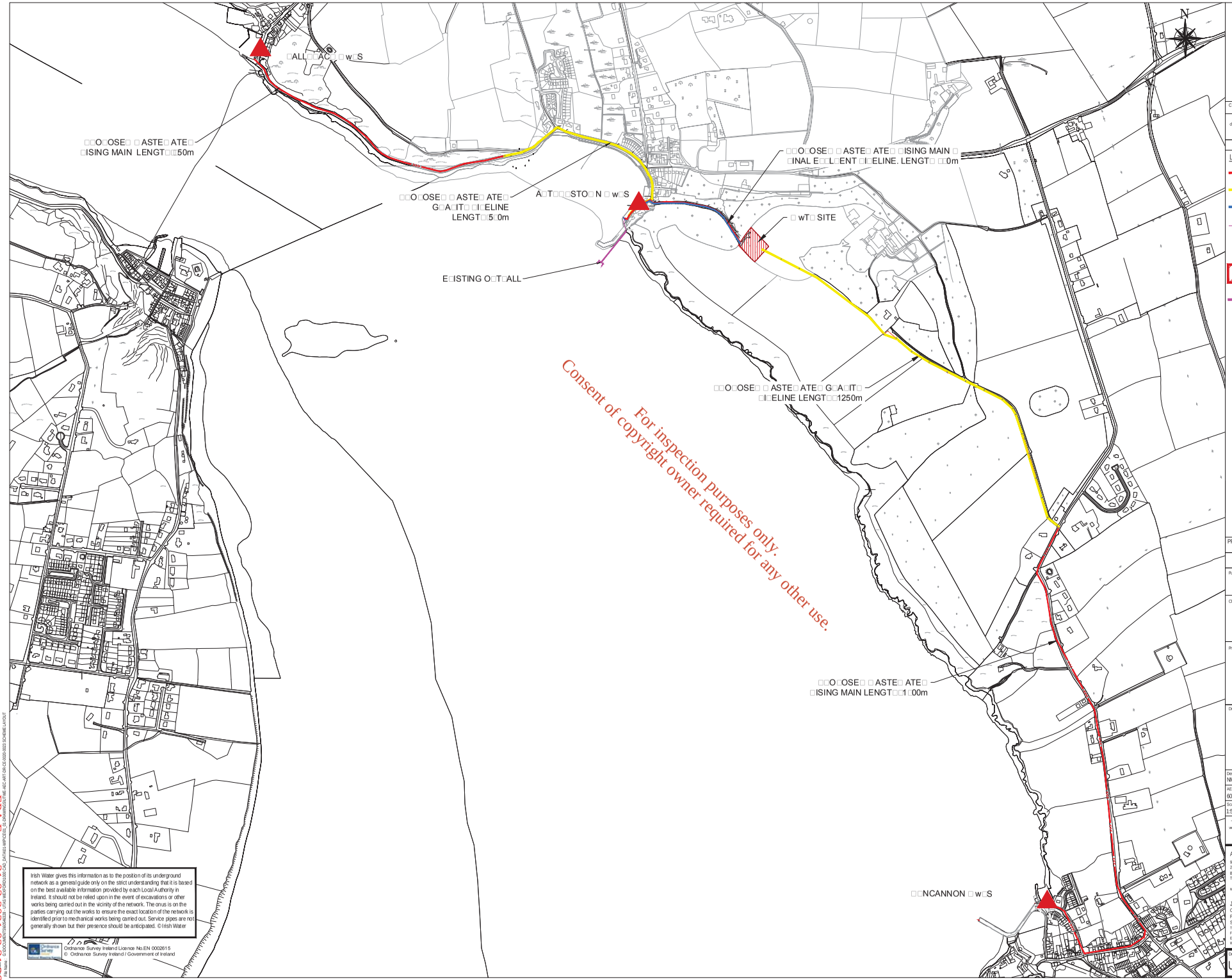
Appendix A

Project Drawings

UTAS-AEC-ART-DR-CE-0020 to 0023

UTAS-AEC-ART-DR-CE-3010

UTAS-AEC-ART-DR-CE-1050 to 1053



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PRELIMINARY	NMcE / AM	18/04/18	P4
Revision Details	By / Check	Date	Suffix

Purpose of Issue: PRELIMINARY

Client: UISCE ÉIREANN / IRISH WATER

Project Title:
UTAS WEXFORD
ARTHURSTOWN
IW PROJECT NO. 10015231

Drawing Title:
ARTHURSTOWN
OVERALL SCHEME LAYOUT

Designed	Drawn	Checked	Approved	Date
NMcE	NK	AM	AB	JULY 2017

AECOM Internal Project No.: 60546329

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Drawing Number: UTWE-AEC-ART-DR-CE-0020 | Rev: P4

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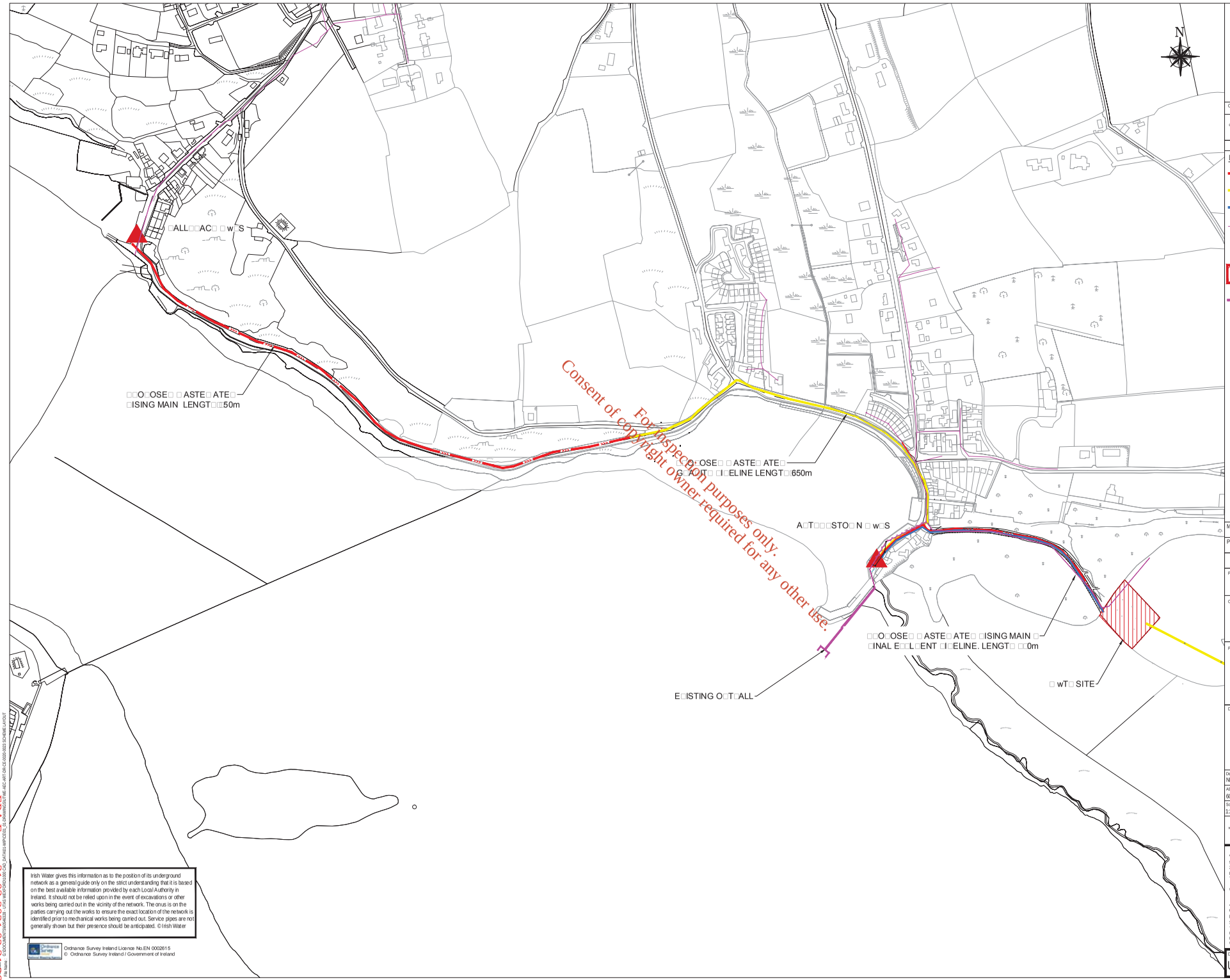
File Name: C:\DOCUMENTS\REVIT\UTAS WEXFORD\UTAS WEXFORD_CENTRAL_D_DRAWINGS\UTWE-AEC-ART-DR-CE-0020-0023 SCHEME LAYOUT



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Revision Details	By / Check	Date	Suffix
MINOR UPDATES	GA / AM	01/15/18	P3
PRELIMINARY	NMcE / AM	18/04/18	P2

Purpose of Issue: PRELIMINARY

Client: UISCE ÉIREANN / IRISH WATER

Project Title:

UTAS WEXFORD
ARTHURSTOWN
IW PROJECT NO. 10015231

Drawing Title:

ARTHURSTOWN
SCHEME LAYOUT
SHEET 1 OF 3

Designed	Drawn	Checked	Approved	Date
NMcE	NK	AM	AB	JULY 2017

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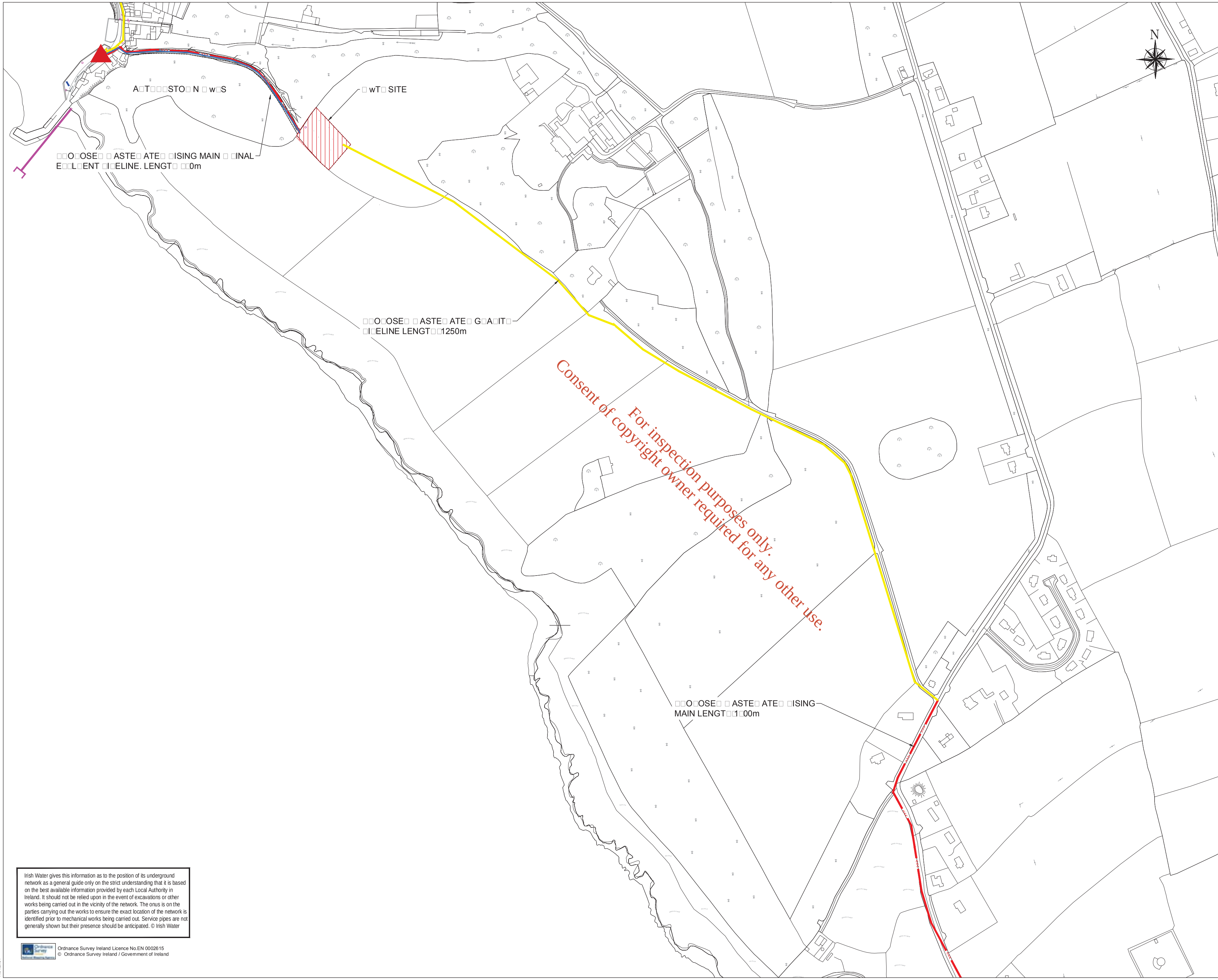

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PRELIMINARY	NMcE AM	18/04/18	P2
Revision Details	By Check	Date	Suffix

Purpose of Issue

PRELIMINARY

Client

UISCE ÉIREANN : IRISH WATER

Project Title

UTAS WEXFORD
ARTHURSTOWN
IW PROJECT NO. 10015231

Drawing Title

ARTHURSTOWN
SCHEME LAYOUT
SHEET 2 OF 3

Designed	Drawn	Checked	Approved	Date
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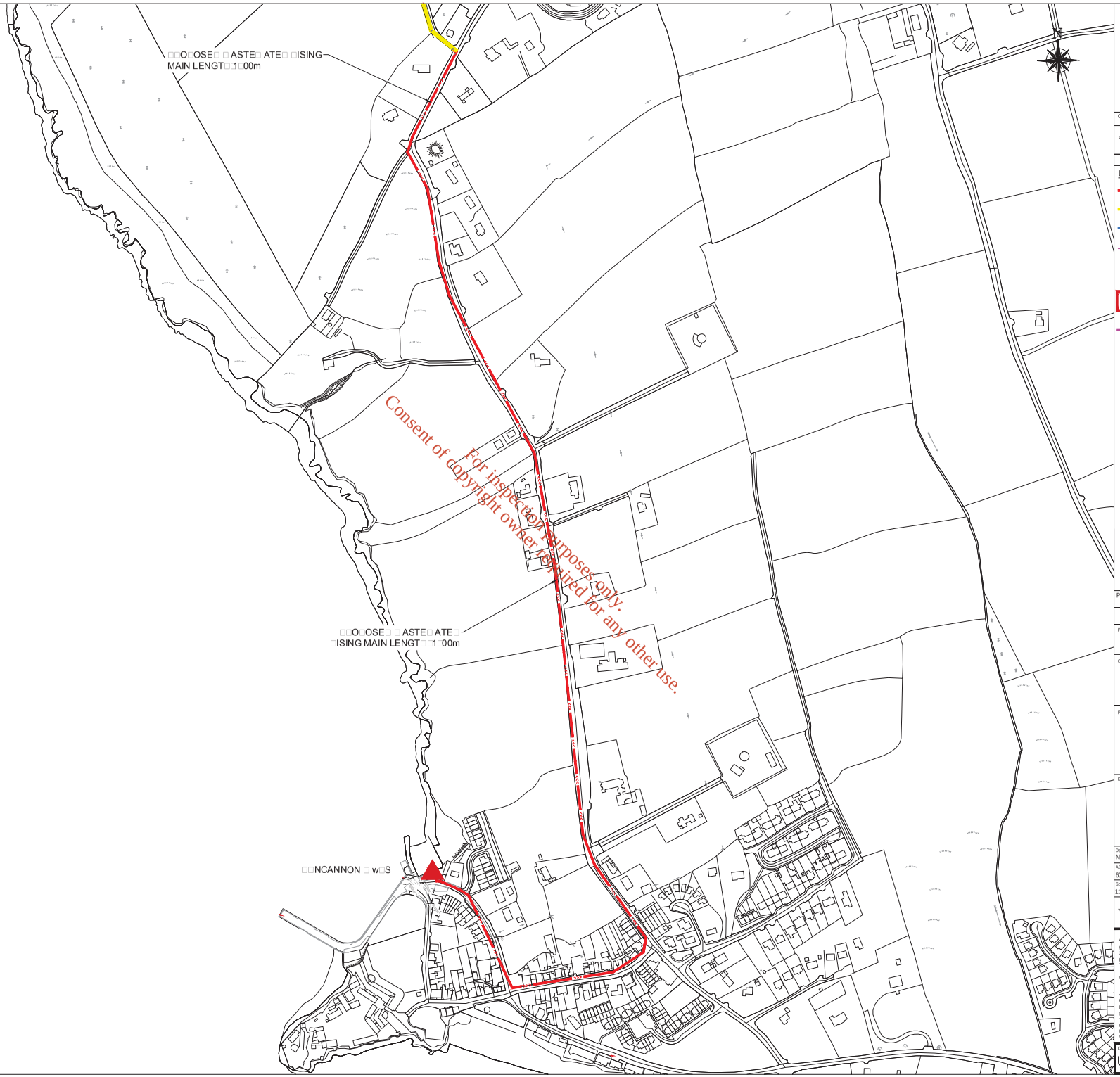

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PRELIMINARY	NMcE / AM	18/04/18	P2
Revision Details	By / Check	Date	Suffix

Purpose of Issue: PRELIMINARY

Client: UISCE ÉIREANN / IRISH WATER

Project Title:
UTAS WEXFORD
ARTHURSTOWN
IW PROJECT NO. 10015231

Drawing Title:
ARTHURSTOWN
SCHEME LAYOUT
SHEET 3 OF 3

Designed	Drawn	Checked	Approved	Date
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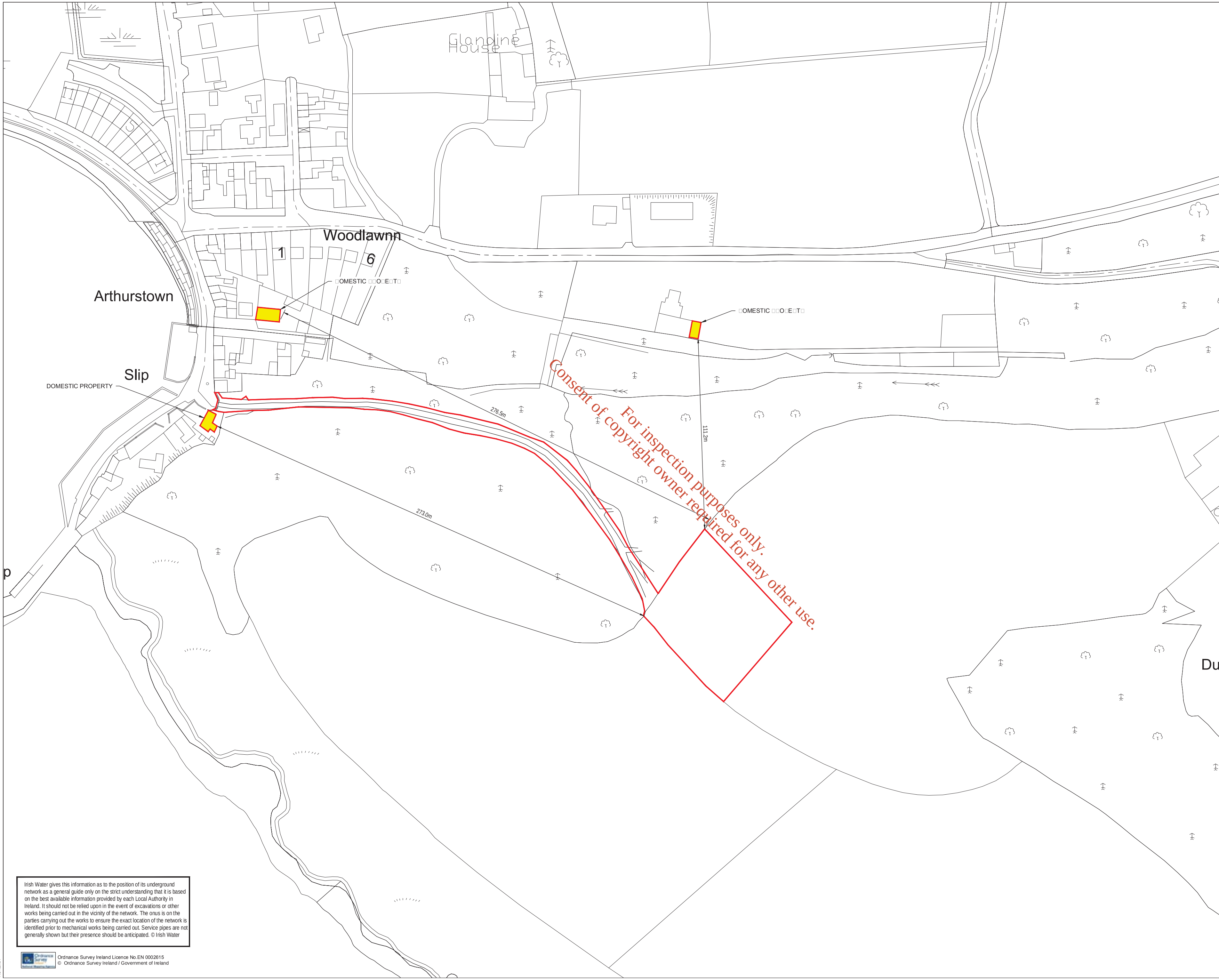

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LEGEND:

- PROPOSED WwTP SITE
- SENSITIVE RECEPTOR

NOTES

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Revision Details	By	Check	Date	Suffix
PRELIMINARY	LT	AM	07.02.19	P0

Purpose of issue: PRELIMINARY

Client: UISCE ÉIREANN : IRISH WATER

Project Title: UTAS WEXFORD ARTHURSTOWN IW PROJECT No. 10015231

Drawing Title: ARTHURSTOWN WwTP NEAREST SENSITIVE RECEPTOR

Designed	Drawn	Checked	Approved	Date
LT	LT	AM	KM	FEB 2019

AECOM Internal Project No. 60546328

Scale @ A1 1:1000

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Drawing Number: UTWE-AEC-ART-DR-CE-1050 Rev: P0

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CONSTRUCTION RISKS	
MAINTENANCE / CLEANING RISK	
DEMOLITION RISKS	

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SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION BOX

LEGEND:

NEW SITE

NEAREST SENSITIVE RECEPTORS

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Purpose of Issue: PRELIMINARY

Client: UISCE ÉIREANN / IRISH WATER

Project Title:
UTAS WEXFORD
ARTHURSTOWN
IW PROJECT No. 10015231

Drawing Title:
DUNCANNON
PUMPING STATION
NEAREST SENSITIVE RECEPTORS

Designed	Drawn	Checked	Approved	Date
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CONSTRUCTION RISKS	
MAINTENANCE / CLEANING RISK	
DEMOLITION RISKS	

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SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION BOX

LEGEND:

- NEW SITE
- NEAREST SENSITIVE RECEPTORS

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Purpose of issue
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Client
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Project Title
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ARTHURSTOWN
IW PROJECT No. 10015231

Drawing Title
ARTHURSTOWN
PUMPING STATION
NEAREST SENSITIVE RECEPTORS

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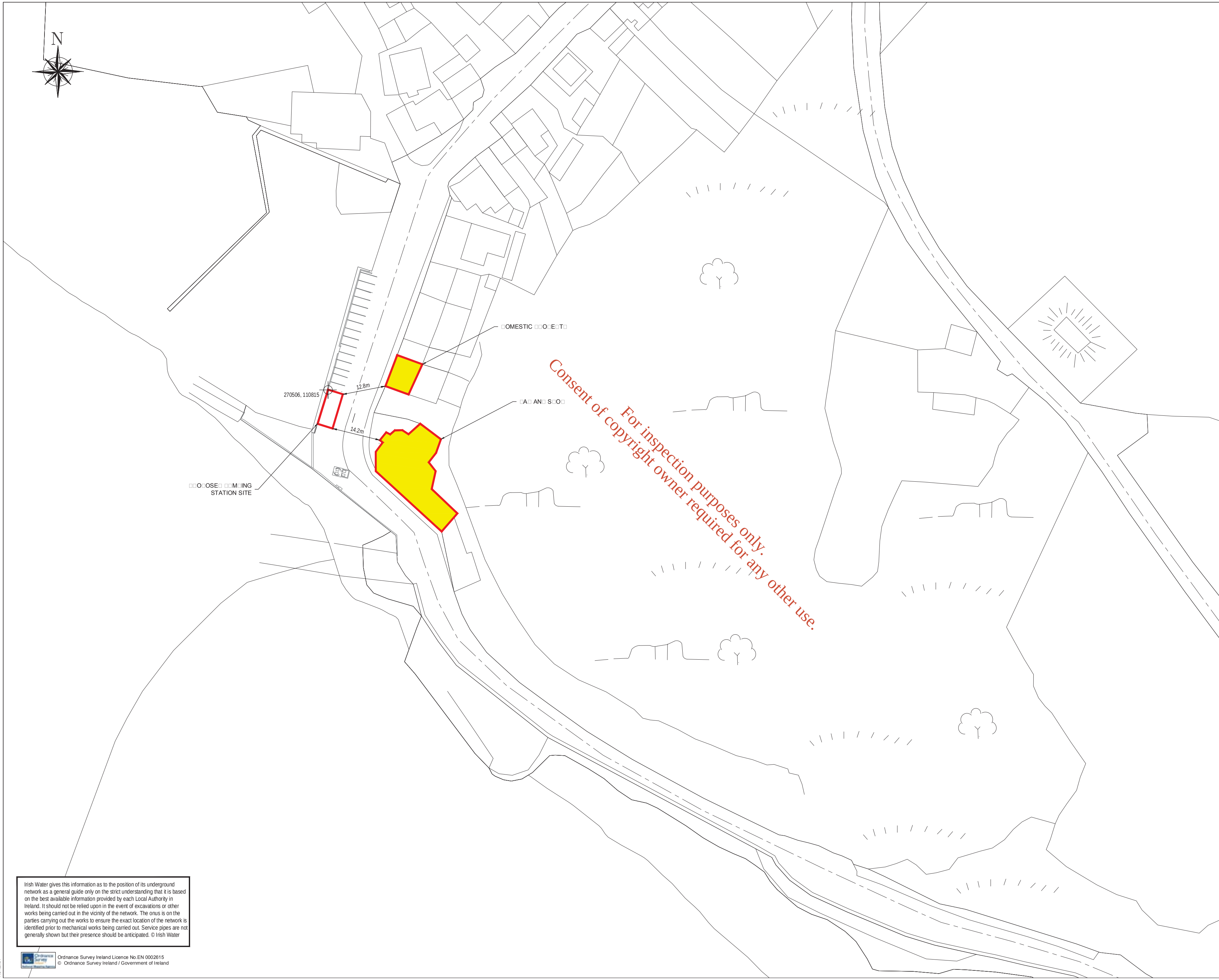

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CONSTRUCTION RISKS

MAINTENANCE / CLEANING RISK

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LEGEND:

NEW SITE

NEAREST SENSITIVE RECEPTORS

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Purpose of issue

PRELIMINARY

Client

UISCE ÉIREANN : IRISH WATER

Project Title

UTAS WEXFORD
ARTHURSTOWN
IW PROJECT No. 10015231

Drawing Title

BALLYHACK
PUMPING STATION
NEAREST SENSITIVE RECEPTORS

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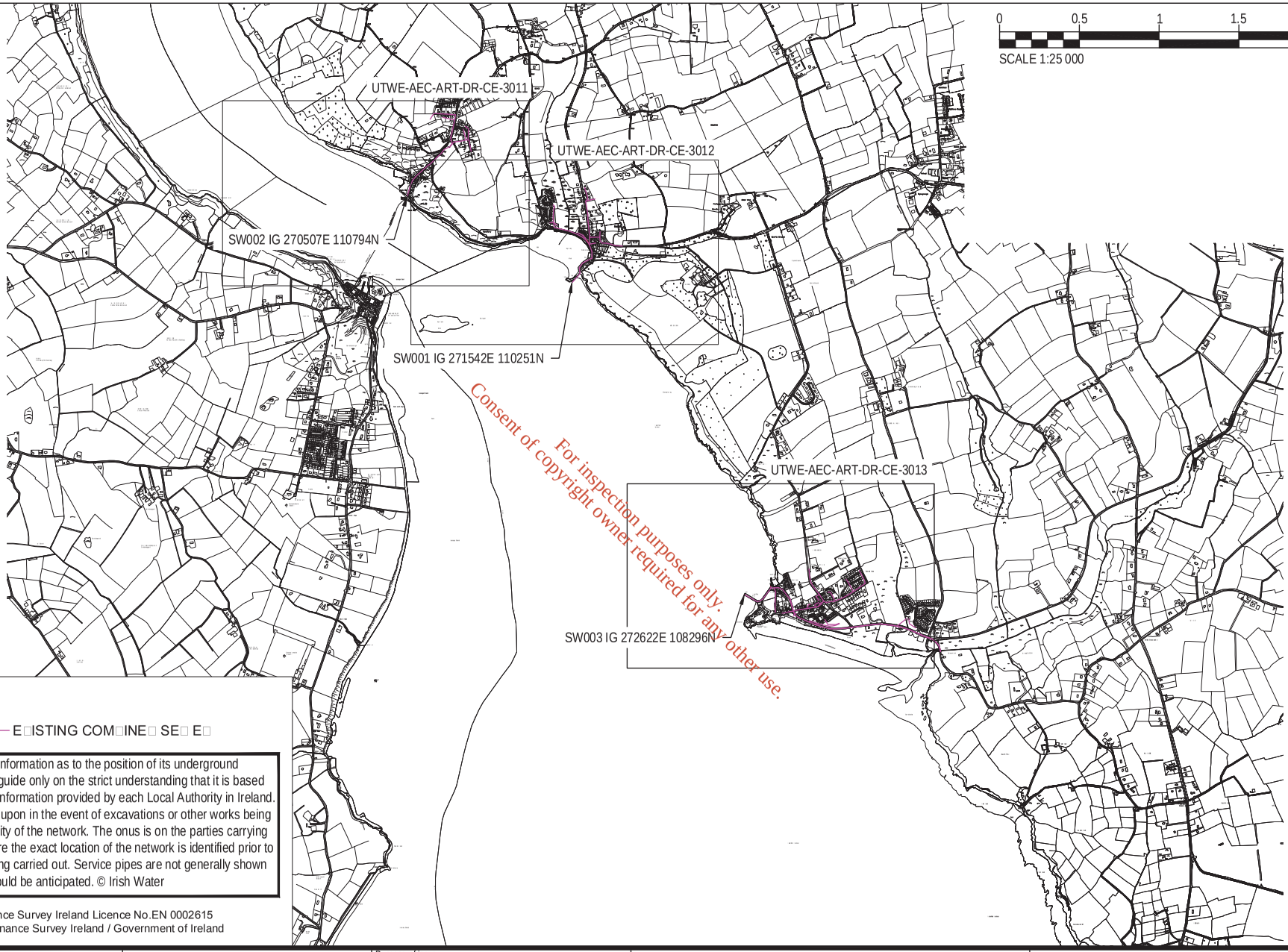

Project Title
ARTHURSTOWN, BALLYHACK AND DUNCANNON SEWERAGE SCHEME

Client
IRISH WATER

Drawing Title
COMBINED STORM WATER OVERFLOW OVERALL LOCATION MAP

Purpose of issue
INFORMATION

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Suitability
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Zone / Mileage

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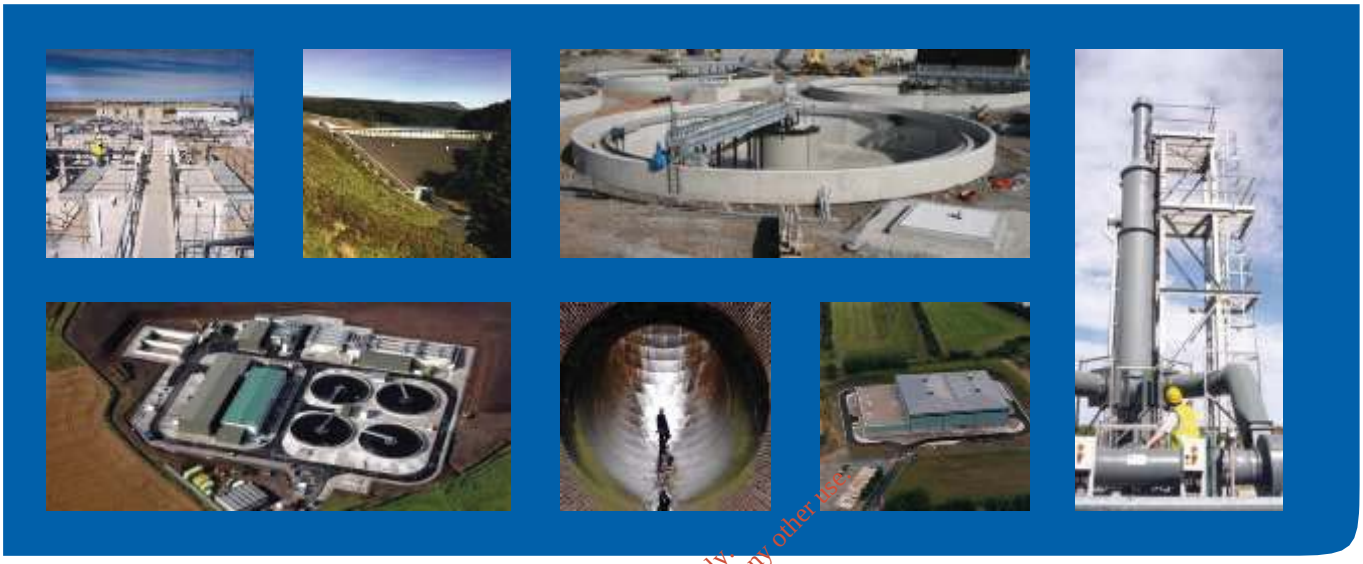
Appendix B

Invasive Species Report



UTAS Wexford Wastewater Consultancy Services
Wexford
Ballyhack/Arthurstown/Duncannon

Invasive Species Report No. 1

August 2017

Rev	Date	Details	Prepared by	Checked by	Approved by
0	August 2017	Invasive Species Report No 1	Nuala Carr Environmental Engineer, JOD	Karl McKenna, Water Sector Lead, Aecom	Ronan Clancy Technical Director, Aecom

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The methodology adopted and the sources of information used by AECOM in providing its services are outlined in this Report. The work described in this Report was undertaken in July 2017 and is based on the conditions encountered and the information available during the said period of time. The scope of this Report and the services are accordingly factually limited by these circumstances.

Where assessments of works or costs identified in this Report are made, such assessments are based upon the information available at the time and where appropriate are subject to further investigations or information which may become available.

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APPENDICES

1.0 INTRODUCTION

1.1 SCOPE

AECOM and Jennings O'Donovan were appointed by Irish Water to progress the Untreated Agglomeration Study (UTAS) Wexford agglomerations (12/085-264) from Gate 2 through to Gate 4 based on the recommendations of each Concept Design Report, in order to bring these sites into compliance with the Urban Wastewater Directive. The project encompasses 4no.sites across County Wexford.

The project objective is to provide the detailed design, procurement and management of wastewater treatment systems capable of providing appropriate treatment for the agglomerations within UTAS Wexford.

Jennings O'Donovan & Partners Limited have been commissioned to carry out an invasive species survey on the various elements of the project. This report is the Invasive Species Report for three of those agglomerations, Ballyhack Agglomeration, Arthurstown Agglomeration and Duncannon Agglomeration.

The locations where works will be carried out were surveyed for the presence of invasive species (as listed in the Third Schedule of S.I. No. 477 of 2011, EC (Birds and Natural Habitats) Regulations 2011). Please refer to Drawing No. UTWE-AEC-ART-DR-CE-0020.

1.2 SITE LOCATION

The study location is defined by the existing and potential future wastewater collection network serving the villages of Arthurstown, Ballyhack and Duncannon in County Wexford. The three villages are located in the southwest of County Wexford and each is adjacent to Waterford Harbour. Ballyhack and Arthurstown are located on the R733. Ballyhack is approximately 20km south of New Ross. Arthurstown is approximately 21km south of New Ross. Duncannon is located on the R737, approximately 24km south of New Ross.

Ballyhack is in the Ramsgate Parish; Duncannon is in the Duncannon Parish, and Arthurstown is in both the Ramsgrange and Duncannon Parishes. All three villages are located in the New Ross electoral ward of Wexford County Council.

The village of Ballyhack is located on the side of a relatively steep hill, with the lower portion of the town running down to meet Waterford Harbour. The village of Arthurstown is located on the shores of Kings Bay, Waterford Harbour. The agglomeration extends from Cois Cuan Housing Estate in the west to Dunbrody Country House in the east. The village of Duncannon is located on the shores of Waterford Harbour.

1.3 SITE DESCRIPTION

As part of the Gate 1 solutions development, it has been agreed that the ultimate solution for the Ballyhack, Arthurstown and Duncannon agglomerations will be delivered on a phased basis allowing for an interim and ultimate solution delivery, as directed by Irish Water.

The proposed works can be summarised in Table 1.1 as follows;

Table 1.1: Summary of scope of works

Arthurstown, Ballyhack and Duncannon Agglomerations	
Gate 2-4 Overview Requirements	
- Treatment Standards: Primary treatment at 1no. location for combined Arthurstown, Ballyhack and Duncannon agglomeration. - Population Equivalent: 10 year design horizon [727 (W), 1875 (S)] and 30 year design horizon [1,035(W), 2,475 (S)] - Network: Ballyhack [1no. foul pumping station and ancillaries, transferring flows to Arthurstown] Arthurstown [1no. foul pumping station and ancillaries, transferring flows to WwTP] Duncannon [1no. foul pumping station and ancillaries, transferring flows to WwTP]	
Interim Preferred Solution to advance to Gate 2	**Ultimate Preferred Solution**
Ballyhack: • Terminal PS with 18m³ storage. • 1350m rising main to convey Ballyhack Formula A flows to the Arthurstown. Arthurstown: • Terminal PS with 43m³ storage. • 415m rising main to convey Arthurstown and Ballyhack Formula A flows to the WwTP. Duncannon: • Terminal PS with 80m³ storage • 1670m rising main to convey Duncannon Formula A flows to Blackhill • 1140m gravity main to convey Duncannon Formula A flows to the WwTP WWTP: • Primary WwTP • 450m terrestrial gravity sewer sized to convey Formula A to the existing outfall.	As per the interim solution with the following inclusion; WWTP: • Tertiary WwTP • 450m terrestrial gravity sewer sized to • convey Formula A to the outfall • 170m gravity sea outfall sewer sized toconvey Formula A to the discharge point.

The interim option is illustrated on Drawing No. UTWE-AEC-ART-DR-CE-0020, please refer to Appendix A.

1.2.1 Ballyhack Requirements

Terminal Pumping Station:

A terminal wastewater pumping station is required. The likely location for the station is shown in Drawing No. UTWE-AEC-ART-DR-CE-0020. Except for the control kiosk (GRP – 1m high x 1m wide), the pumping station will be located entirely below ground. It is envisaged that the pumping station footprint will consist of a circular, 3 metre diameter (approx.) shaft which is 6 metres deep. It is envisaged the shaft will be installed as a concrete caisson. Excavated material will be removed from site.

Gravity Main:

A short gravity main diversion shall be required to divert flows into the pumping station. The existing gravity line runs alongside the proposed site.

Terminal Sewage PS Rising Main:

A 1350-metre-long rising main will be laid from the Ballyhack PS to the Arthurstown sewage network. The rising main will be approximately 90 mm diameter and will be laid approximately 1.2m below existing ground level. All of the rising main will be laid within existing roads. There is no SI at this stage; therefore assume open cut and that excavated material will used for backfill, with surplus being removed from site.

1.2.2 Arthurstown Requirements

Terminal Pumping Station:

A terminal wastewater pumping station is required. The likely location for the station is shown on Drawing No. UTWE-AEC-ART-DR-CE-0020. Except for the control kiosk (GRP – 1m high x 1m wide), the pumping station will be located entirely below ground. It is envisaged that the pumping station footprint will consist of a circular, 3 metre diameter (approx.) shaft which is 7 metres deep. It is envisaged the shaft will be installed as a concrete caisson. Excavated material will be removed from site.

Gravity Main:

A short gravity main diversion shall be required to divert flows into the pumping station. The existing gravity line runs alongside the proposed site.

Terminal Sewage PS Rising Main:

A 415-metre-long rising main will be laid from the Athurstown PS to Site 4. The rising main will be approximately 125 mm diameter and will be laid approximately 1.2m below existing ground level. All of the rising main will be laid within existing roads and laneways. There is no SI at this stage; therefore assume open cut and that excavated material will used for backfill, with surplus being removed from site.

1.2.3 Duncannon Requirements

Terminal Pumping Station:

A terminal wastewater pumping station is required. The likely location for the station is shown in Drawing No. UTWE-AEC-ART-DR-CE-0020. Except for the control kiosk (GRP – 1m high x 1m wide), the pumping station will be located entirely below ground. It is envisaged that the pumping station footprint will consist of a circular, 5 metre diameter (approx.) shaft which is 7 metres deep. It is envisaged the shaft will be installed as a concrete caisson. Excavated material will be removed from site.

Network Diversion:

A short gravity main diversion shall be required to divert flows into the pumping station. The existing gravity line runs alongside the proposed site.

Terminal Sewage PS Rising Main and Gravity Sewer:

A 1670 meter long rising main will be laid from the Duncannon PS to Blackhill. The rising main will be approximately 125 mm diameter and will be laid approximately 1.2m below existing ground level. All of the rising main will be laid within existing roads. There is no SI at this stage; therefore assume open cut and that excavated material will used for backfill, with surplus being removed from site.

The rising main will discharge into a 375mm diameter gravity sewer. The gravity sewer will extend between the rising main discharge point and Site 4. This sewer will be 1140m and approximately 375 mm diameter. The sewer will be laid approximately 2.5m below existing ground level and will be located in fields. There is no SI at this stage; therefore assume open cut and that excavated material will used for backfill, with surplus being removed from site

1.2.4 Wastewater Treatment Plant

The location of the proposed WwTP site is shown on Drawing No. UTWE-AEC-ART-DR-CE-0020. Detailed drawings have not been developed at this stage of the scheme. Construction is likely to be open-cut i.e. no cofferdam required. Excavated materially will be retained on site and used for screening/mounding. The following is a summary of what will be included at the site.

Inlet Works

- Required earthworks, formwork and concrete.
- Incoming, outgoing pipework and associated chambers.
- Inlet channel with FFT flume, overflow and associated penstocks.
- 6mm mechanically raked inlet screen.
- Screenings handling unit.
- Use of final effluent as washwater.
- Bypass channel with 12mm manually raked screen.
- Associated control equipment, testing and commissioning.

Primary Settlement

- Required earthworks, formwork and concrete.
- Incoming, outgoing pipework and associated chambers.
- 3 no. pyramidal prefabricated primary settlement tanks each providing a volume of 27m³.
- Desludging valves and pipework.
- Associated control equipment, testing and commissioning.

Sludge Handling

- Rectangular sludge holding tank providing 139m³ of storage.
- Required earthworks, formwork and concrete.
- Incoming, outgoing pipework and associated chambers.
- Sludge tank mixers.
- Associated control equipment, testing and commissioning.

Storm Handling

- Circular storm tank providing 122m³ of storage
- Required earthworks, formwork and concrete.
- Incoming, outgoing pipework and associated chambers.
- Storm tank mixer.
- Testing and commissioning.

Miscellaneous

- Site clearance.
- Road to the site – 200m long x 5m wide
- Road within the site – 65m x 4.5m wide, with three number legs – 15m x 4.5m wide.
- Watermain to the site and within the site.
- Water supply break tank.
- Control kiosk

Pumping Stations

- Sludge pumping station.
- Storm return pumping station.
- Wastewater booster set.
- Final effluent washwater booster set.
- Control kiosk
-

2.0 METHODOLOGY

2.1 INVASIVE SPECIES LIST

Each area was surveyed in detail to determine the presence of non-native species included in the Third Schedule of S.I. No. 477 of 2011, EC (Birds and Natural Habitats) Regulations 2011. (Please refer to Appendix A).

2.2 SITE VISIT

A site visit was undertaken on July 13th, 2017. All elements of the project were walked to identify any invasive species. Please refer to Drawing No. UTWE-AEC-ART-DR-CE-0020. Where non-native invasive species were identified, the distribution of the species was mapped as accurately as possible.

3.0 RESULTS

Ballyhack

No invasive species were recorded along the pipeline route or at the pumping station site in Ballyhack.

Arthurstown

Japanese knotweed (*Fallopia japonica*) was recorded in one location, on the eastern side of the access road to the wastewater treatment plant, in Arthurstown. Rhododendron

(*Rhododendron ponticum*) was also recorded along the access road. Please refer to Drawing No. UTWE-AEC-ART-DR-CE-0070 for locations of the invasive species.

Duncannon

Rhododendron was recorded along the existing access road in Dunbrody Estate, at the first junction.

4.0 RECOMMENDED CONTROL MEASURES DURING CONSTRUCTION

4.1 GOOD SITE HYGIENE

It is important to make sure that the site is not contaminated by fresh invasive species listed on Schedule 3 of the S.I.477 of 2011, or the parts of the site previously unaffected by Schedule 3 invasive species (i.e. Japanese knotweed) do not become contaminated. To maintain good site hygiene, the following are best practice avoidance measures to help contain (and in some cases prevent the introduction of) invasive species infestation on a site:

- Understand the possible extent of the rhizome system underground – up to 7 metres horizontally and 3 meters vertically (i.e. Japanese knotweed).
- Where possible fence off or clearly mark infested area including the extent of the rhizome system underground.
- Do not use machinery with tracks within an infested area, if possible.
- Clearly identify and mark out areas where contaminated soil is to be stockpiled on site and cannot be within 50m of any watercourse or within a flood zone.
- Creation of entry and exit points for operators on foot and for small mobile equipment. A delineated access track to be maintained free of Japanese knotweed should be established through the site to minimise the spread of Japanese Knotweed by permitted vehicles accessing the site.
- Installation of a dedicated footwear & vehicular wheel wash down facility into a contained area within the site.
- Vehicles leaving the site should be inspected for any plant material and washed down into a contained area.
- Vehicles used in the transport of contaminated material will need to be visually checked and washed down into a contained area before being used for any other work, either on the same site or at a different site.
- Material gathered in dedicated wash down contained areas will need to be appropriately treated along with other contaminated soil on site.
- For any material entering the site, the supplier must provide an assurance that it is free of any invasive species listed on the Schedule 3 of the S.I.477 of 2011 (i.e. Japanese knotweed).

- Ensure all site users are aware of measures to be taken and alert them to the presence of the Site Management plan for invasive species.

4.2 AVOIDING NEW CONTAMINATION TO THE SITE

The three most common ways a site can become infected are:

1. **Infested topsoil:** There have been numerous incidence where site owners have paid to remove Japanese knotweed infested soil from their site, only to introduce it again with topsoil they have bought and not inspected.

   BS 3882:2007 'The British Standard Specification for topsoil and requirements for use' states that the supplier shall exercise diligence to avoid the spread of Japanese knotweed and other pernicious or injurious weeds. You should always inspect topsoil brought into the site. You can often get topsoil from different sources. Ideally, you should inspect these sources before you receive material on site. You should use topsoil from different sources within distinct areas of the site and keep a record of this. This may help you with compensation claims against the supplier, should Japanese knotweed subsequently grow. If you have any evidence that sub-standard topsoil is being sold, you should let the local Trading Standards Office know.

2. **Contamination on vehicles:** You should inspect vehicles before using them on site you need to pay particular attention to caterpillar tracks and where trucks and dumpers are stowed.

3. **Fly-tipping**: Most Japanese knotweed infestations on development sites started as a result of fly-tipped waste and often continues after the development has started.

More information on Japanese knotweed can be found in Irish Waters Information and Guidance Document on Japanese knotweed, to minimise potential impacts from Japanese knotweed on Irish Water Projects, please refer to Appendix B.

4.3 MANAGEMENT OPTIONS FOR JAPANESE KNOTWEED

There is an extensive body of literature on control of this species including the NRA Guidelines on The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads (2008) and Best Practice Management Guidelines Japanese knotweed (*Fallopia japonica*) (2008) prepared for the Northern Ireland Environment Agency (NIEA) and the National Parks and Wildlife Service (NPWS) as part of Invasive Species Ireland.

The EU Regulation (No.1143/2014) on invasive alien species entered into force on 1st January 2015. This Regulation seeks to address the problem of invasive alien species in a comprehensive manner so as to protect native biodiversity and ecosystem services, as well as to minimize and mitigate the human health or economic impacts that these species can have.

The Regulation foresees three types of interventions: prevention, early detection and rapid eradication, and management.

Due to its invasive nature, knotweed control has been the subject of considerable research and investigation. The primary objective of control should be total eradication by targeting the underground rhizome and not simply the aerial parts. Knotweed is highly invasive and extremely difficult to eradicate.

The approach to control will depend on several factors including the scale of infestation, the topography and terrain of the site, the proximity to watercourses or other sensitive receptors (such as protected flora) and the funds available. Current control measures are limited to a combination of physical and chemical means and chemical means alone. It should be noted that the use of physical methods on their own are extremely unlikely to control knotweed.

As knotweed roots can extend up to 7m horizontally (and up to 3m in depth) from the nearest growth, it is vital to map the distribution of the species accurately. The extent of the rhizomes should be mapped by digging a series of test pits.

It should be noted that all control measures will require follow up monitoring for a minimum of 2 growing seasons, such that complete eradication is achieved.

A combination of physical and chemical treatments tend to be more effective than chemical treatments alone. A combination of digging and spraying is effective in reducing the time needed for chemical control. By digging and breaking up the rhizome, the aim is to stimulate leaf production leaving the plant more vulnerable to treatment with chemical control measures. A number of chemicals have been found to be effective against the plant, however, many of these are undesirable due to their non-selective nature, persistence or toxicity to aquatic ecosystems. More information on Japanese knotweed can be found in the Environment Agency (EA) Japanese knotweed Code of Practice. The National Biodiversity Centre Factsheets (NBDC) for Japanese knotweed can be found on the NBDC website (http://www.biodiversityireland.ie).

A summary of physical and chemical control measures for Japanese knotweed are listed in Table 4.1 below:

Table 4.1: Summary of Management Options for Japanese knotweed.

Physical and Chemical Control-Combined Treatment Method		
Method	**Season**	**Follow-up**
Combined digging and spraying.	Digging can take place in winter, chemical control as described below.	Chemical control may be required over five years.
Cut and inject technique.	Late October or November.	Chemical control may be required over five years.
Physical and Chemical Control		
Method	**Season**	**Follow-up**
Chemical control followed by excavation.	Chemical control when non-persistent herbicide is 'active'. Excavation two weeks later.	Monitor site of excavation regularly.
'Deep burial'.	Following excavation.	Monitor site of burial regularly.
'Disposal to landfill'	Following excavation.	N/A.
Chemical Control		
Method	**Season**	**Follow-up**
Glyphosate-based Plant Protection Product.	May and late September/early October.	Chemical control may be required over five years.
2,4-D Amine-based Plant Protection Product.	May and late September/early October.	Chemical control may be required over five years.

5.0 CONCLUSION

The optimum time to treat Japanese knotweed by chemical control is late September/early October. It is recommended that treatment of Japanese knotweed is commenced this season, prior to construction, such that the optimal result can be obtained from the treatment.

It is recommended that a second round of invasive species survey be carried out at a suitable time, prior to any works starting on site, in order to map the full extent of growth and areas affected. Where it is not possible to re-route pipelines away from affected areas, a Japanese knotweed Management Plan will be required, which will determine the most appropriate control measures to eradicate this species. This management plan should include all provisions for site hygiene and appropriate disposal of contaminated soil and subsoil.

To reduce the potential for Japanese knotweed to impact on construction projects it is recommended that Japanese knotweed / Invasive Species surveys are incorporated into the Irish Water Project Gate Approvals Structure as follows:

- **Gates 1 to 2:** During preliminary design and optioneering of sites and routes it is recommended that Japanese knotweed / Invasive Species surveys are undertaken and factored into the route and site selection process.

- **Gates 2 to 3:** During the planning and detailed design process, it is recommended that detailed Japanese knotweed / Invasive Species surveys are undertaken along selected routes and sites. If Japanese knotweed / Invasive species are present, then a detailed Japanese knotweed / Invasive Species Management Plan will be required for Schedule 3 of the S.I.477 of 2011 invasive species only (i.e. Japanese knotweed), and should be incorporated into the relevant Construction Contract Documents. Re-survey and updating of Japanese knotweed / Invasive Species Management Plan will be required should a period of two years pass between original detailed survey and project tendering process.

- **Gates 3 to 4:** During construction, it is essential that the Japanese knotweed / Invasive Species Management Plan is implemented in full. Should new Japanese knotweed / Invasive Species infestations be recorded during the construction process then the appropriate measures should be identified immediately and the Management Plan updated accordingly to reduce potential for impact on construction contract.

Please refer to Irish Water's Information and Guidance Document on Japanese knotweed to minimise potential impacts from Japanese knotweed on Irish Water Projects, found in **Appendix C**.

DRAWINGS

Drawing No. UTWE-AEC-ART-DR-CE-0020

Drawing No. UTWE-AEC-ART-DR-CE-0070

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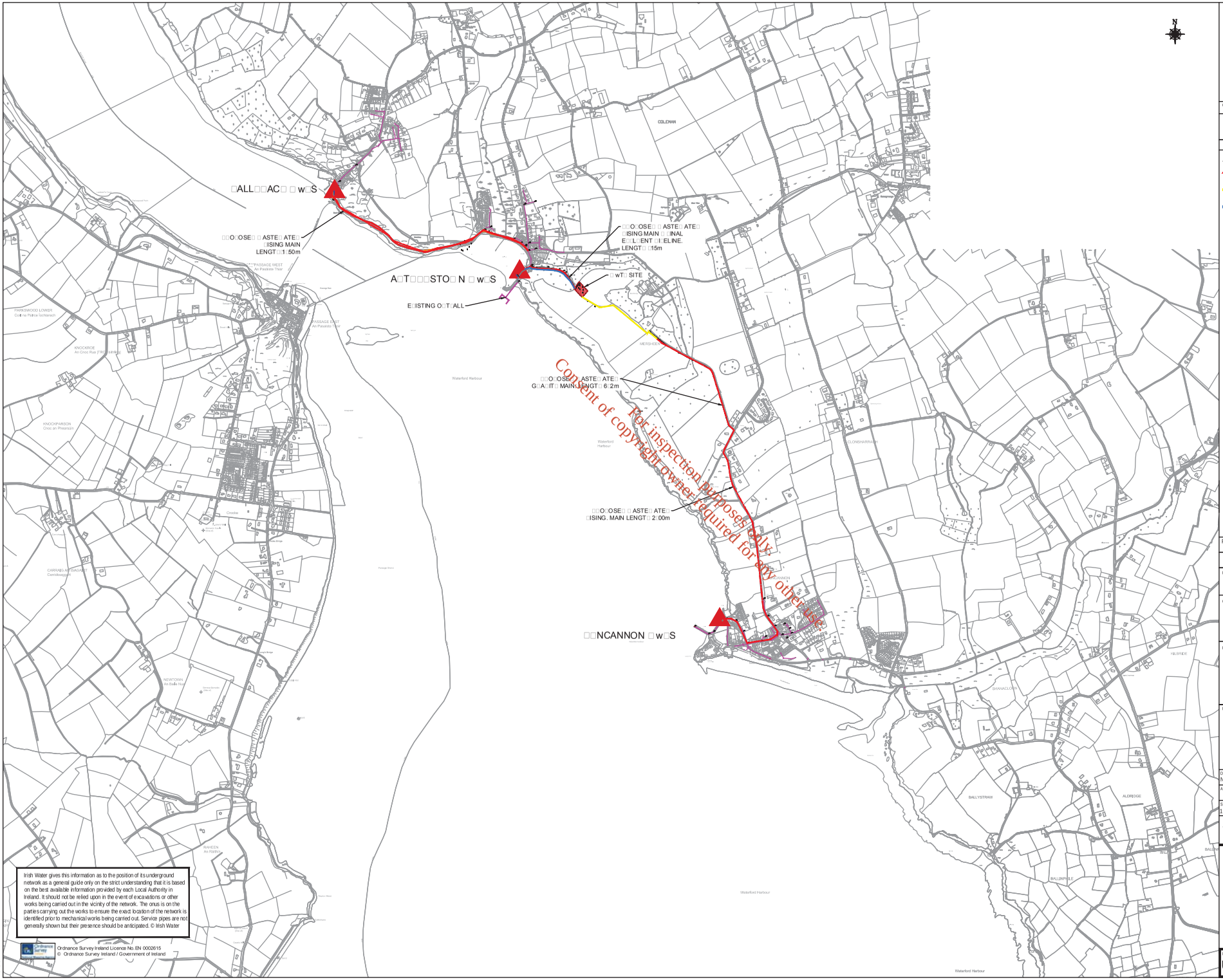

Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland. It should not be relied upon in the event of excavations or other works being carried out in the vicinity of the network. The onus is on the parties carrying out the works to ensure the exact location of the network is identified prior to mechanical works being carried out. Service pipes are not generally shown but their presence should be anticipated. © Irish Water

CONSTRUCTION RISKS	MAINTENANCE / CLEANING RISK	DEMOLITION RISKS

In addition to the hazard/risks normally associated with the types of work detailed on this drawing take note of above. It is assumed that all works on this drawing will be carried out by a competent contractor working, where appropriate, to an appropriate method statement.

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION BOX

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PRELIMINARY	NMcE / AM	06/07/17	P0	
Revision Details	By / Check	Date	Suffix	

Purpose of Issue: PRELIMINARY

Client: UISCE ÉIREANN WATER

Project Title:
UTAS WEXFORD
ARTHURSTOWN
IW PROJECT NO. 10015231

Drawing Title:
ARTHURSTOWN
SCHEME LAYOUT

Designed	Drawn	Checked	Approved	Date
NMcE	NK	AM	AB	JULY 2017

AECOM Internal Project No.

Scale @ A1: 1:10000

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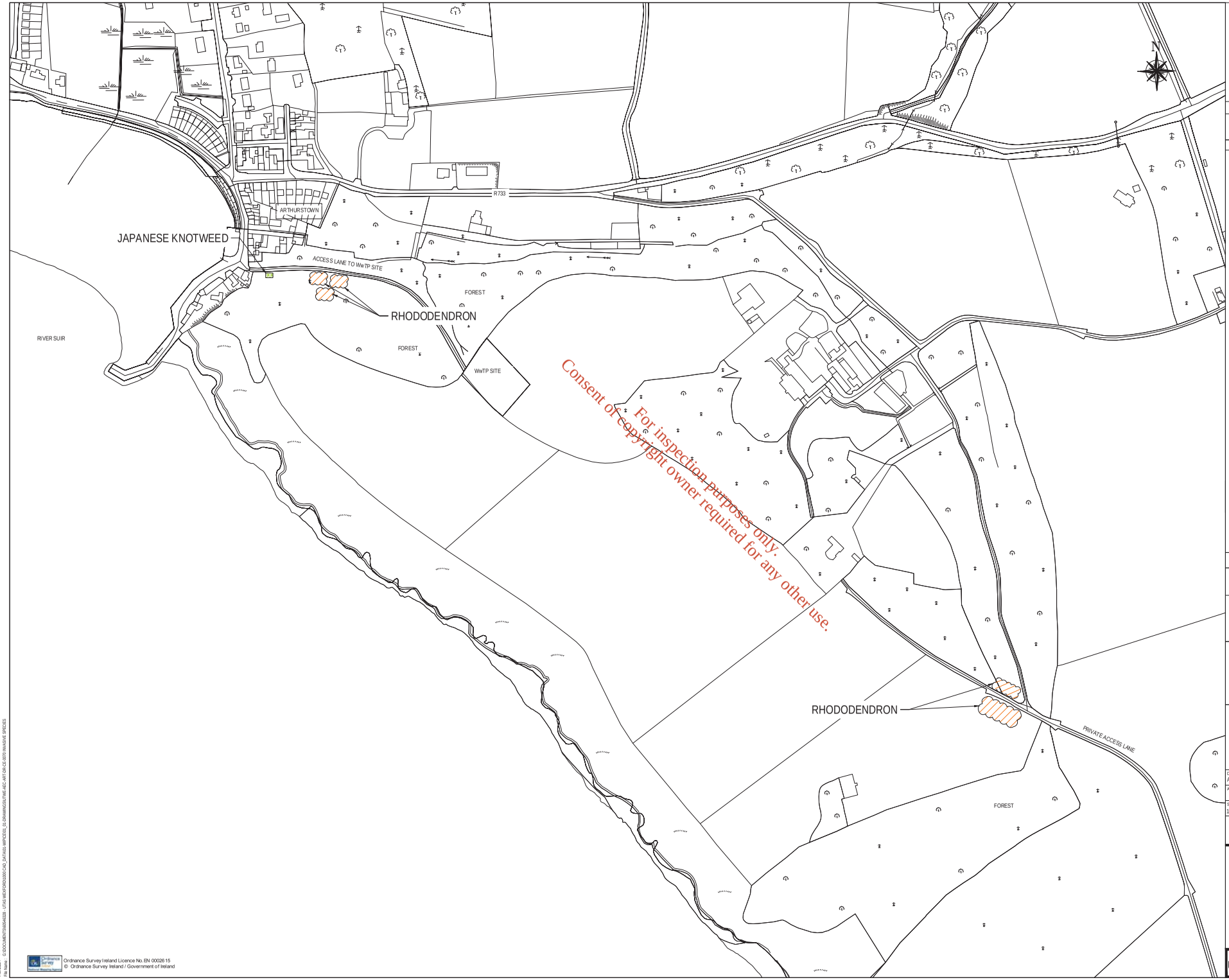
File Name: G:\DOCUMENTS\PROJECTS\UTAS WEXFORD\0000 CAD_DATA\01-WIP\CIVIL\UTWE-AEC-ART-DR-CE-0020 SCHEME LAYOUT



CONSTRUCTION RISKS	MAINTENANCE / CLEANING RISK	DEMOLITION RISKS

In addition to the hazard/risks normally associated with the types of work detailed on this drawing take note of above, it is assumed that all works on this drawing will be carried out by a competent contractor working, where appropriate, to an appropriate method statement.

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION BOX

LEGEND:

RHODODENDRON

JAPANESE KNOTWEED

Revision Details	By / Check	Date	Suffix

Purpose of issue: INFORMATION

Client: UISCE ÉIREANN / IRISH WATER

Project Title:

UTAS WEXFORD
ARTHURSTOWN
IW PROJECT NO.10015231

Drawing Title:

ARTHURSTOWN
INVASIVE SPECIES

Designed	Drawn	Checked	Approved	Date
AM	NK	AM	NC	JULY 2017

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Rev: P0

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APPENDIX A

S. I. 477 of 2011 Third Schedule

140 **[477]**

THIRD SCHEDULE

Non-native species subject to restrictions under *Regulations 49 and 50*

Part 1: PLANTS

First column	Second column	Third column
Common name	Scientific name	Geographical application
American skunk-cabbage	*Lysichiton americanus*	Throughout the State
A red alga	*Grateloupia doryphora*	Throughout the State
Brazilian giant-rhubarb	*Gunnera manicata*	Throughout the State
Broad-leaved rush	*Juncus planifolius*	Throughout the State
Cape pondweed	*Aponogeton distachyos*	Throughout the State
Cord-grasses	*Spartina* (all species and hybrids)	Throughout the State
Curly waterweed	*Lagarosiphon major*	Throughout the State
Dwarf eel-grass	*Zostera japonica*	Throughout the State
Fanwort	*Cabomba caroliniana*	Throughout the State
Floating pennywort	*Hydrocotyle ranunculoides*	Throughout the State
Fringed water-lily	*Nymphoides peltata*	Throughout the State
Giant hogweed	*Heracleum mantegazzianum*	Throughout the State
Giant knotweed	*Fallopia sachalinensis*	Throughout the State
Giant-rhubarb	*Gunnera tinctoria*	Throughout the State
Giant salvinia	*Salvinia molesta*	Throughout the State
Himalayan balsam	*Impatiens glandulifera*	Throughout the State
Himalayan knotweed	*Persicaria wallichii*	Throughout the State
Hottentot-fig	*Carpobrotus edulis*	Throughout the State
Japanese knotweed	*Fallopia japonica*	Throughout the State
Large-flowered waterweed	*Egeria densa*	Throughout the State
Mile-a-minute weed	*Persicaria perfoliata*	Throughout the State
New Zealand pigmyweed	*Crassula helmsii*	Throughout the State
Parrot's feather	*Myriophyllum aquaticum*	Throughout the State
Rhododendron	*Rhododendron ponticum*	Throughout the State
Salmonberry	*Rubus spectabilis*	Throughout the State
Sea-buckthorn	*Hippophae rhamnoides*	Throughout the State
Spanish bluebell	*Hyacinthoides hispanica*	Throughout the State
Three-cornered leek	*Allium triquetrum*	Throughout the State
Wakame	*Undaria pinnatifida*	Throughout the State
Water chestnut	*Trapa natans*	Throughout the State
Water fern	*Azolla filiculoides*	Throughout the State
Water lettuce	*Pistia stratiotes*	Throughout the State
Water-primrose	*Ludwigia* (all species)	Throughout the State

APPENDIX B

Irish Water-Information and Guidance Document on Japanese knotweed

(IW-AMT-SOP-009)

UISCE ÉIREANN : IRISH WATER	**Revision:** 1.0	**Approved by:** John Casey
IW-AMT-SOP-009	**Information and Guidance Document on Japanese knotweed**	

Irish Water Report

Information and Guidance Document on Japanese knotweed
Asset Strategy and Sustainability

Contents

1.0 Purpose and Scope of This Document

The purpose of this document is to provide information to Irish Water staff on the invasive plant species Japanese knotweed (*Fallopia japonica*). It is intended that these guidelines will provide answers to the following questions;

- What is Japanese knotweed?
- Why does Irish Water need to be concerned with Japanese knotweed?
- How to identify Japanese knotweed?
- What are the management options available for the control of Japanese knotweed?
- What is a Japanese knotweed Management Plan?
- What are the management options proposed by Irish Water for the control and/or treatment of Japanese knotweed?
- Who to contact in Irish Water for further information/guidance on Japanese knotweed?

Note 1: It should be noted that the scope of these guidelines extends to Irish Water sites only. Irish Water sites are defined for the purposes of these guidelines as follows;

- Any Irish Water owned site e.g. water treatment plants, wastewater treatment plants.

- Any Irish Water construction site e.g. construction of treatment plants or associated infrastructure, extension to, maintenance of, or alteration of existing Irish Water assets including the distribution and collection networks.

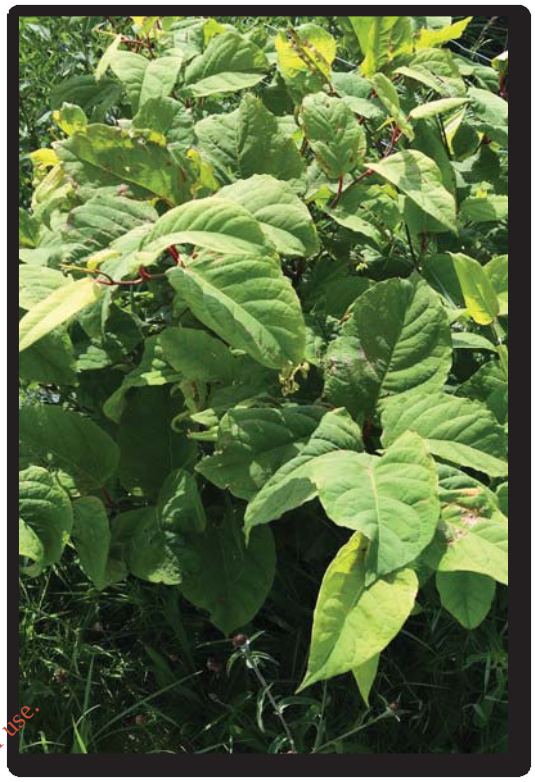
2.0 What is Japanese knotweed ?

Native to Japan, Taiwan, and Northern China, Japanese knotweed *(Fallopia japonica*) was introduced to the Kew Gardens (UK) in 1825 and to Ireland later in the 19th Century. It was introduced into large demesne estates as an ornamental garden plant due to its spectacular foliage and attractive white flowers and also as an animal fodder plant. It has since spread beyond the confines of cultivated gardens where it now grows along watercourses, waste grounds and transport corridors. Refer to **Images 2.1-2.3.**

The major problem with this non-native perennial herbaceous weed is its ability to disperse by plant fragments and to colonise and invade disturbed land and riverine habitats. It has an ability to grow through the edge of asphalt, walls, floors, foundations and footpaths. The rhizomes can form an extensive underground network extending several metres (up to 7m) from the above ground plant material and going down deep into the soil (depending on ground conditions). The rhizomes have been shown to be viable 3m below ground in disturbed conditions. However, most rhizomes are in the top 0.25m of the soil.

Japanese knotweed is classified as an invasive alien species which can be defined as *"an alien species whose introduction and/or spread threatens biodiversity*" *(CBD Decision V1/23).* Invasive non-native alien species are so-called as they typically display one or more of the following characteristics or features: (1) prolific reproduction through seed dispersal and/or re-growth from plant fragments; (2) rapid growth patterns; and, (3) resistance to standard weed control methods.

Where a non-native species displays invasive qualities and is not managed it can potentially: (1) outcompete native vegetation, affecting plant community structure and habitat for wildlife; (2) cause damage to infrastructure including road carriageways, footpaths, pipe networks, walls and foundations; and, (3) have an adverse effect on landscape quality through a loss of naturalness, aesthetics and regional identity (refer to **Section 3**).



Images 2.1 and 2.2 **Japanese knotweed growth on a roadside verge in the month of July**

Image 2.3 **Japanese knotweed flowering in August**

3.0 Why does Irish Water need to be concerned with Japanese Knotweed?

3.1 Legal Implications

At an international level Ireland has signed up to a number of treaties and conventions, including the **Convention on Biological Diversity.** Such treaties and conventions require the Irish Government to address issues of invasive alien species. This has been implemented through **the Wildlife Act 1976 and 2000** and further regulated through **the European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477).**

Articles 49 and 50 of these regulations set out the legal implications associated with alien invasive species and Schedule 3 of the regulations lists Japanese knotweed as a non-native species subject to the restrictions of articles 49 and 50.

Under Article 49 and 50 of these Regulations it is an offence to;

- Plant, disperse, allow dispersal or cause the spread of Japanese knotweed,
- Keep the plant in possession for the purpose of sale, breeding, reproduction, propagation, distribution, introduction or release,
- Keep anything from which the plant can be reproduced or propagated from without a granted licence,
- Keep any vector material, in this case soil or spoil taken from a Japanese knotweed contaminated site, for the purposes of breeding, distribution, introduction or release.

3.1.1 Irish Water Biodiversity Policy

Within the Irish Water Biodiversity Policy are specific policies which relate to the management of invasive alien species such as Japanese knotweed, and include:

- Where Invasive Alien Species are present on sites owned or managed by Irish Water, invasive species management plans will be developed and implemented in accordance with the relevant environmental legislation; and
- All Contractors carrying out works on behalf of Irish Water will ensure that Invasive Alien Species are not transferred through contaminated materials and equipment.

Japanese knotweed is considered to be one of the most problematic invasive alien species in Ireland. The impacts that this plant can have and is having in Ireland can be considered at two levels. The first level relates to the primary impacts that the presence and spread of this plant can have, see **Section 3.1** below. The second relates to the impacts resulting from having to manage and treat Japanese knotweed on a site, secondary impacts, see **Section 3.2** below. Both levels of impacts have potential implications for Irish Water and its operations.

3.1 Primary Impacts

3.2.1 Biological Diversity

Plants within their native range are usually controlled by a variety of natural pests and diseases. When these plants are introduced into new areas that are free from these pests and diseases, they can become larger and more vigorous. Japanese knotweed has a prolific and dense growth habit and is free from and resistant to native pests and diseases in Ireland and Europe.

During establishment, the species becomes very competitive with native herbaceous and juvenile woody plants, reducing species diversity. Once established the dense canopy and aggressive nature of the plant essentially excludes other species. If the species establishes along riparian corridors it will result in the exclusion of native species that function to maintain bankside stability along rivers. In the winter when the plant dies back the river banks are left bare and vulnerable to erosion, which can result in sedimentation of the receiving watercourses.

3.2.2 Structures

In addition to having a significant impact on the natural environment, Japanese knotweed can also have a wide ranging impact on the human environment. Owing to its aggressive and persistent growth, Japanese knotweed is capable of growing through concrete and tarmac which can cause structural damage to infrastructure and raise health and safety issues, with a potential long term legacy owing to its persistence.

3.2.3 Waterways

Growth of the plant along waterways can have an impact on natural and manmade flood defences resulting in the increased risk of future flooding. Other water related structures, including dams, could also be structurally affected by the presence of this species.

3.2.4 Transport Corridors

Its growth along transport corridors can result in loss of sight lines particularly during the growing season. Structural damage to road surfaces and railway lines can also result from the presence and spread of Japanese knotweed. In addition, structural damage could also occur to Irish Water assets which are adjacent to or within the transport corridor, e.g. Irish Water distribution and collection networks.

3.3 Secondary Impacts

3.3.1 Waste Management

The Waste Management Act 1996, as amended and associated regulations must be complied with if deciding to move Japanese knotweed contaminated material off site. To this end it will be required to dispose of this material to a fully licenced waste facility, capable of accepting such contaminated material.

The requirement to dispose of this material to a licenced facility will apply to all Japanese knotweed material including untreated and treated plant material. It also applies to soil containing the plant material, i.e. a 7m radius around the above ground stand and up to 3m deep below the stand. In addition to this, if the Japanese knotweed material to be disposed of at a licenced waste facility has been treated through chemical means (refer to Section 5 for further details) it will need to be classified as hazardous waste and transported and disposed to a fully licenced hazardous waste facility in accordance with Waste Collection Permit Regulations (S.I. No.820/2007 & Amended SI.No.87/2008) and European Communities (Shipments of Hazardous Waste exclusively within Ireland) Regulations, S.I. No.324/2011.

Furthermore, if Japanese knotweed contaminated material is removed off site it will require a licence from the National Parks and Wildlife Service in advance of any removal, in accordance with the European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477).

Therefore, if at all possible, it is strongly recommended that Japanese knotweed is treated and managed *in-situ*, avoiding any need to move contaminated material off site. Please refer to Section 5 on methods to treat and control Japanese knotweed *in-situ*.

For burial of contaminated material on site, the provisions of the Waste Management Act 1996 as amended requiring a waste license, permit or registration certificate must also be considered and complied with. Under Article 11 of the Waste Management (Facility Permit and Registration) Regulations 2007 (amended by SI 86 of 2008) the EPA can be requested for its view on whether a waste license, waste permit or registration certificate is required.

3.3.2 Cost and Time Delays

It is clear from **Sections 3.1** and **3.3.1** that the presence of Japanese knotweed on a site can have significant cost implications in order to be compliant with the Irish Water Biodiversity Policy and the relevant Environmental and Waste Legislation.

Additional cost implications can result from the presence of Japanese knotweed on a site, particularly where construction is taking place. The requirement to treat this plant on site in order to manage it could result in delays to project programmes with the associated cost implications (please refer to **Section 5** for treatment options available).

Table 3.1 summarizes the impacts both primary and secondary that may result from the presence of Japanese knotweed on an Irish Water site.

Table 3.1 Potential Impacts due to the Presence of Japanese knotweed on Irish Water Sites.

Impact	Details	Implications for Irish Water (IW)
Legislation & IW Policy	Articles 49 & 50 of SI 477, 2011, must be complied with. Irish Water Biodiversity Policy must be implemented.	- IW could be found guilty of offences set out in legislation. - Cost implications for IW. - Public image implications for IW.
Biological Diversity	Displacement and loss of native habitats and species. Sedimentation of watercourses and fish spawning habitats.	- Loss of native habitats and species on IW sites. - At odds with IW Biodiversity and Sustainability policies and practices.
Structures	Structural damage to infrastructure and health and safety issues with a potential long term legacy.	- Damage to IW assets. - H & S issues. - Damage to infrastructure not owned by IW with resulting liabilities.
Waterways	Impact on natural and manmade flood defences.	- Damage to IW assets including dams. - H & S issues. - Damage to infrastructure not owned by IW with resulting liabilities.
Transport Corridors	Potential loss of sight lines and structural damage to road surfaces and railway lines. Structural damage could also occur to Irish Water assets which are adjacent to or within the transport corridor.	- Damage to IW assets, e.g. distribution and collection networks. - H & S issues. - Damage to transport routes not owned by IW with resulting liabilities.
Waste Management	Compliance with the Waste Management Act 1996, as amended and all related regulations. Compliance with the Birds and Natural Habitats Regulations 2011 (SI 477).	- Cost implications associated with the proposed management and disposal of Japanese knotweed form IW sites e.g. Landfill levy's, transport etc.
Cost & Time	Certain treatment methods may	- Time and cost implications for IW

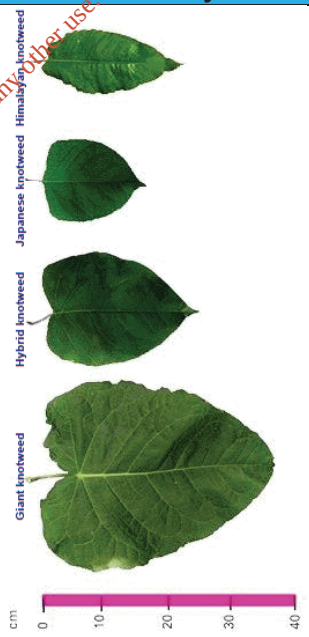
Impact	Details	Implications for Irish Water (IW)
Delays	require cessation of or limit the area of construction works on site.	capital works, minor works and routine maintenance to assets. - Cost of developing and implementing a Japanese knotweed Site Specific Management Plan.

4.0 How to Identify Japanese Knotweed ?

This section of the guidelines provides a general background to the ecology of Japanese knotweed . Guidance is also provided on how to identify this plant in its various states throughout the seasons.

There are three species of the Knotweed family found in Ireland. The most common of these is the Japanese knotweed (*Fallopia japonica*). The remaining two species are the Giant knotweed (*Fallopia sachalinensis*) and a hybrid knotweed plant – Bohemian knotweed (a cross breed of Japanese knotweed and Giant knotweed) which are also known to grow in Ireland although less common than the Japanese knotweed. All three species are described in **Table 4.1** for comparitive purposes, though in some circumstances precise identification can be a challenge. The management options prescribed in this guidance document should therefore also be applied to occurances of Giant knotweed and Hybrid knotweed.

Table 4.1 Species of Knotweed Family in Ireland

Latin Name	Common Name	Note	Depiction of the leaves of the Knotweeed Family
Fallopia japonica	Japanese knotweed	Grows up to 3 metres high with leaves up to 12cm in length	 **Source:** http://www.cornwallweedcontrol.co.uk
Fallopia sachalinensis	Giant knotweed	Grows up to 3 metres high with leaves up to 30cm in length	
Fallopia x bohemica	Hybrid knotweed	Mix of Japanese and Giant knotweed	

Japanese knotweed is a perennial plant (lives for more than two years). In Ireland it is only female Japanese knotweed plants that exist and while they can produce seeds they are rarely viable. Instead the plant spreads by way of a rhizome or underground stem system. Cut stems of growing plants can also produce new shoots and rhizomes when buried in soil or immersed in water. It is only when cut stems are allowed to dry out thoroughly that no further regeneration will occur in this way. However the rhizomes or underground stem material can remain dormant for up to 20 years.

The shoots of a Japanese knotweed plant appear in early spring and have a distinctive red stem and the leaves typically resemble the mature plant (see **Table 4.2** for details). The Japanese knotweed plant grows to approximately three metres in height and has hollow bamboo like stems that are a green with specks of red/purple colour. The growing off-shoots from the main stem are a distinctive red colour.

The leaves of the plant grow to the size of a human hand (7-12cm in length) and have a heart shape with a square cut base. The leaves grow in a distinctive zig-zag pattern. The plant flowers between late June and August producing a yellow cream flower, and grow from the point at which the leave grows from the stem. In winter time the plant dies back leaving only the bamboo like stems, which turn brown/orange in colour.

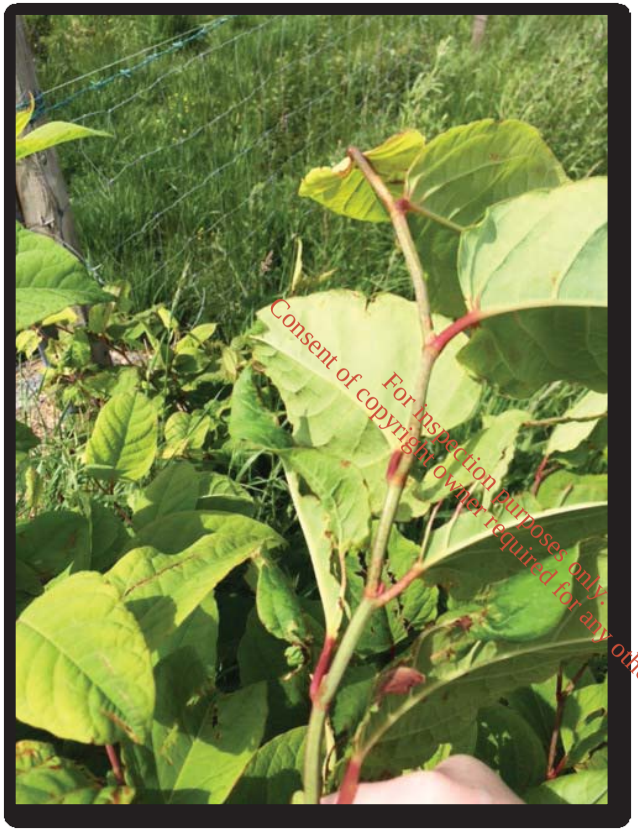
The rhizomes which form the underground element of the plant are thick woody stems with a “knotty” appearance. When broken, the inside of these rhizomes displays a bright orange colour. The rhizome system can extend up to 7 metres laterally and 3 metres in depth. Further details on how to accurately identify a Japanese knotweed rhizome system can be obtained in the UK’s Environment Agency publication “The Knotweed Code of Practice” (‘EA Guidelines’) which has been referenced in these guidelines.

Refer to **Table 4.2** for a summary guide to identifying Japanese knotweed.

Table 4.2 Characteristics of the Japanese knotweed Plant

Item	Description	Images
Shoots	Appear in early spring. Distinctive red stem with typical shaped leaves (refer to leaf identification).	 **Image 4.1 Shoots of Japanese knotweed emerging in Spring (Source: http://www.greglongtreecare.co.uk/page2.html**  **Image 4.2 Japanese knotweed shoots emerging in Spring from top soil exaction along river bank**

Item	Description	Images
Stems	**Winter:** Brown/orange bamboo like stems. **Spring/Summer:** Hollow bamboo like stems. Green with specks of red/purple colour. Off-shoots distinct red colour.	 **Image 4.3 Stems of Japanese knotweed in Winter along river bank (Source: http://adlib.everysite.co.uk/adlib/defra)**  **Image 4.4 Stems of Japanese knotweed in Winter (Source: http://www.gigl.org.uk/GiGLer/?p=1898)**

Item	Description	Images
		 Image 4.5 Red/purple speckled stems of the Japanese knotweed in July with red off shoots  Image 4.6 Red off shoots of Japanese knotweed

Item	Description	Images
		

Image 4.7 Hollow centre to Japanese knotweed stem (Source: http://vitalsignsme.org)

Item	Description	Images
Leaves	**Spring/Summer:** Green leaves arranged in a zig-zag pattern. Leaves appear heart shaped with a square cut base. Leaves up to 12cm in length (up to 30 cm in Giant Knotweed)	 **Image 4.8 The leaf of the Japanese knotweed plant**  **Image 4.9 Typical zig-zag pattern of leaf growth of the Japanese knotweed**

Item	Description	Images
Flowers	**Summer:** Creamy white flowers bloom between late June and August. Flowers grow from the axil of the leaf. Pollinating insects will not be attracted to these flowers.	 **Image 4.10 Japanese knotweed in flower (Source: http://www.greglongtreecare.co.uk/page2.html)**  **Image 4.11 The Japanese knotweed Flower (Source: http://www.downgardenservices.org.uk/japknot.htm)**

Item	Description	Images
Rhizomes (Please also refer to EA Guidance Document - Appendix p48)	Thick woody stems. "Knotty" like appearance. Bright orange coloured centres. Range: Up to 3 metres in depth and 7 metres laterally	 **Image 4.12 The rhizome of the Japanese knotweed (Source: http://www.pinstopin.com/japanese-knotweed-shoots/)**

5.0 What are the Management Options Available for the Control of Japanese Knotweed?

If Japanese Knotweed has been positively identified on an Irish Water site it is not an option to do nothing i.e. action of some form must be taken to address the invasive species in accordance with the Irish Water Biodiversity Policy and the relevant environmental legislation (the European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477).

There are several options available for the successful treatment of Japanese knotweed which fall into two main categories of physical treatment and chemical treatment or a combination of both. The treatment option chosen will depend on a number of site variables as discussed in **Section 5.1.**

It is also vitally important to be vigilant with regards to the import of contaminated soil onto an Irish Water site. All soil imported during construction, minor works or maintenance must be free of Japanese knotweed material**. The soil provider needs to provide assurance that the soil is not contaminated with Japanese Knotweed.**

5.1 Site Variables

The chosen method of Japanese knotweed management and control on a site will depend on a number of variables as follows;

Extent of Infestation: The extent and location of the Japanese knotweed stand can have an impact on the preferred method of management, this will also be linked to the proposed activities and use of the site.

Characteristics of the site: Numerous variables such as the size of the site, topography, location relative to water courses, hydrogeology (e.g. groundwater vulnerability) and land use will all have a bearing on the approach to managing the Japanese knotweed infestation.

Intended use of the site: The preferred management approach will also be strongly influenced by the proposed site activities. For example if Japanese knotweed is found to be growing on an area of land in which it is proposed to excavate and build, the management approach will be different to that for an area of land hosting the plant but no proposed construction activities. Likewise there may be immediate requirements to manage the infestation if it is causing structural damage to buildings and other infrastructure.

In addition to a combination of the above variables, the element of time and cost will also play a part in the final approach taken to the management of Japanese knotweed on a site. The successful treatment of the plant on a site will take time and this is important to consider when finalising a management approach.

Section 6.0 explores the content and approach to completing a Japanese knotweed Management Plan for a site.

5.2 Management Options

If Japanese knotweed has been positively identified on an Irish Water site it is important that activities on site do not cause the further spread of the plant and that the existing growth is treated and managed. In choosing an approach to this the variables set out in **Section 5.1** need to be considered. The options for treatment are set out here and further summarized in **Table 5.2.**

It should be noted that the removal of plant material and contaminated soil off-site should be avoided where at all possible i.e. the preferred Irish Water method of treatment is *in situ*. However owing to site specific circumstances this may not be possible and other forms of treatment may be required. The various treatment options are set out in this section.

5.2.1 Site Hygiene

Regardless of the preferred method of treatment good site organisation and hygiene shall be maintained at all time on a site, particularly during construction activities. The following **best practice avoidance measures** will help to contain (and in some cases prevent the introduction of) a Japanese knotweed infestation on a site:

- Understand the possible extent of the rhizome system underground – up to 7 metres horizontally and 3 meters vertically.
- Where possible fence off or clearly mark infested area including the extent of the rhizome system underground.
- Do not use machinery with tracks within an infested area, if possible.
- Clearly identify and mark out areas where contaminated soil is to be stockpiled on site and cannot be within 50m of any watercourse or within a flood zone.
- Creation of entry and exit points for operators on foot and for small mobile equipment. A delineated access track to be maintained free of Japanese knotweed should be established through the site to minimise the spread of Japanese Knotweed by permitted vehicles accessing the site.
- Installation of a dedicated footwear & vehicular wheel wash down facility into a contained area within the site.
- Vehicles leaving the site should be inspected for any plant material and washed down into a contained area.
- Vehicles used in the transport of contaminated material will need to be visually checked and washed down into a contained area before being used for any other work, either on the same site or at a different site.
- Material gathered in dedicated wash down contained areas will need to be appropriately treated along with other contaminated soil on site.
- For any material entering the site, the supplier must provide an assurance that it is free of Japanese Knotweed.
- Ensure all site users are aware of measures to be taken and alert them to the presence of the Japanese knotweed Site Management plan.

- Erection of adequate site hygiene signage in relation to the management of non-native invasive material.

Note: All of the proposed management options listed below involve the use of herbicides. It is important when using herbicides that the manufacturer's instructions are followed, and that there is compliance with relevant legislation and adherence to Irish Waters Biocide Strategy and Policy.

5.2.2 Chemical Treatment

This option involves the application of a herbicide to the Japanese Knotweed stand without any excavation or removal of the plant material. The preferred types of herbicides to be used in the treatment of Japanese Knotweed are Glyphosate and 2,4-D Amine. Generally, if herbicide is applied as the treatment option, it will need to be reapplied for up to five years after the first application to ensure the plant control measures have been effective, or monitored for a minimum of 2 years during which no regrowth is recorded. Further details on the two preferred herbicides are set out in **Table 5.1.**

Table 5.1 Herbicides Used in the Treatment of Japanese knotweed

	Glyphosate	2,4-D Amine
Persistence	**Non-Persistent**	**Up to 1 month**
Approved for Use Near Water	**Yes**	**Yes**
Time of Application	**May-October (later season preferable)**	**May-October (early season preferable)**
Selective	**No**	**Yes**

The most effective time to apply Glyphosphate is from July to September (or before cold weather causes leaves to discolour and fall). The majority of herbicides are not effective during the winter dormant stage because they require living foliage to take up the active ingredient. **It is essential that a competent and qualified person carries out the herbicide treatment in accordance with the Irish Water Biocide Strategy and Policy.** Reapplication rates will depend on site specific considerations including the extent of the infestation, its location, and the time of year treatment commences. Details of the proposed treatment plan will be provided in the site-specific Japanese Knotweed Management Plan (see template provided in Appendix 1).

Foliar Application

This type of treatment is usually applied with a sprayer such as a knapsack sprayer. It is important to use a treatment dye to identify clearly all areas treated. It is an efficient way to treat large monocultures of invasive plants, or to spot-treat individual plants that are difficult to remove mechanically such as Japanese knotweed.

Depending on weather and temperatures in the days following the initial treatment, and to ensure optimal uptake of herbicide into the rhizome system, a second similar treatment will be required usually within ten days, before the internal vascular system is no longer capable of translocating the herbicide to the root system. While the upper surface of the leaves will be easier to treat, it is

also important to treat the leaf under surface as Japanese knotweed possesses many stomata openings on the leaf under surface. Dead stems should be cut, removed and burned on site in accordance with the Waste Management Acts 1996 as amended and the Waste Management (Prohibition of Waste disposal by burning) Regulations 2009 (SI 286).

For deep rooted species, such as Japanese knotweed, regrowth will occur in subsequent years, albeit much less vigorously, which will require follow up treatment at the appropriate time of year. Spot treatment will be required each year until no regrowth is observed.

Stem Injection

The stem injection method is sometimes used for Japanese knotweed control. This treatment requires a higher concentration of the active ingredient than is used in foliar applications. It involves the use of a specialist herbicide injection tool whereby the injection tool injects the herbicide directly into each of the canes approximately 20-30cms from the base of each cane (between the 1st and 2nd nodule). Subsequently approximately 10 mls of herbicide mix is injected into each cane at a ratio of 5:1 through the use of a specialist stem injection tool. The application of glyphosate based products, are most effective when applied in the early Autumn (Mid to Late Sept). Regrowth will occur in subsequent years, albeit much less vigorously, which will require follow up treatment at the appropriate time of year. Spot treatment will be required each year until no regrowth is observed.

Cutting and Injecting

As the name suggests this management approach requires the cutting of a plant that has matured (in mid to late September) to approximately 200mm above ground and ideally 40mm above the node. The cut material must be left on top of plastic sheeting until dried out and subsequently monitored for any sign of regrowth (this is not recommended for a river bank habitat where there is the possibility of flooding occurring). They should not be placed in your green waste recycling bin. Once dried out, the material should be burned on site in accordance with the Waste Management Acts 1996 as amended and the Waste Management (Prohibition of Waste disposal by burning) Regulations 2009 (SI 286). Herbicide is then injected into the remaining hollow stems; subsequent spot treatment of herbicide may be required for up to five years after the initiall application. This method of treatment can be very labour intensive particularly if there is a large extent of infestation.

Studies carried out in 2004 for the cut and inject method stated “Initial monitoring has shown a success rate of between a 60% to 95% kill of Japanese knotweed in the treated areas. Although the cut and inject method did not match the kill of the more commonly used method of foliar spraying it did allow very selective application” (Ford 2004)[1].

[1] Ford S. (2004) Cut and inject herbicide control of Japanese Knotweed *Fallopia japonica* at Rocky Valley, Cornwall, England. *Conservation Evidence*, 1, 1-2

5.2.3 Physical and Chemical Treatment

Wherever possible, Japanese knotweed should be treated in its original location. Excavating Japanese knotweed should only be considered as a last resort, unless this is part of an on-site treatment method.

For all forms of treatment or management involving excavation the EA Guidelines advise that the extent of the rhizome network should be identified prior to excavation. Where it is known that recently contaminated soil has been introduced to the site, the rhizome system may not be deeper than 3 metres. However, where you are dealing with long established infestations of Japanese knotweed the extent of the rhizome system can be deeper than this. These guidelines also advice on applying a non-persistent herbicide to the proposed excavation area approximately two weeks before the planned excavation takes place.

Excavation and Herbicide Treatment

This option employs both physical and chemical methods of treatment. This method is employed in situations where treatment of the Japanese Knotweed is required to be completed in a shorter timeframe. The EA suggest that by digging up the rhizomes and recultivating it stimulates plant growth and will result in more successful herbicide application and management.

In summary this management method requires cutting and killing of the surface plant. The cut material must be left on top of plastic sheeting until dried out and subsequently monitored for any sign of regrowth (this is not recommended for a river bank habitat where there is the possibility of flooding occurring). They should not be placed in a green waste recycling bin. Once dried out, the material should be burned on site in accordance with the Waste Management Acts 1996 as amended and the Waste Management (Prohibitation of Waste disposal by burning) Regulations 2009 (SI 286). The surface of the affected area should be raked with tines to remove crowns and surface material, and in order to break up the rhizomes, bringing them to the surface, which will stimulate leaf production. This will make the plant more vulnerable to herbicide treatment. The more rhizomes that are brought to the surface, the more growth will occur and allowing for a more successful treatment. An excavator can be used to scrape the surface crowns and rhizomes into a pile and then cultivate the ground to stimulate rhizomes to produce higher density of stems for treatment. Reapplication of herbicide may be required for up to five years after initially application, subject to the site specific management plan.

Excavation and Burial

Excavated material containing Japanese Knotweed can also be buried on site. This will require burying the material at a depth of at least five metres. The contaminated material must be covered with a root barrier membrane before being backfilled with topsoil or other suitable fill material. The membrane must stay intact for at least 50 years. A manufacturer's guarantee is required.

Accurately map and record the location of the burial site to prevent any future accidental disturbance. Inform future owners of its position. Following the provisions of the Waste

Management Act 1996, as amended, a license or permit may be required for the burial of excavated material.

If soil containing Japanese knotweed is stockpiled, the material must be stored in a manner that will not harm health or the environment. The stockpile should be on an area of the site that will remain undisturbed. The area should be clearly fenced and signed, and should be regularly treated with herbicide to prevent any regrowth or reinfestation. As a precaution, the stockpiled material should be laid on a root barrier membrane and covered to avoid contaminating the site further.

Excavation and Root Barrier Cell Method

Excavated material containing Japanese Knotweed can also be buried on site within a root barrier membrane cell. This will require burying the material at a depth of at least two metres. The contaminated material must be within a contained cell consisting of a root barrier membrane before being backfilled with topsoil or other suitable fill material. The membrane must stay intact for at least 50 years. A manufacturer's guarantee is required. Following the provisions of the Waste Management Act 1996, as amended, a license or permit may be required for the burial of excavated material.

If soil containing Japanese knotweed is stockpiled, the material must be stored in a manner that will not harm health or the environment. The stockpile should be on an area of the site that will remain undisturbed. The area should be clearly fenced and signed, and should be regularly treated with herbicide to prevent any regrowth or reinfestation. As a precaution, the stockpiled material should be laid on a root barrier membrane and covered to avoid contaminating the site further.

Excavation and Bund Method

Where there is not sufficient depth on a site for deep burial the EA Guidelines set out another option whereby such excavated material is placed in a structured bund. The bund will comprise a raised area above ground level or a shallow excavation, no more than 0.5m deep, and lined with a root barrier membrane. The membrane must stay intact for at least 50 years and a manufacturer's guarantee is required. This method of treatment can also be used where the Knotweed material needs to be moved from a location and there is another ideal area of the site available to contain it. Following the provisions of the Waste Management Act 1996, as amended, a license or permit may be required for the burial of excavated material.

The aim of this method is to concentrate the rhizome material into the upper surface of the bund, where it will grow and be controlled by herbicide. If the rhizome is buried deep, it will become dormant when inside the bund and regrow when the apparently clean soil is used for landscaping on the site. The bund location needs to be clearly signed and protected from potential accidental damage.

Reapplication of herbicide may be required for up to five years after the initial application, subject to the site-specific management plan.

Excavation and Removal from Site

Where the above treatment options are not possible (site is too small to contain excavated material, two shallow for burial, or where there is lack of space) removal of excavated material may be the only option. Where there are small amounts of Japanese Knotweed material to be removed it is possible to double bag the material and send to a fully licenced waste facility for disposal (i.e. landfill). Where the amount of material is larger in volume it will be necessary to haul from site to a suitably licenced waste facility.

It should also be noted that in the process of excavating the Japanese Knotweed if it has been treated with a persistent herbicide, the excavated material will need to be classified as hazardous waste and there will need to be disposed of to a hazardous waste facility.

This option is generally considered to be the least favourable option because of the high costs involved.

Furthermore, if Japanese knotweed contaminated material is removed off site it will require a licence from the National Parks and Wildlife Service in advance of any removal, in accordance with the European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477).

Table 5.2 Summary of Management Options for Japanese knotweed

Treatment	Description	When	Follow up Treatment	Comment
Chemical Treatment - General	The application of a herbicide to the Japanese knotweed plant without the removal of the plant.	Glyphosate: May to October (later in the season is preferable) 2,4-D Amine: May to October (earlier in the season is preferable).	Up to five years after the first application or monitored for a minimum of 2 years during which no regrowth is recorded.	- The two preferred herbicides to use are Glyphosate and 2,4-D Amine.
Chemical Treatment - Foliar Application	Herbicide is applied directly on plant with a sprayer using a treatment dye.	Refer to relevant instructions for specific herbicide used.	A second similar treatment will be required usually within ten days before the internal vascular system is no longer capable of translocating the herbicide to the root system. Regrowth will occur in subsequent years, all be it much less vigorously, which will require follow up treatment at the appropriate time of year. Spot treatment will be required each year until no regrowth is observed.	- Most desirable method of treatment - Most cost effective method of treatment - May not be possible if development of the site is a priority - Used to treat large monocultures of invasive plants, or to spot-treat individual plants that are difficult to remove mechanically such as Japanese knotweed. - Dead stems should be cut, removed and burned on site in accordance with relevant waste legislation.
Chemical Treatment -	Use of a specialist	Glyphosate based	Spot treatment will be	- Labour intensive

Treatment	Description	When	Follow up Treatment	Comment
Stem Injection	herbicide injection tool whereby the injection tool injects the herbicide directly into each of the canes approximately 20-30cms from the base of each cane Subsequently approximately 10 mls of herbicide mix is injected into each cane.	products are most effective when applied in the early Autumn (Mid to Late Sept).	required each year until no regrowth is observed.	- Suited to smaller areas of infestation - Requires a higher concentration of the active ingredient than is used in foliar applications
Chemical Treatment - Cutting and Injecting	Cut stems down, inject individual stems with herbicide.	Mid to later September	Herbicide application may be required for up to 5 years after initial application.	- Labour intensive - Suited to smaller areas of infestation - Limited to time of year when this method can be employed - Cut stems should be stored on plastic sheeting until dried out and no signs of regrowth, then burned in accordance with relevant waste legislation. - This method is not be suitable for riverside sites which may be liable to flooding.
Physical & Chemical Treatment	All forms of such treatment will require excavation and chemical treatment .	Refer to relevant treatment type	Refer to relevant treatment type	- The extent of the rhizome network should be identified prior to excavation - A non-persistent herbicide should be applied to the proposed excavation area approximately two weeks before the

Treatment	Description	When	Follow up Treatment	Comment
				planned excavation takes place
Excavation and Herbicide Treatment	Excavate, promote growth of rhizomes to increase success of herbicide application The surface of the affected area should be raked with tines to remove crowns and surface material, and in order to break up the rhizomes, bringing them to the surface, which will stimulate leaf production. This will make the plant more vulnerable to herbicide treatment.	Excavation can occur at any stage but to optimize herbicide treatment, application must occur during the growing season (May-October).	Herbicide application may be required for up to 5 years after initial application.	- May be required where faster treatment is required. - Cut stems should be stored on plastic sheeting until dried out and no signs of regrowth, then burned in accordance with relevant waste legislation. - Suited to a site where infested area is not required to be developed immediately. - This method is not suitable for riverside sites which may be liable to flooding.
Excavation and Burial	Excavate, allow plant material to die off and bury at 5metre depth with root barrier membrane.	Following excavation	Monitor site of excavation and burial regularly	- Requires space to store excavated material before burial - Requires space for deep burial - Costly to bury at this depth with a root barrier membrane - The membrane must stay intact for at least 50 years. A manufacturer's guarantee is required. - If excavated material needs to be stockpiled the material must be stored in

Treatment	Description	When	Follow up Treatment	Comment
				a manner that will not harm health or the environment e.g. store on root barrier membrane. - May require a waste license or permit for burial
Excavation and Root Barrier Cell Method	Excavated material containing Japanese Knotweed can also be buried on site within a root barrier membrane cell. This will require burying the material at a depth of at least 2 metres.	Following excavation	Monitor site of excavation and burial regularly	- Requires space to store excavated material before burial - Requires space for burial - Costly to bury at this depth within a root barrier membrane cell - The membrane must stay intact for at least 50 years. A manufacturer's guarantee is required. - If excavated material needs to be stockpiled the material must be stored in a manner that will not harm health or the environment e.g. store on root barrier membrane. - May require a waste license or permit for burial
Excavation and Bund Method	Excavated material is placed in a structured bund (shallow lined area lined with a root barrier membrane) of no more than 0.5 metre depth	Following excavation	Apply suitable herbicide	- Used where the Knotweed material needs to be moved from a location and there is another ideal area of the site available to contain it. - May require a waste license or permit for burial

Treatment	Description	When	Follow up Treatment	Comment
	which can be raised above ground level or placed within a shallow excavation. The aim of this method is to concentrate the rhizome material into the upper surface of the bund, where it will grow and be controlled by herbicide.			
Excavation and Removal Off-Site	Excavate, remove off site to a fully licences waste facility.	Following excavation	Monitor site of excavation regularly. Inform operator of destination waste facility of content of waste beforehand.	- Least desirable method of treatment - Costly to remove material from site and landfill - Potential for higher costs if material is deemed hazardous. - Will require a licence for the National Parks and Wildlife Service in advance of any removal

Note: Before all excavations treat affected area with a non-persistent herbicide, if during the growing season.

6.0 What is a Japanese Knotweed Management Plan?

A Japanese Knotweed Management Plan is a formulated plan that should be developed once it has been confirmed that Japanese Knotweed is actually present on site. A preferred template for a Japanese Knotweed Management Plan is provided in Appendix 1. The purpose of developing such a plan is to;

- Identify the extent of the infestation on the site,
- Ensure further growth and spread of the plant on the site does not occur,
- Ensure the plant is not spread to other sites either adjacent to the infested site or through transportation of contaminated soil to another site,
- Identify the optimal method of managing and controlling Japanese Knotweed on the site, having regard to specific site variables and uses,
- Communicate the plan to all site operatives to ensure its success,
- Develop a follow up system to ensure the success of the plan, and
- Document and record the treatment carried out on site for future reference (future site owners, avoidance of litigation etc.).

A Japanese Knotweed Management Plan should be completed by a suitably qualified ecologist, made as simple as possible and should typically have the following sections included;

- Introduction to the site
- Extent of Japanese Knotweed Infestation
- Specific Control Plans to be put in place with timeline and costs
- Individuals responsible
- Follow up requirements
- Any other relevant information in Appendix.

7.0 How to Stop Japanese knotweed from Neighbouring Properties from Re-infesting the Site?

7.1 Co-ordinated control programmes

Before starting any Japanese knotweed control programme, one must consider all areas which are infested with Japanese knotweed that are close to or adjacent to the boundary of the Irish Water site, and the potential for re-infestation by Japanese knotweed from those adjacent lands. Ideally, some sort of arrangement should be negotiated with the relevant landowner in advance of any Japanese knotweed control programme to reduce the likelyhood of re-infestation by Japanese knotweed from those adjacent lands.

Where distribution and collection networks are within public lands, it is the responsibility of the relevant Local Authority to control any Japanese knotweed infestations. Irish Water is responsible for ensuring that any Irish Water activities do not cause further dispersal of the infestation when undertaking works within public lands.

7.2 Root barrier membrane methods

The careful use of root barrier membrane buried vertically to the appropriate depth can be an effective way of stopping Japanese knotweed rhizomes from spreading from neighbouring infested sites onto Irish Water sites. However, this will not stop above ground plant fragments from the neighbouring infested sites from re-infesting the Irish Water site.

8.0 What are the Management Options Proposed for the Control of Japanese Knotweed on Irish Water Sites?

This section of the guidelines sets out the approach to be taken by Irish Water where it is suspected that Japanese Knotweed is present on an Irish Water Site or an Irish Water controlled site.

The flow diagram depicted in **Figure 8.1** sets out the Irish Water approach to the correct containment and management of Japanese Knotweed. In developing this process due consideration has been given to the Irish Water Biocidecide Policy, Biodiversity Policy, etc., and relevant legislation.

Figure 8.1 has been adapted from the Environment Agency (EA) Knotweed Code of Practice-Managing Japanese Knotweed on Development Sites, 2006-2013.

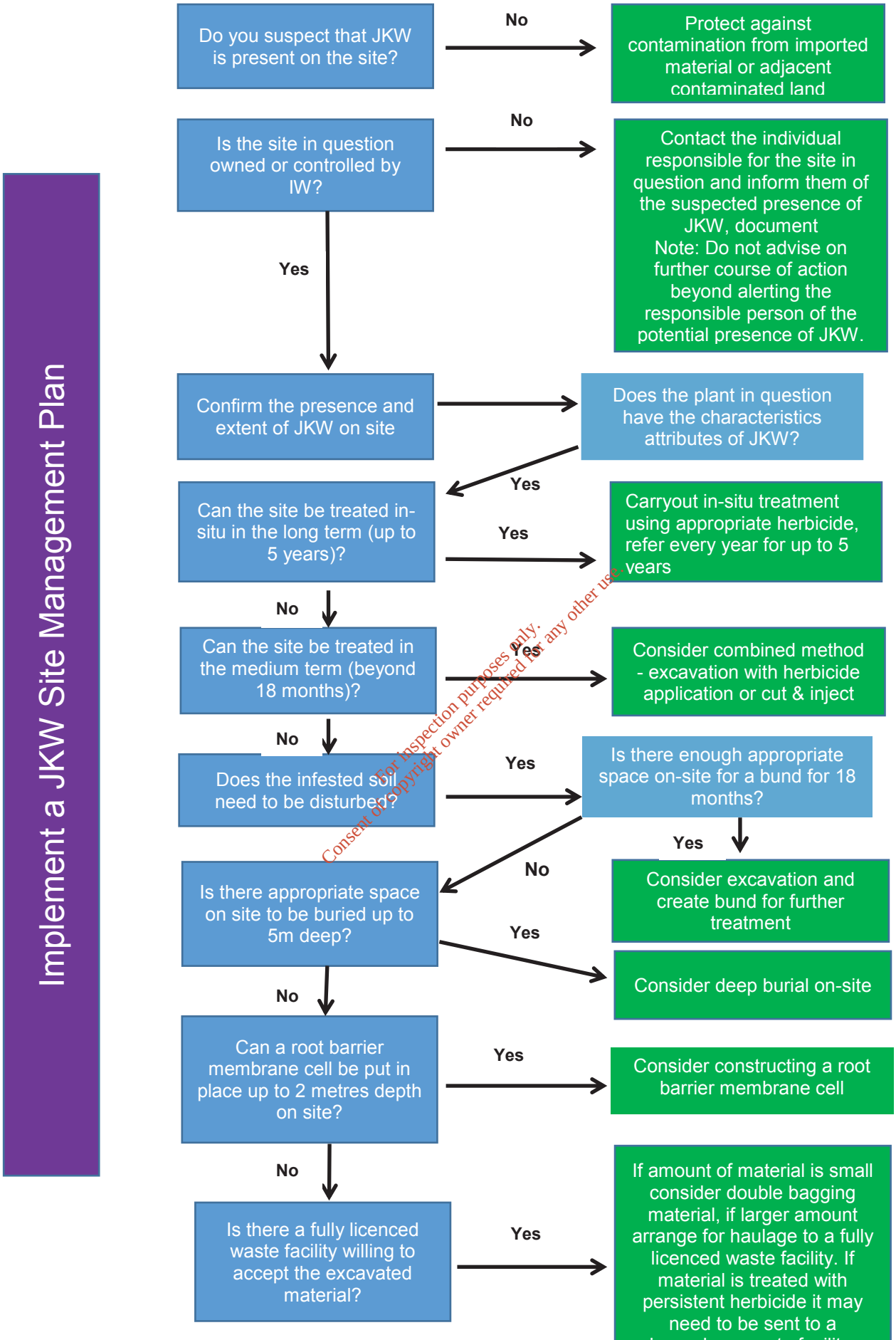


Figure 8.1 What to do if it is Suspected that Japanese Knotweed is Present on an Irish Water Site?

ese knotweed

9.0 Alignment with Irish Water Phases & Gates Approvals Structure to Minimise Potential Impacts from Japanese Knotweed on Irish Water Projects

To reduce the potential for Japanese knotweed to impact on construction projects it is recommended that Japanese knotweed / Invasive Species surveys are incorporated into the project Gate Approvals Structure as follows:

- **Gates 1 to 2:** During preliminary design and optioneering of sites and routes it is recommended that Japanese knotweed / Invasive Species surveys are undertaken and factored into the route and site selection process.

- **Gates 2 to 3:** During the planning and detailed design process it is recommended that detailed Japanese knotweed / Invasive Species surveys are undertaken along selected routes and sites. If Japanese knotweed / Invasive species are present then a detailed Japanese knotweed / Invasive Species Management Plan (as detailed in Section 6.0) will be required and should be incorporated into the relevant Construction Contract Documents. Re-survey and updating of Japanese knotweed / Invasive Species Management Plan will be required should a period of two years pass between original detailed survey and project tendering process.

- **Gates 3 to 4:** During construction it is essential that the Japanese knotweed / Invasive Species Management Plan is implemented in full. Should new Japanese knotweed / Invasive Species infestations be recorded during the construction process then the appropriate measures should be identified immediately and the Management Plan updated accordingly to reduce potential for impact on construction contract.

- Following the construction and commissioning phase of the project, and if the Japanese knotweed / Invasive Species Management Plan identifies further monitoring and treatment requirements, it is essential that the Management Plan is transferred to Operations and Maintenance to ensure its full implementation.

10.0 Who to Contact in Irish Water for Further Information/Guidance on Japanese Knotweed ?

If you have any queries relating to Japanese Knotweed and Irish Water sites please contact Dr Brian Deegan or Kate Harrington for further assistance.

Dr. Brian Deegan,
Catchment Scientist,
Asset Strategy and Sustainability,
Irish Water,
Colvill House,
24-26 Talbot Street,
Dublin 1
Tel: 01 8925369
Mobile: 087 7955439
Email: brdeegan@water.ie

Kate Harrington,
Ecology Specialist,
Asset Strategy and Sustainability,
Irish Water,
Colvill House,
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Dublin 1
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Appendix 1

Irish Water Japanese Knotweed Management Plan Template

Contents

1.0 Irish Water Approach to a Japanese Knotweed Management Plan

The flow diagram depicted in **Appendix A** sets out the Irish Water approach to the correct containment and management of Japanese Knotweed (JKW). In developing this process due consideration has been given to the Irish Water Biodiversity Policy, etc., and relevant legislation.

The flow chart and this management plan template has been adapted from the Environment Agency (EA) Knotweed Code of Practice-Managing Japanese Knotweed on Development Sites, 2006-2013.

2.0 Introduction to the Site

2.1 Description of the site

Description of the site including site boundaries, access, topography. Include prescence of any nature conservation features – e.g. protected species; vegetation; watercourses (including proximity of streams or rivers if adjacent to the site); buildings; drainage on site; other relevant features.

2.2 Japanese knotweed distribution

Include detailed map showing location of JKW and exact area covered. Allowcate a unique number (e.g. JK001, JK002 etc) and complete a recording sheet for each occurance of JKW (Appendix B). If Japanese knotweed is present off-site on adjacent land, record distribution and details of land use and land ownership.

2.3 Site development and management

Describe any proposed development at the site, if relevant.
Identify the threat/risk JKW poses to any development at the site, or ongoing site management in terms of - Increasing costs, delays in works, damage caused by the plant, potential to spread, potential for export of material.

3.0 Japanese Knotweed Management Plan

3.1 Brief description of the management plan

Allocate personnel to oversee the JKW management plan and be responsible for sign-off at the end of the treatment period

3.2 Preventing further spread

Description of methods to be employed to prevent further spread e.g.:

- Isolation of JKW on site by fencing to avoid disturbance during treatment.
- Assessment of risk of re-invasion of JKW from adjacent land.
- Liason wiiith adjacent landoweners to treat Japanese knotweed which poses a risk to the site.
- Procedures to ensure that imported materials are free from JKW.
- Identification of designated haul routes through site to avoid contamination.

3.3 Management objectives

Establish measurable objectives for the planned control activities. These should include:

- the impact on density, cover, etc. that you want to achieve;
- the size of the area in which you hope to achieve this;
- the period in which you hope to achieve it.

Examples:
Objective 1. Elimination of Japanese knotweed on all parts of the site within 5 years.
Objective 2. Reduce percentage cover by 50% on 1 ha of the site within 2 years.
Objective 3. Prevention of further spread of Japanese knotweed on site.
Objective 4. Co-ordination with adjacent landowners to commence active treatment of Japanese knotweed in adjacent areas within 1 year.

3.4 Management options

Detail the preferred control option and explain why this is considered the best option for the site. Refer to the approach outlined in the flow chart in Appendix A.

3.5 Actions planned

Describe the locations to be treated, materials and methods to be used, and an approximate schedule for control and monitoring activities. Record details in Table 1.

Table 1: Implementation schedule
Schedule the planning, surveying, and treatment for Japanese knotweed for at least the next year

Treatment Schedule	Date

3.6 Resource needs

Estimate the amount of time for staff, materials, contractors etc. and money that will be required to carry out the planned control, monitoring and evaluation. Record in Table 2.

Table 2: Projected resources and costs

Item	Description	Projected resources	Projected costs	Actual costs

3.7 Evaluation

Outline the methods that will be used to monitor control activities and the criteria that will be used to evaluate success or failure of the program. The criteria for success should be based on the management objectives.

This section is to be filled in later, with the first evaluation preferably within 1 year, when monitoring data has been taken and evaluated. The evaluation should be used to determine whether any of the measures detailed in Sectrions 3.1-3.4 should be modified. All subsequent management plan evaluations should be detailed up to the point where the plant if considered eradicated. Each revision of the plan should be sent to Irish Water for review.

4.0 References

List any references cited.

5.0 Appendices

Appendix A: Irish Water Approach to Implementing a JKW Site Management Plan

Appendix B: Site maps and Japanese knotweed distribution maps

Appendix C: Japanese knotweed recording sheets (template provided)

Appendix D: Herbicide records

Attach details of herbicides used, dose rate and application rates and dates applied.

Appendix E: Waste records

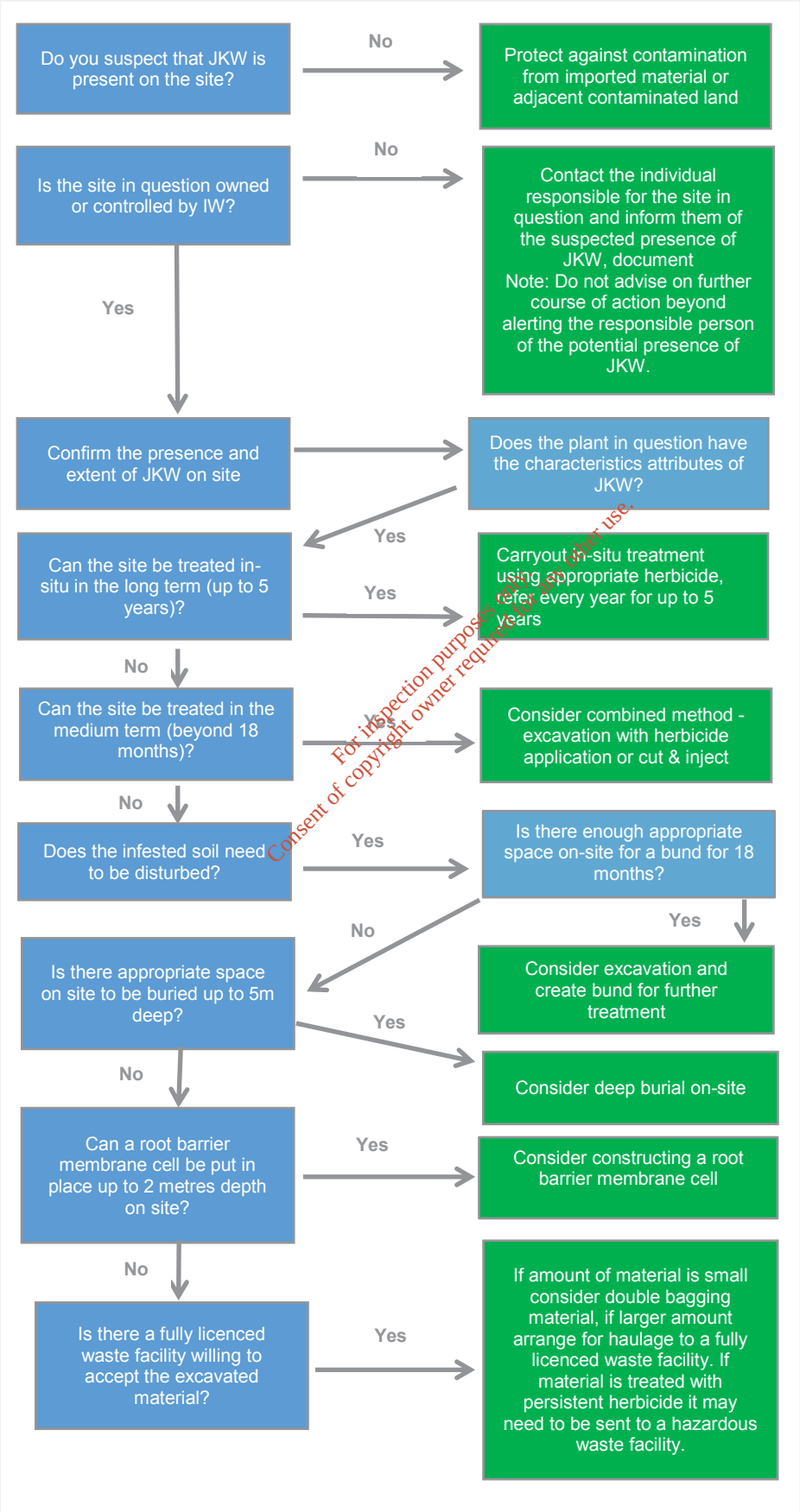
Attach details of waste records for any material containing Japanese knotweed taken off site.

Appendix F: Useful contacts

Attach details of contractors, local authority/irish water contact, adjacent landowners etc.

Appendix A: Irish Water Approach to Implementing a JKW Site Management Plan

Adapted from the Environment Agency (EA) Knotweed Code of Practice-Managing Japanese Knotweed on Development Sites, 2006-2013.



Appendix B: Site maps and Japanese knotweed distribution maps

Appendix C: Japanese knotweed recording sheets

JAPANESE KNOTWEED RECORDING SHEET

To be completed for each occurrence within an Irish Water Site. Site ref and Unique ID should cross reference with annotations on maps.

Recorded by:				Date:		
Site name:				Site ref:		
Grid ref of occurrence:				Unique ID of occurrence:		
Area (m^2)						
Average height of stems	<1m		1-2.5m		>2.5m	
Max. stem diameter at 30cm above ground	<1cm		1-2cm		>2.5cm	
Vegetation composition	Japanese knotweed only		Mixture of knotweed and other vegetation			
Proximity to watercourses	Yes (give distance in m)		No			
Slope	Flat		Moderate		Steep	
Land use – Record primary land use as 1 and secondary use as 2 e.g. landscaped area adjacent to river bank record as Riverbank 1; Landscaped area 2.						
Buildings/ Structures		Landscaped Areas		Road verge		Edge of pond/lake	
Car park		Waste ground		Bank river or drain		Foreshore	
Woodland/ Hedgerow		Other (specify)		Off-site (specify)		
Comments						

Appendix D: Herbicide records

Appendix E: Waste records

Appendix F: Useful contacts

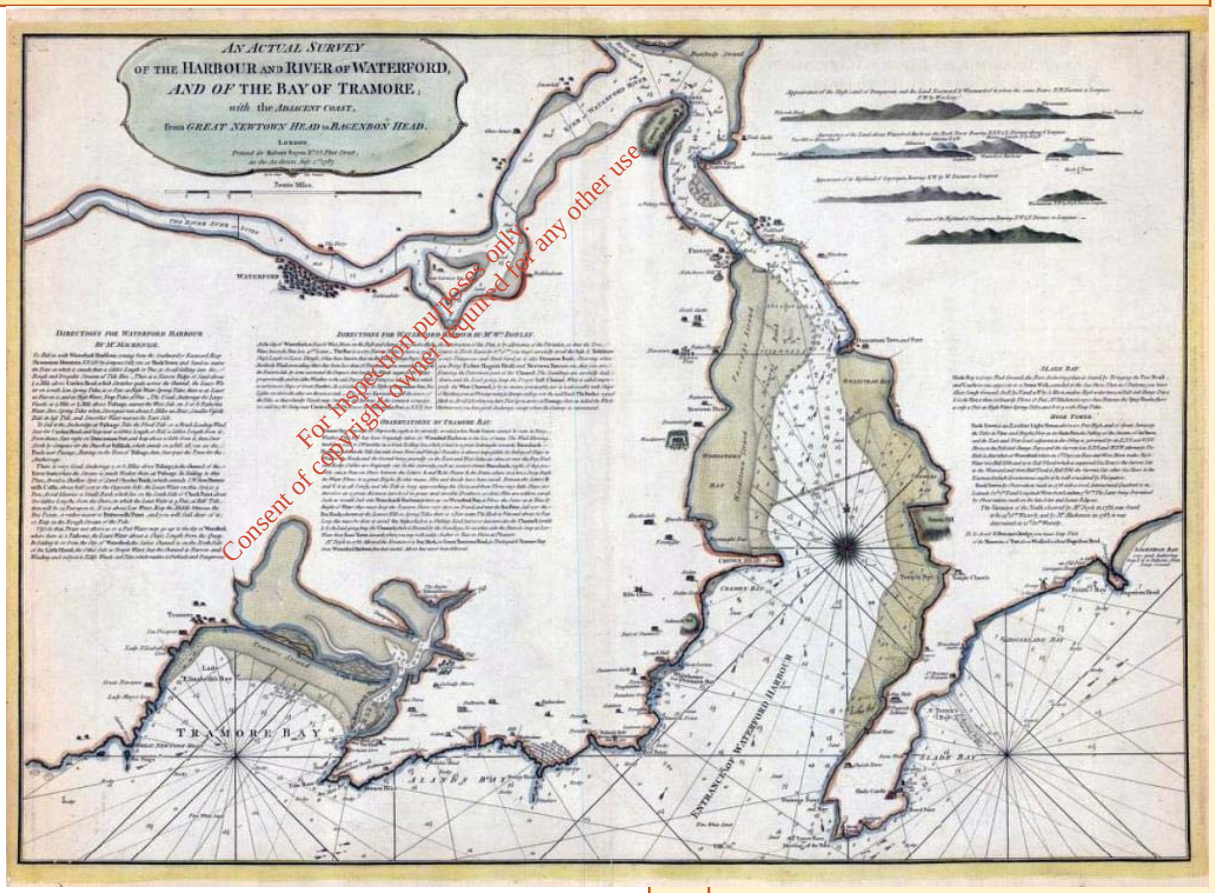
Appendix C

Benthic Fauna Survey Report

Appendix D

Water Quality Assessment Report

The Impact of Nutrient Loading from the Combined Arthurstown, Ballyhack & Duncannon Agglomerations on the Suir, Nore, Barrow Estuary



A Report to Irish Water

September 2017

Martin McGarrigle
Limnos Consultancy

Contents

Introduction

Irish Water propose to combine the discharges from Ballyhack, Duncannon and Arthurstown (Table 1) into a single discharge to be discharged at Arthurstown into the Barrow Nore Suir Estuary water body. This report models the likely future impact of this discharge on the nitrogen and phosphorus levels in Barrow Nore Suir Estuary. The discharge is modelled as if it were a new additional input to the water body.

Table 1. Characteristics of the three agglomerations to be combined in a single discharge at Arthurstown

Agglomeration:	**Arthurstown**	**Ballyhack**	**Duncannon**
Certificate Number:	A0243-01	A0242-01	D0245-01
Current Discharge Point:	271542 E, 110251 N	270507 E, 110793 N	272622 E, 108297 N
Receiving Water Body:	Barrow Nore Suir Estuary	Barrow Nore Suir Estuary	Barrow Nore Suir Estuary
Person Equivalent (pe)	490	331	1044

The combined person equivalent of the three agglomerations is estimated at 1865 pe. Assuming a 20% reduction if primary treatment is applied, this yields a total BOD load of 32,675 kg per annum, giving 6,862 kg N and 817 kg P per annum from the combined agglomerations.

The total N and P loading to the Barrow Nore Suir Estuary water body from terrestrial sources (inflowing rivers and Waterford WWTP) is estimated at almost 16,000 t N and over 200 t P per annum.

The nitrogen, phosphorus and chlorophyll concentrations in the Barrow Nore Suir Estuary transitional water body are modelled using the Dynamic Combined Phytoplankton Macrophyte (DCPM) model (Aldridge et al. 2013; Aldridge et al. 2008) and calibrated against the data from the Environmental Protection Agency (EPA) monitoring programme under the Water Framework Directive (WFD) for the 2013–2015 period. The incremental loading from the combined agglomerations is then added to the calibrated model and the likely impact is analysed and conclusions are drawn regarding the potential outcome.

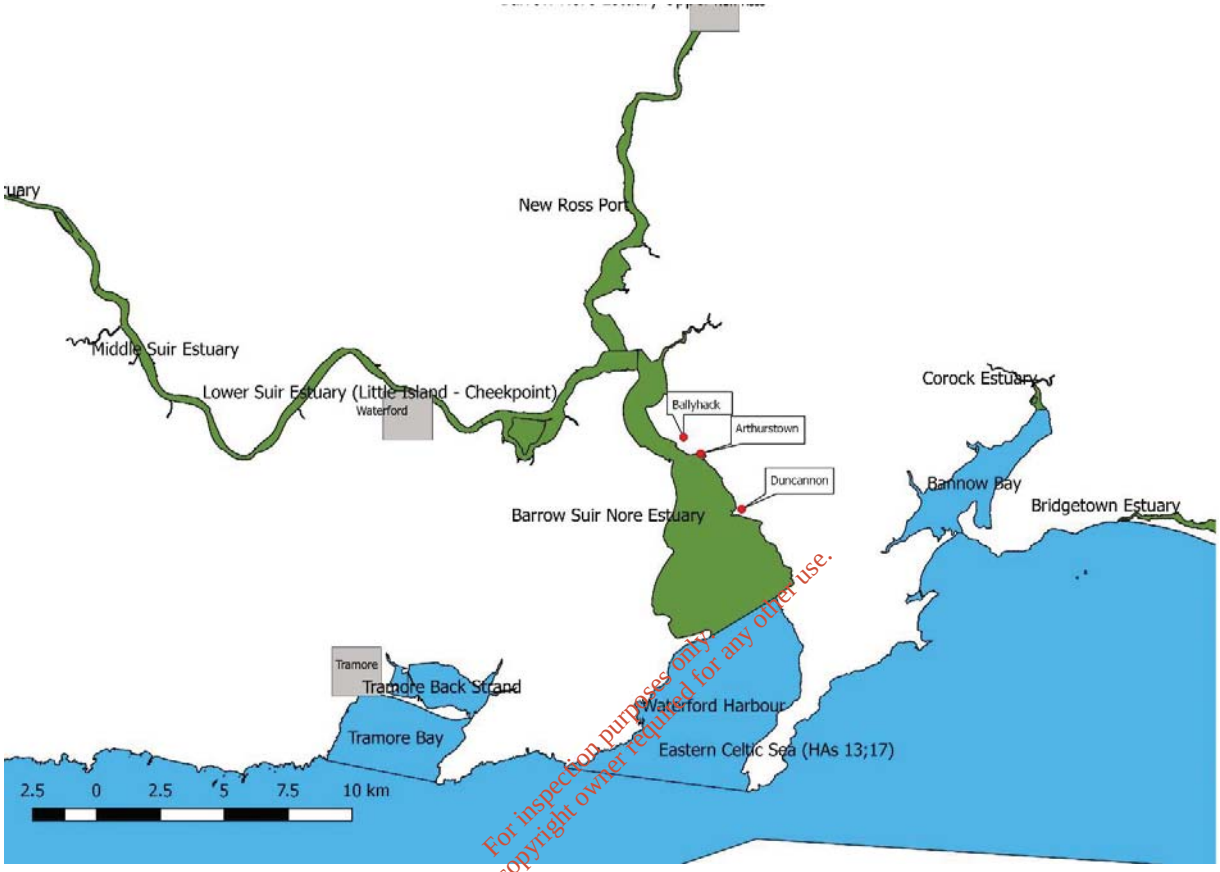


Figure 1. The Suir, Nore, Barrow Estuary showing adjacent water bodies and the location of the Arthurstown, Duncannon and Ballyhack agglomerations.

Methods

The Suir, Nore, Barrow Estuary was simulated using the Dynamic Combined Phytoplankton Macrophyte (DCPM) model (Aldridge et al. 2008). This model has been used by EPA marine scientists to model a number of Irish Estuaries (e.g. Ní Longphuirt et al. 2016) and the present author has also used to model the Lower Suir Estuary, The Tolka Estuary and Cork Harbour. The model was calibrated to predict the observed summer and winter nitrogen, phosphorus and chlorophyll concentrations in the Barrow Nore Suir Estuary for the period 2013-2015 and then used to predict the impact of the discharge from the three agglomerations at Arthurstown.

The model's inputs include a range of hydrographic data such as depth, volume and mixing rates together with nutrient and chlorophyll data for the water body being modelled plus loadings of nutrients entering from adjacent seawater and land-based sources (for details see Aldridge et al. 2013; Ní Longphuirt et al. 2016).

Significant quantities of water chemistry data were available for the period 2013–2015 for the Suir, Nore, Barrow Estuary and its adjacent transitional and coastal water bodies (see Figs. 1 and 2). These were summarised into seasonal averages – required as an input to the DCPM model. The volume of the Suir, Nore, Barrow Estuary, including its tidal prism volume, was estimated from the Admiralty chart for Waterford. The residence time of the estuary was estimated using the Hartnett et al. equation (Hartnett et al. 2011). River flow data and gross nitrogen and phosphorus loading from the rivers Suir, Nore and Barrow was obtained from EPA OSPAR reports and associated datasets. The loading from the Waterford WWTP is estimated from data provided by Irish Water and added to the riverine loadings. Discharge loads from the agglomerations were estimated from the annual environment reports, EPA inspectors' reports for the three agglomerations for 2014 – 2016, as published on the EPA website.

The calibration process for the DCPM model attempts to match the observed N, P and chlorophyll concentrations within a 20% margin for each of these in summer and winter. The model is sensitive to exchange rates in the water body and adjacent seawater concentrations. This is due to the dominant influence of the daily tidal cycle with very large volumes of water plus associated nutrients moving in and out of this transitional water body twice per day. Adjustments to the adjacent seawater concentrations (Waterford Harbour) and the immediate upstream New Ross Port and Lower Suir Estuary water bodies were made during the calibration process. Similarly, the mixing efficiency or exchange rate of the water body was optimised to obtain the best match between the model predictions and the observed concentrations from the EPA monitoring programme.

A successful calibration was obtained and the calibrated model was then altered by increasing the N and P loading equivalent to that of 1865 pe. The 'before' and 'after' modelled results are then compared.

Results

WWTP discharges and Riverine Loads to the Estuary

Table 2 shows the estimated annual concentrations for biochemical oxygen demand (BOD), total nitrogen (TN), and total phosphorus (TP) to be discharge from the combined agglomerations. This is based on a combined load of 1865 pe, at 0.06 kg BOD per person per day and assuming 20% removal efficiency in the plant. Table 3 shows the riverine loadings of nitrogen and phosphorus entering via the three river systems converging at the Suir, Nore, Barrow Estuary. The direct loadings of N and P from the Waterford WWTP in the Lower Suir Estuary are also shown. These are important inputs to the model.

Table 2. Assumed loading from the combined WWTP discharge based on 1865 pe @ 0.06kg/p/d with 20% removal efficiency.

BOD kg/year	TN kg/year	TP kg/year/l
32,675	**6,862**	**817**

Table 3. Riverine and direct discharges of N and P to the Barrow Nore Suir Estuary used as inputs to the DCPM model.		
	TN kg/year	TP kg/year
Riverine Loads (OSPAR estimates)	15,878,267	214,334
Waterford WWTP (Irish Water estimate for 2015)	194,667	78,084

Ecological Status of the Suir, Nore, Barrow Estuary

Table 4 shows the individual quality elements underpinning ecological status for the Suir, Nore, Barrow Estuary and its adjacent water bodies based on the supporting physico-chemical quality elements and biological quality elements (O'Boyle et al. 2015).

Note that DIN is not used for classification in transitional waters and thus the Barrow Nore Suir Estuary is classified as being of Good Ecological status for these supporting quality elements. The Barrow Nore Suir Estuary is at Moderate ecological status, however, for its biological elements as it failed on its benthic fauna – moderate ecological status for benthos. The benthic fauna issue may be a legacy issue relating to the relatively recent commissioning of the new Waterford WWTP, but it may be due to disturbance due to ship traffic – but it is not viewed as relevant to the three agglomerations under investigation in this report.

Table 4. Status of Suir, Nore, Barrow Estuary and adjacent Transitional and Coastal Water Bodies from EPA 2010-2012 WFD Summary Ecological Status Report. (O'Boyle et al. 2015)

Water body	Supporting Quality Elements				
	DIN[1]	MRP[2]	DO[3]	BOD[4]	EQS OOAO[5]
Lower Suir Estuary	moderate	good	good	high	**good**
Barrow Suir Nore Estuary	moderate	good	high	high	**good**
New Ross Port	moderate	good	good	high	**good**
Waterford Harbour	high	high	good	high	**good**

DIN [1]
MRP [2]
DO [3]
BOD [4]
EQS OOAO[5]

1. Dissolved Inorganic Nitrogen - assessed in both transitional and coastal waters but only used for classification in coastal waters.
2. Molybdate Reactive Phosphorus - assessed in both transitional and coastal waters but only used for classification in transitional waters.
3. Dissolved oxygen as per cent saturation - assessed and used in classification for both transitional and coastal waters.
4. Biochemical Oxygen Demand (5-days) - assessed in both transitional and coastal waters but only used for classification in transitional waters.
5. Environmental Quality Standard (one out all out)

Table 4 (contd). WFD Status Biological Quality Elements

Water body	Biological Quality Elements: Phytoplankton (biomass and bloom frequency)[6]	Phytoplankton biomass (chlorophyll) [7]	Opportunistic Macroalgae [8]	Reduced Species List [9]	Angiosperms[9]	Marine Plants	Benthos [10]	Fish [11]	Biology OOAO
Lower Suir Estuary	good						moderate	good	**moderate**
Barrow Suir Nore Estuary	high						moderate	good	**moderate**
New Ross Port	high						poor	good	**poor**
Waterford Harbour	high			high		high	good		**good**

Table 4 footnotes for Biological Quality Elements.

Phytoplankton	6. Community biomass and frequency of individual phytoplankton taxa above a predefined threshold - applied in both transitional and coastal waters.
Phytoplankton biomass (chlorophyll) [7]	7. Phytoplankton biomass (chlorophyll) - applied in both transitional and coastal waters.
Opportunistic Macroalgae	8. Macroalgae - Assessment of opportunistic green algae in transitional and coastal waters and Reduced Species List in coastal waters.
Reduced Species List	
Angiosperms [9]	9. Angiosperms - Intertidal Seagrass and Lagoon Angiosperm communities
Marine Plants	The lower of the classification for opportunistic macroalgae, reduced species list and angiosperm
Benthos [10]	10. Benthic Invertebrates - assessed using the Infaunal Quality Index.
Fish [11]	11. Fish assessment from Inland Fisheries Ireland
Biology OOAO	Biology Status - one out all out.

Model Results

Table 5 compares summer and winter nutrient concentrations in the Suir, Nore Barrow Estuary. Row 1 giving the measured averages for the water body – these were the target values during the calibration process. The modelled results for the current 'status quo' situation are shown on the Row 2 of the table. The modelled results following the addition of the combined three agglomerations at a pe of 1865 is shown on Row 3, and an additional modelled prediction of a discharge equivalent to twice the proposed discharge is shown in Row 4. The proposed discharge results in a small change to the predicted nitrogen concentrations (at the fourth decimal place) but no discernible change in phosphorus concentrations or chlorophyll at this level of precision. The model assumes that the discharge is well mixed into the full water body.

Table 5. Comparison of observed and predicted nutrient and chlorophyll concentrations in the Suir, Nore, Barrow Estuary 'before' and 'after' the combined three-agglomeration discharge at Arthurstown. Row 2 predicts the impact of the discharge at 1865 pe. Row 3 in the table models a discharge equivalent to twice the proposed discharge.

		N Winter Mean (mg/l)	P Winter Mean (µg/l)	N Summer Mean (mg/l)	P Summer Mean (µg/l)	Chlorophyll Winter Mean (mg m^{-3})*	Chlorophyll Summer Mean (mg m^{-3})
1	Status Quo	1.1100	30.045	0.3458	15.487	3.47	3.96
2	Status Quo (calibrated model)	1.1979	32.213	0.3500	14.867	2.88	4.24
3	Plus, new Arthurstown discharge	1.1983	32.213	0.3502	14.867	2.88	4.24
4	Plus, x2 new Arthurstown discharge	1.1986	32.213	0.3502	14.867	2.88	4.24
*	Chlorophyll is here taken as half the EPA measured value to allow for methodological differences between DCPM model and EPA hot methanol analysis method.						

The results are graphed in Fig. 2 showing nitrogen concentrations in the Barrow Nore Suir Estuary over the course of a calendar year. The baseline 'status quo' is compared with two scenarios - Arthurstown 1865 pe discharge added and a second with twice that. The three plots merge at this scale and Fig. 3 provides a bar chart with the summer, winter and annual nitrogen concentrations labelled for clarity.

Fig. 4 plots the 'delta' change in concentrations predicted by the model, over the course of a calendar year, following the addition of the Arthurstown 1865 pe discharge and a second scenario at twice this level. Note the scale in Fig. 4 is µg/l N.

Fig. 5 and 6 provide similar graphs for phosphorus concentrations for the same scenarios.

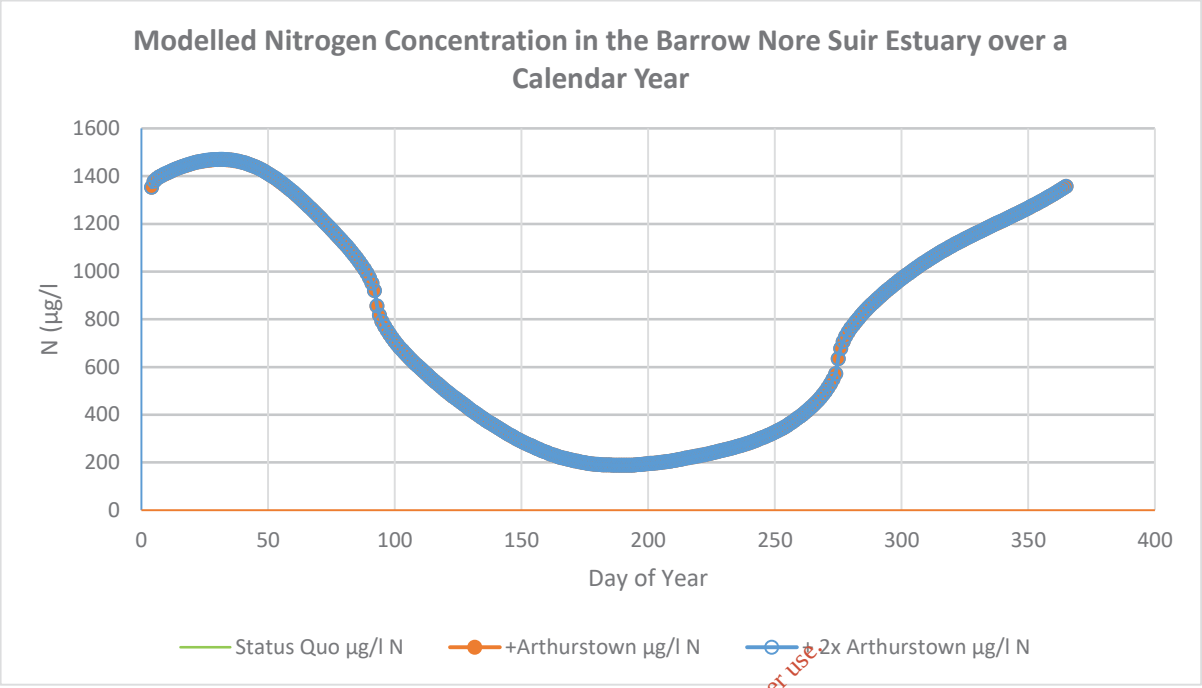


Figure 2. Nitrogen concentrations in the Barrow Nore Suir Estuary over the course of a calendar year. The baseline 'status quo' is compared with two scenarios - Arthurstown 1865 pe discharge added and a second with twice that. The three plots merge at this scale.

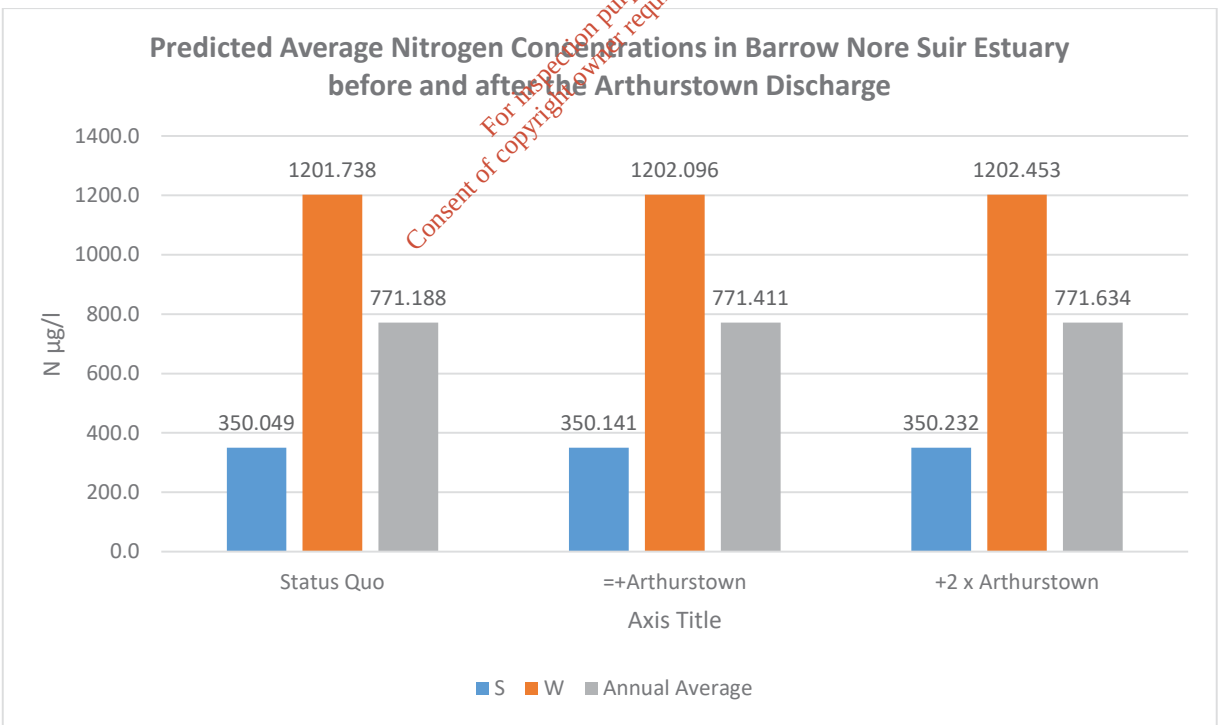


Figure 3. Seasonal and annual mean concentrations for nitrogen (µg/l N) in the Barrow Nore Suir Estuary comparing the current 'status quo' concentrations against two scenarios – the 1865 pe Arthurstown discharge added and a second with twice the loading at 3730 pe. The model predicts small changes at the decimal place level.

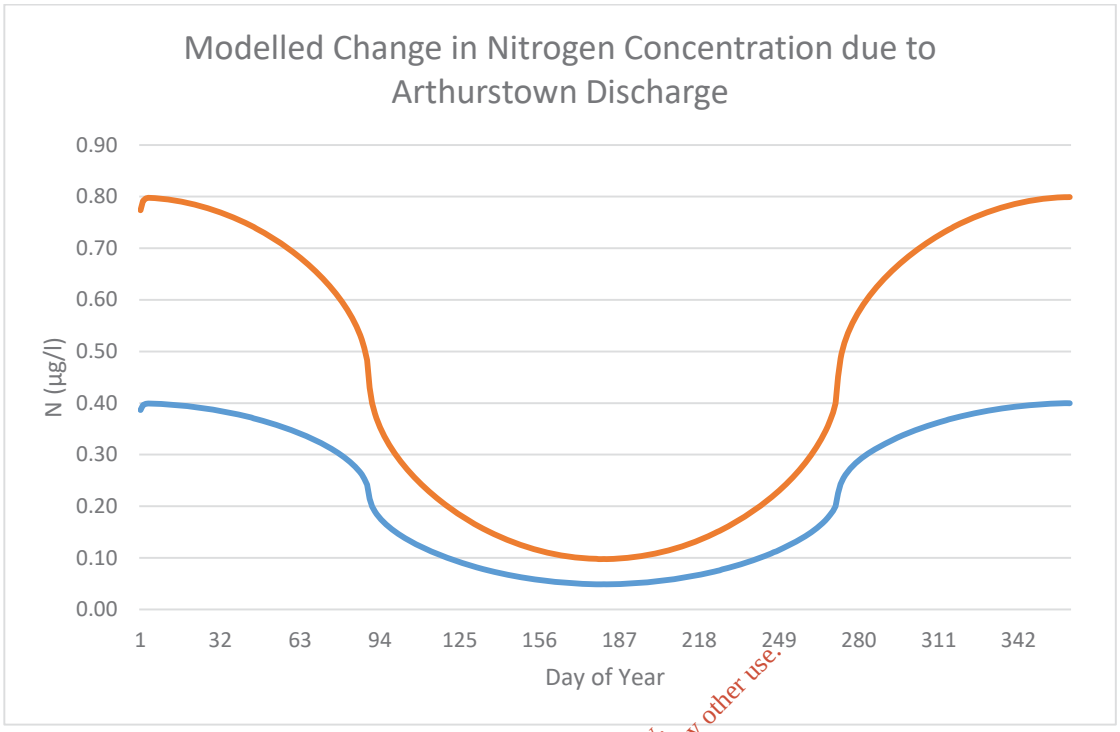


Figure 4. Predicted change in concentration of nitrogen (µg/l N) in the Barrow Nore Suir Estuary over the course of a calendar year following the addition of the 1865 pe Arthurstown discharge (bottom blue line) and a second of 3730 equal to twice the proposed discharge for comparison (top orange line).

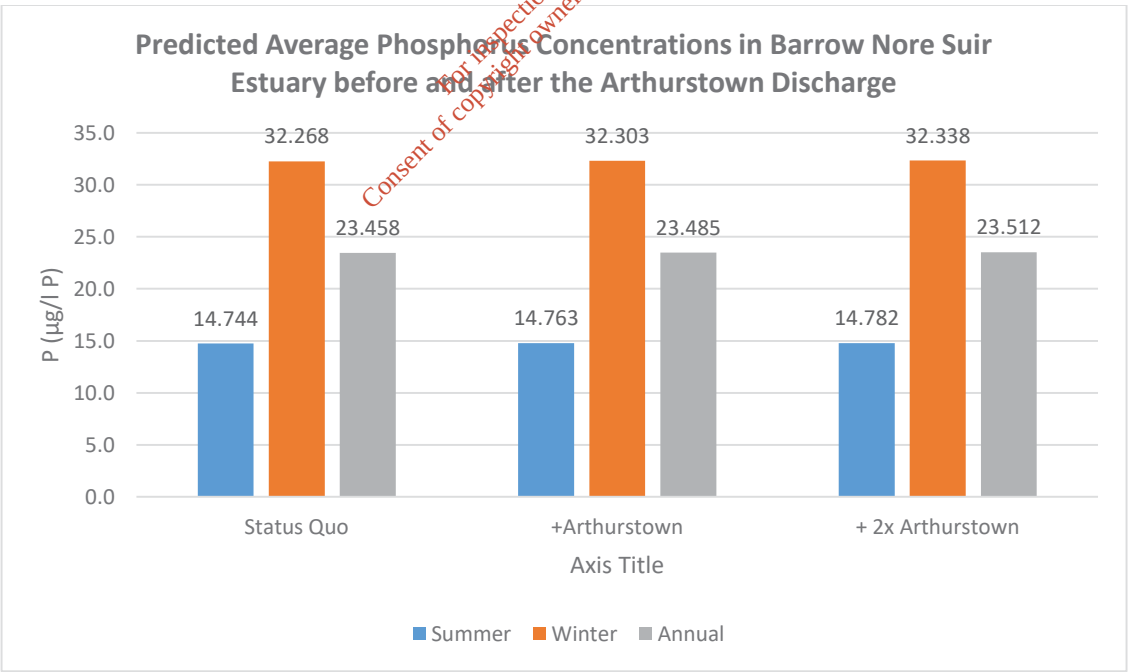


Figure 5. Seasonal and annual mean concentrations for phosphorus (µg/l N) in the Barrow Nore Suir Estuary comparing the current 'status quo' concentrations against two scenarios – the 1865 pe Arthurstown discharge added and a second with twice the loading at 3730 pe.

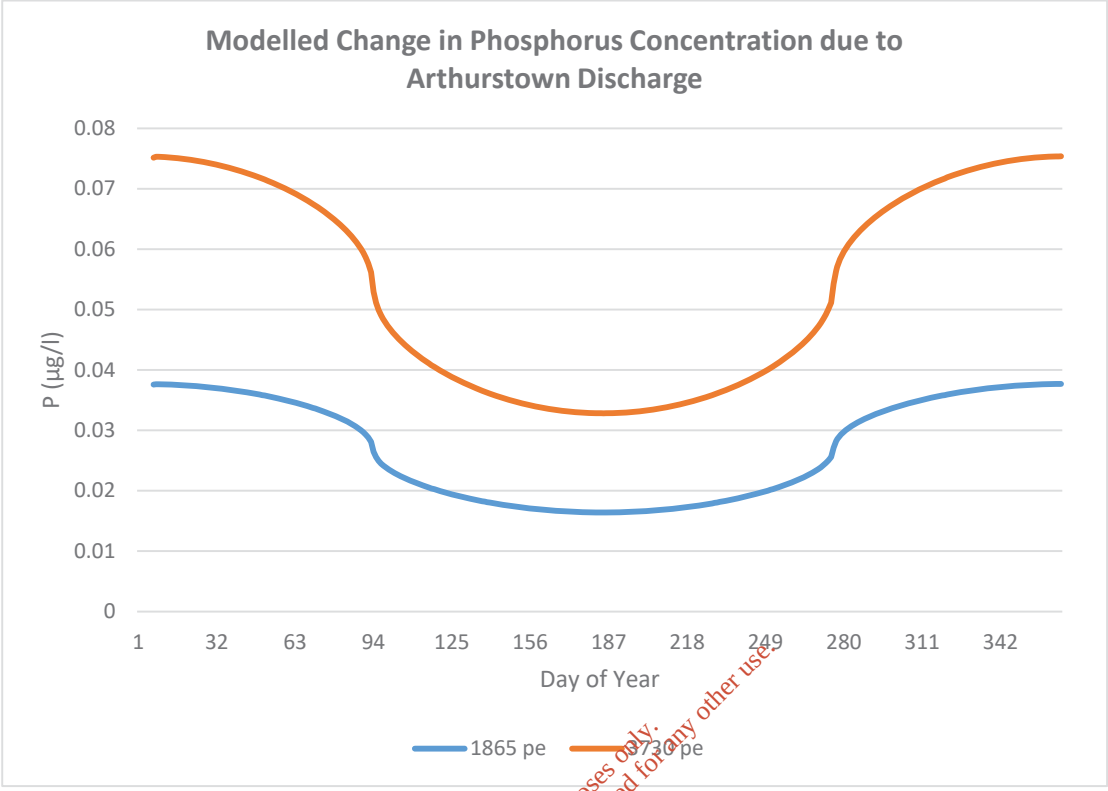


Figure 6. Predicted change in concentration of phosphorus (µg/l P) in the Barrow Nore Suir Estuary over the course of a calendar year following the addition of the 1865 pe Arthurstown discharge (bottom blue line) and a second of 3730 equal to twice the proposed discharge (top orange line).

Conclusions

The model predictions suggest that the incremental impact of the combined discharge from Ballyhack, Duncannon and Arthurstown, over and above the existing untreated discharges from the same population equivalent, would be small and difficult to detect on a whole water body basis. The loading of nitrogen from the agglomerations at ~7,000 kg N per annum is some three orders of magnitude less than the ~16,000,000 kg loading from other sources.

The model suggests that proposed discharge is unlikely to have any impact on the existing WFD ecological status of the Barrow Nore Suir Estuary.

The Barrow, Nore, Suir Estuary is a well-mixed water body with good dispersion. The possibility of some localised impacts at the point of discharge exists, however, and a local investigation of the existing Arthurstown discharge is warranted – e.g., have there been any complaints or issues related to local bathing waters or shellfish beds or obvious signs of localised pollution on the shoreline? The results of such an investigation would help to determine whether a near-shore discharge point would be sufficient or whether an offshore discharge point would be required to mitigate any localised impacts.

References

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