



MORTARSTOWN WASTEWATER TREATMENT PLANT UPGRADE

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Executive Summary

Uisce Éireann (UÉ) 2017-2021 Investment Plan is a capital investment portfolio in water services infrastructure developed to address national strategic objectives as laid out in UÉ's Water Service Strategic Plan. To assist the progression and development of the 2017-2021 Investment Plan, fifty-one Wastewater 'Above Ground' (i.e. treatment) projects were identified nationally and bundled into appropriate works packages and nine separate Call-Offs.

This report is written for Carlow (Mortarstown) Wastewater Treatment Plant (WwTP) upgrade, which comes under Call Off 5. This upgrade project meets An Coimisiún Pleanála (ACP) criteria for Strategic Infrastructure Development (SID). The principal objective of the works associated with Mortarstown WwTP is to ensure that the treatment process can produce a treated effluent which satisfies the conditions of the Wastewater Discharge Licence (D0028-01). Discharge limit values stipulated in the WWDL are as follows:

▪ cBOD	15 mg/L
▪ COD	125 mg/L
▪ Suspended Solids	35 mg/L
▪ Ammonia-Total (as N)	2 mg/L
▪ Total Phosphorus (as P)	1mg/l
▪ Orthophosphate (as P)	0.8 mg/L

The works are designed to cater for a population equivalent of 58,500 p.e. (25-yr design horizon) and achieve calculated emission limit values (ELV) of 25 mg/L BOD, 35 mg/L SS, 2.0 mg/L Ammonia and 1.0 mg/L Orthophosphate. The WwTP was commissioned in 1986 as a conventional extended aeration WwTP with a design capacity of 28,500PE. The aeration basins were upgraded in 2003 to a A2O bioreactor system (anaerobic, anoxic, aerobic) which provides an additional treatment capacity of 7,500 p.e. in the bioreactors. Therefore, the WwTP has inadequate capacity to cater for future demand and much of the existing mechanical and electrical equipment is at end of serviceable life and some equipment is no longer functioning.

In addition, the Supervisory Control and Data Acquisition (SCADA) system is defunct and the systems for automatic control and measurement of the storm return and surplus sludge are not operational, consequently, the plant requires greater manual input than was originally intended.

As part of the upgrade works all flows to the WwTP will be subjected to preliminary treatment comprising fine screening, grit removal and storm water storage. Biological treatment for carbonaceous and nitrogen removal will be achieved by supplementing the existing activated sludge process with upstream primary treatment. Phosphorus removal will be achieved using a combination of biological and chemical treatment and all treated effluent will discharge by gravity to the River Barrow.

A summary of the works required is as follows:

Microtunnel Gravity Trunk Sewer

A 785m microtunnel gravity sewer (Ø1650mm internal diameter) will be constructed from the south side of Kilkenny Road Pumping Station (PS) to the wet well of the new inlet pump station adjacent to the new inlet works of the upgraded WwTP. The microtunnel will be routed under the R448 Kilkenny Road before it traverses under a treelined verge and local access road (to UÉ owned property) to connect to the WwTP.

New Inlet Pump Station (PS) (replaces Kilkenny Road PS)

- The provision of 1 no. terminal pump station (supplemented by the WwTP standby generator).



- The provision of 4 no. raw sewerage pumps inclusive of Mechanical, Electrical, Instrumentation, Control, and Automation (MEICA) works.
- The provision of 1 no. odour control unit.
- The provision of 1 no. flow meter chamber.

Mortarstown WwTP

- Provision of a new foul pumping station for local agglomeration adjacent to existing inlet works (supplemented by the WwTP standby generator).
- Provision of new fuel storage tank (5000L) and standby diesel generator to service the WWTP (roofed).
- Provision of new inlet works to include fine screening, mechanically raked by-pass screen, screening compaction and conveyance to skips, grit removal, grit classification and conveyance to skips. The new inlet works will be provided with an odour treatment unit.
- Provision of 2 no. new stormwater storage tanks and 2 no. new stormwater return pumps.
- Existing final settlement tanks and associated Return Activated Sludge (RAS)/ Waste Activated Sludge (WAS) to be retained, cleaned and decommissioned.
- Provision of 4 no. new primary settlement tanks and scraper systems.
- Provision of 4 no. new primary sludge pumps.
- Provision of a new scum pump.
- Provision of 4 no. new air blowers and modifications to existing air delivery pipework.
- Provision of a new air blower building (roofed).
- Provision of new fine bubble diffused air system in existing aeration tanks.
- Provision of 2 no. new final settlement tanks with half-bridge scrapers.
- Provision of a new RAS/WAS pumping station and station fitted with 2 no. RAS pumps and 2 no. WAS pumps.
- Structural refurbishment of the existing picket fence tanks.
- Mechanical and electrical refurbishment of existing picket fence thickener and conversion of second existing tank to a sludge blending tank.
- Provision of 2 no. additional picket fence thickener tanks.
- Provision of 1 no. belt press, polymer prep unit and polymer dosing pumps in the existing sludge dewatering building.
- Provision of a new pumped sludge transfer system.
- Provision of upgrades to the existing sludge import facility.
- Provision of minimum 6 no. new odour control units.
- Provision of upgrade to existing chemical storage tank and dosing facility.
- Provision of 1 no. new outfall chamber and outfall pipe.
- Modifications to existing administration building.
- Provision of MEICA and SCADA upgrades.
- New storage shed and associated gantry (roofed).
- Demolition of existing inlet works structure.
- Existing service relocations.
- General civil site works.
- Future storm tank (not part of this planning consent).
- Future aeration tank (not part of this planning consent).
- Future final settlement tank (not part of this planning consent).
- Provision for PV solar panels,



- Diversion of existing ESB 38kv HV overhead lines and 10kV/20kV MV line on site (carried out by ESB).



1. Introduction

AtkinsRéalis Ireland Ltd. have been commissioned as Engineering Service Providers (ESP) by Uisce Éireann to assist in the delivery of the Mortarstown Wastewater Treatment Plant (WwTP) upgrade project. The primary objective is to deliver an upgraded WwTP to service the current and the future agglomeration loading, ensuring the scheme complies with the Urban Wastewater Treatment Regulations 2001, the conditions enforced by the WWDA licence and to maintain the designation and status of the receiving waters.

1.1 Previous Reports

The following previous reports prepared by AtkinsRéalis have been used to inform this Specimen Design Report:

- Mortarstown WWTP Upgrade – Feasibility Study Report (FSR) – AtkinsRéalis (June 2018)
- Mortarstown WWTP Upgrade – Stormwater Management Assessment Report (November 2018)
- Mortarstown WWTP Upgrade – Design Inception Report – AtkinsRéalis (October 2019)
- Mortarstown WWTP Upgrade – Outline Design Report – AtkinsRéalis (July 2020)
- Mortarstown WWTP Upgrade – Specimen Design Report (SDR) Rev 01 – AtkinsRéalis (March 2023)
- Mortarstown WwTP Upgrade – Waste Assimilative Capacity (WAC) Assessment Report – AtkinsRéalis (November 2024)
- Mortarstown WWTP Upgrade – Specimen Design Report Rev 02 – AtkinsRéalis (December 2024)
- Mortarstown WwTP Upgrade – Updated WAC Assessment Report – AtkinsRéalis (February 2026)

1.2 Status of Employer Consents

The discharge from the wastewater treatment plant is governed by conditions detailed in Wastewater Discharge Licence (D0028-01). A review of this licence will be required as part of these works. In this regard, the WAC analysis has been updated by using recent ambient water flow rate and quality data provided by UÉ. Results of this study are discussed in detail in Section 3.2. The WAC assessment report has been agreed on with UÉ, and upon completion of the Strategic Infrastructure Development (SID) application, an application for the renewal of the discharge license will be made.

A planning application for the works has been prepared and is being submitted to An Coimisiún Pleanála along with this report and the Environmental Impact Assessment Report (EIAR). On approval of the SID application, the Design Build Contractor will be required to comply with all design constraints as set out in planning permission conditions granted for the upgrade works to the wastewater treatment plant.

1.3 Project Constraints/Restrictions/Obligations

The risks associated with the works along with their likelihood and impacts are assessed in the designer's risk assessment (DRA). The DRA also involves the proposed mitigations for the risks and post mitigated likelihood and impact. The project risk register is provided in Appendix J of this design report.



1.4 Content of the SID Engineering Report

This SID Engineering report builds on the Specimen Design Report (SDR), Feasibility Study Report (FSR), Design Inception Report and Preliminary Investigative Surveys. It is noted, that the scope and project constraints have changed considerably since the production of the FSR, Design Inception Report and previous versions of the SDR.

This report includes the following items described in detail in the following chapters:

- Site Description;
- Summary of the Key Feasibility / Inception Report Findings;
- Detailed Design;
- Geotechnical Considerations;
- Civil and Structural Considerations;
- Odour Management Plan;
- Noise;
- Energy and;
- Constructability.

2. Site Description

2.1 Name, Nature, Location of the Existing Scheme

Mortarstown Wastewater Treatment Plant is located 2.2km south of Carlow Town on the eastern bank of the River Barrow and serves the Carlow Town and its environs. The WwTP is predominantly fed from the Kilkenny Road Pumping Station but also accepts flows from the Glen Pumping Station, College Green Pumping Station, Cluain Buí Pumping Station, Maple Court Pumping Station and the Carlow Institute of Further Education and Training Pumping Station.

Mortarstown Wastewater Treatment Plant

The plant is of an A2O (anaerobic, anoxic, aerobic) design with a discharge to the River Barrow from the Eastern bank. The treatment process includes the following:

- Preliminary Treatment (Inlet screen/grit classifier)
- Secondary Treatment (Anaerobic/anoxic/aeration/clarification)
- Nutrient Removal (Organic P&N removal and P removal through ferric sulphate dosing)

Mortarstown WwTP serves the agglomeration of Carlow Town and its environs (including a section in Co. Laois). The WwTP treats the wastewater from a micro-brewery and a housing development to the west of Carlow Town in the village of Killeslin, Co. Laois.

The lands of the existing treatment plant are owned by Uisce Éireann.

An aerial layout of the existing site is presented in Figure 2-1.





Figure 2-1 – Existing Mortarstown WwTP – Aerial View

The existing secondary treatment process at Mortarstown WwTP caters for the combined removal of carbon, phosphorus and nitrogen by biological methods and consists of 4 no. streams with separate cells in each stream providing anaerobic, anoxic, and aerobic environments.

Kilkenny Road WwPS Site

Kilkenny Road pumping station (PS) passes forward circa. 95% of the flows from the Carlow Town agglomeration to Mortarstown WwTP. The pumping station is located approximately 1km away from the main treatment works.

The incoming flows are combined at a terminal chamber upstream of the PS, at the PS site, before being directed in a single 750mm gravity pipeline to the pumping station wet well. The incoming flows to the station cannot be isolated which makes the construction works more challenging. This constraint and other challenges (as detailed below) have been considered in the constructability assessments for the works to be carried out at the existing WwPS site. Other complexities relating to the design which have been accounted for include;

- The incoming gravity pipelines enter the existing pumping station in excess of 5m below ground level.
- The lack of a penstock on the incoming pipelines, resulting in the inability to isolate the incoming flows to the existing pumping station.
- The extremely poor ground conditions and a high-water table.
- The limited space available within the site
- The requirement to maintain the existing pump station as operational during the construction phase.
- The proximity of the pump station to the River Barrow
- The Special Area of Conservation (SAC) comprising qualifying interest habitat 'priority alluvial forest' surrounds the western and southern sides of the pumping station.

The pump station currently pumps the collected flows via a 600mm and a 400mm rising main to the WwTP.

An aerial layout of the existing pumping station site is presented in Figure 2-2.





Figure 2-2 – Existing Kilkenny Road Pumping Station – Aerial View

2.2 Scheme Deficiencies

Site visits, maintenance record reviews and discussions with Carlow County Council operations and caretaker staff indicate that the existing assets are in reasonable condition.

A high-level summary of the scheme deficiencies is listed as follows:

- The Kilkenny Road pump station, pumps and rising mains are not adequate to pump the Formula A flows calculated for the agglomeration based on the forecasted 2037 and 2052 design horizon loadings.
- The WwTP is hydraulically overloaded under wet weather conditions, particularly during the winter. The current storm tank is undersized with a capacity of approximately 750m³. Some organic overloading has also been observed during the environmental compliance monitoring. Given the anticipated future loading the overloading is set to become more pronounced without intervention.
- The current SCADA system is defunct and operated by a PC which is over 15 years old and operating on Windows 2000, rendering it obsolete (Windows 2000 is no longer supported by Microsoft). The WwTP control system has exceeded its serviceable design life and thus poses a substantial operational risk.
- The existing inlet works poses a number of operational considerations, a main concern being the numerous pumped and gravity feeds at the head of the inlet works and the unscreened nature of the storm tank contents given the pipework configuration from Kilkenny Road PS to the WwTP. The rake bar screen, which is the original screen installed during commissioning, is no longer operational.
- The flow to the existing bioreactors is based on a fixed flow splitter chamber and the split of flows to each reactor is not believed to be equal with consequent adverse impact on the performance of the bioreactors.
- The air blowers serving the bioreactors are over 15 years old and are anticipated to be inefficient with a high energy consumption. In addition, the control of the air blowers is based on a single DO sensor serving two aeration tanks, which may result in the under or over aeration of one of the tanks particularly in light of the poor flow split to the bioreactors.
- The existing final settlement tanks have a shallow side wall depth which often results in poor clarifier hydraulics and a reduced margin of safety when changes in the activated sludge process affect sludge density and settleability. Sludge washouts at the final settlement tanks are a regular occurrence in Mortarstown WwTP



during storm events. Settlement tank sludge washouts are attributable to hydraulic over-loading, inadequate capacity of the RAS pumps, poor sludge settleability and an inadequate settlement tank side-wall depth.

- Flooding of the dewatering building and adjacent site has been observed during high flows at the inlet works or when power failure at plant has ceased operation of the storm return pumps. The Kilkenny Road Pumping Station is also located on the boundary of a flood zone.



3. Summary of the Key Feasibility / Inception Report Findings

WS Atkins Ireland Limited (now AtkinsRéalis Ireland Limited) prepared a Feasibility Study Report (FSR) to assess the capacity and condition of the existing Mortarstown WwTP. The purpose of the report was to provide sound technical justification for any remedial works which may be required to achieve effluent discharge compliance. Revision 2.0 was issued in August 2018, with an Addendum to include for Stormwater Management issued in November 2018. Sign-off on the FSR design loadings was received in May 2019 as part of Phase 1/Gate 2. The key findings of these documents which informed the detailed design are hereunder discussed.

3.1 Population Equivalent

The population equivalent studies carried out to date comprise two phases. The first phase is the Feasibility Study Report calculation based on 2016 Census results and the associated project programme. During the progress of the project, 2022 Census results have been published and the population projections and wastewater load values have been recalculated based on the actual recorded population of Carlow Town. This section summarises the results of both cases.

3.1.1 Feasibility Study Report Outcomes

3.1.1.1 2019 Population Equivalent

The FSR determined that the 2019 population equivalent is 36,354 p.e. consisting of:

- Domestic and Non-Domestic: 29,259 p.e.
- Trade: 7,095 p.e.

3.1.1.2 10-yr Horizon (FSR)

The FSR determined that the 10YR population equivalent to be 58,922 p.e. consisting of:

- Domestic and Non-Domestic: 49,974 p.e.
- Trade: 8,948 p.e.

3.1.1.3 25-yr Horizon (FSR)

The FSR determined that the 25YR population equivalent will be 71,394 p.e. consisting of:

- Domestic and Non-Domestic: 62,613 p.e.
- Trade: 10,477 p.e.

Comments from Uisce Éireann regarding adjustment of headroom and industrial growth rate were incorporated to produce the final agglomeration loadings.



3.1.2 Specimen Design Development

3.1.2.1 2022 Population Equivalent

During the period between completion of the Feasibility Study Report and revisions to the Specimen Design Report, results of the Census 2022 were published by the Central Statistics Office. Given the actual population figures, design horizon population calculations have been revisited based on the recorded 2022 population of Carlow Town.

The related studies have been submitted to Uisce Éireann with the document '*5161805DG0415-Mortarstown WWTP & Kilkenny Road PS – Design Population Equivalent Review Technical Note*' which was followed by a meeting with UÉ. The technical note also revises the design horizon years of the project in accordance with the realised programme. The current year of the calculations is now set as 2023. Likewise, the new design horizon years are now 2037 for 10-yr and 2052 for 25-yr which were 2030 and 2045, respectively.

Following the meeting, UÉ agreed on the results of the revised design horizon years, population and p.e. figures. Thus, the design calculations have been carried out with the new figures in this report. Details of the calculations are provided in '*Design Population Equivalent Review Technical Note*' included in Appendix A.

3.1.3 Final Agglomeration Loading

Final design figures as follows were agreed in November 2023, as detailed in '*5161805DG0415-Mortarstown WWTP & Kilkenny Road PS – Design Population Equivalent Review Technical Note*':

- Current (2023): 39,270 p.e.
- 10-yr (2037): 52,525 p.e. rounded to 52,500 p.e.
- 25-yr (2052): 58,426 p.e. rounded to 58,500 p.e.



3.2 Effluent Discharge Impact to Receiving Waters

The Mortarstown WwTP discharges to the River Barrow. The Urban Wastewater Treatment Directive (UWWD) Regulations 2001 (amended in 2004 and 2010) sets standards to be met in the collection and treatment of wastewater as well as the monitoring requirements for wastewater discharges from urban areas. The Environmental Protection Agency issues wastewater discharges licences (WWDL) for WwTP discharges to environmental waters in accordance with the requirements of the UWWTD. The discharge licence for Mortarstown WwTP was most recently granted under this legislative instrument in August 2009 (ref. D0028-01), with technical amendments in October 2011, December 2016 and December 2021. The Wastewater Discharge Licence sets specific Emission Limit Values.

Table 3-1 - Wastewater discharge licence emission limit values

Parameter	Effluent Limit
BOD	15 mg/l
Suspended solids	35 mg/l
Ammonia (as N)	2.0 mg/l
Total Phosphorous (as P)	1.0 mg/l
Orthophosphate (as P)	0.8mg/l

To assess the potential impact of the wastewater effluent discharge on the receiving waterbody a Waste Assimilative Capacity (WAC) calculation was completed. There are a number of monitoring stations in the River Barrow sub basin, with two of these stations acting as the upstream/downstream monitoring point in the Mortarstown WwTP WWDL.

It is stated in the 2020 AER that receiving water monitoring data taken between 2018 and 2020 showed that the WwTP discharge had no observable impact on the receiving water quality, nor any observable negative impact on the Water Framework Directive status. A summary of the upstream water quality data published in the 2018, 2019 and 2020 AERs is shown in Table 3-2.

Table 3-2 - Average upstream river quality monitoring results for 2018, 2019 and 2020

Date	cBOD (mg/l)	Ortho-P (as P) (mg/l)	Ammonia (as N) (mg/l)
2018	0.63	0.032	0.03
2019	2.05	0.03	0.03
2020	1.608	0.028	0.062
Mean	1.429	0.041	0.029

In addition to the above table, ambient water quality data for years 2020 to 2023 (partly 2024) at upstream and downstream of the outfall point have been made available by Uisce Éireann. Summary of the provided data is given in Table 3-3.



Table 3-3 – Water Quality Sampling Point Statistics (2021 – 2023)

	RS14B012310 (Upstream)		RS14B012460 (Downstream)	
Substance	Mean	95%ile	Mean	95%ile
Ammonia (mg/l)	0.063	0.139	0.069	0.202
BOD (mg/l)	1.805	4.100	1.827	4.279
Orthophosphate (mg/l)	0.020	0.049	0.021	0.058

Along with the ambient water quality data, Uisce Éireann also provided effluent water quality sampling data at Mortarstown WwTP which are shown in Table 3-4.

Table 3-4 – Comparison Between Mortarstown WwTP ELVs and Effluent Quality

Parameter	UWWTD Maximum Permitted Value	Current Mortarstown WWTP ELV	2020-2024 Mortarstown WWTP Treated Effluent Mean
BOD (mg/l)	25	15	3.45
Ammonia (mg/l)	--	2.0	0.11
Orthophosphate (mg/l)	--	0.8	0.216

With the provided data, waste assimilative capacity of the River Barrow has been calculated by adopting both mass balance analysis. Results of these analyses are shown in Table 3-5.

Table 3-5 - Recommended ELVs at Mortarstown WwTP

	Recommended Mortarstown WwTP ELVs (mg/l, 25-year Design Horizon)
	Simple Mass Balance
Ammonia	2.0
BOD	25 (as per UWWTD)
Orthophosphate	1.0

Details of the WAC analysis are provided in the WAC Assessment Report included in Appendix B - WAC Assessment

3.3 Organic Loading Assessment

A Flow and Load (F&L) survey compiled by RPS Consultants in May 2019 collected influent concentration data at the Mortarstown WwTP, however the survey did not include influent flowrate data thus limiting the extent of interpretative analysis that could be undertaken.

WS Atkins Ireland Ltd reviewed the F&L survey data provided in the RPS Consultants May 2019 report to cross reference the influent constituent concentrations at the Mortarstown WwTP with the above anticipated concentrations. Table 3-6 provides a summary of the data obtained. Note that this data was taken between the 2nd and the 30th of May 2019 and is not a full representation of the annual influent constituent variations. This data was reviewed with caution when adopting it to inform the design of the WwTP.



Table 3-6 - Mortarstown WWTP influent constituent concentrations

Parameter	Alkalinity	Ammonia	cBOD	COD	pH	Total N	Total P	Total SS
Samples	22 No.	18 No.	22 No.	22 No.	22 No.	22 No.	22 No.	22 No.
Maximum	900.0	37.0	290.0	778.0	7.8	133.0	13.0	780.0
95%ile	713.8	35.3	217.2	726.7	7.8	82.7	9.4	633.2
Average	449.1	26.3	115.7	448.6	7.5	61.4	5.2	191.1
Minimum	310.0	8.1	10.0	88.0	6.2	17.0	2.1	2.0

Observations in relation to treatability of influent:

- During aerobic wastewater treatment, the C:N:P ratio should be in the range between 100:10:1 and 100:5:1 to ensure a balanced relationship. Based on the influent data in Table 3-6 the average C:N:P ratio observed during the flow and load survey was 100:14:1 which is broadly in line with the ratio required to ensure effectiveness of the biodegradation processes.
- For nitrification the specific alkalinity requirement is typically 7.14 mgCaCO₃/mgNH₄⁺ nitrified. Applying this rate to the average ammonia influent concentration results in an alkalinity demand of approximately 188 mg/L as CaCO₃. The excess alkalinity requirement for stable and neutral pH in the activated sludge process is typically 50 – 100 mg/L as CaCO₃. Therefore, an alkalinity requirement of 288 mg/L is determined. The influent data obtained from the flow and load survey indicates that there is adequate alkalinity present to achieve full nitrification during average influent conditions. Note that the alkalinity consumption associated with chemical dosing for chemical P reduction has not been considered.
- The influent pH has a significant impact on the efficacy of the nitrification process and in some cases, it can fully inhibit nitrification if less than 6.5. The average pH observed at Mortarstown is 7.5 and assuming the influent water temperature is 10 °C, the minimum sludge age required to achieve 2 mg/L NH₃-N at a pH of 7.5 is identified at approximately 7.5 days. A sludge age of 10 days has been selected for the aerobic reactors to ensure that the plant can achieve the ammonia discharge limit of 2 mg/L. It is noted that the influent pH recorded on the 27th of May was 6.2. At this pH the nitrification process would be severely compromised, however this was the only occasion in which the pH dropped below 7 during the flow and load survey and it can therefore be assumed to be outlier, infrequent event.
- The COD:BOD ratio is a measure of the biodegradability of the wastewater and should not exceed 2:1. The observed average COD:BOD ratio is 3:1 indicating the possible presence of poorly biodegradable substances in the influent.
- The BOD:P ratio is critical to ensuring the production of PAOs which trigger biological phosphorus removal in the A2O process. Variations in the BOD:P ratio were observed as well as a constant stream of nitrate to the anaerobic zone rendering bio-P reduction more challenging to control.

In addition to the 2019 F&L survey data, Uisce Éireann provided influent wastewater sampling data at the treatment plant starting in January 2022 up to February 2024. The data provided are 24hr composite samples taken 1 day per month during this period. This data set has been reviewed and related statistics are provided Table 3-7.

Table 3-7 - Mortarstown WwTP influent constituent concentrations (2022 to 2024)

Parameter	Flowrate	Ammonia	cBOD	COD	pH	Total N	Total P	Total SS
Samples	22 No.	25 No.	26 No.	26 No.	26 No.	26 No.	26 No.	26 No.
Maximum	33,019	48.8	1,122.0	2,320.0	8.06	55.0	3.4	1,480.0
95%ile	18,661	37.7	511.8	1,559.8	7.98	51.2	8.1	1,008.8
Average	13,804	23.4	229.1	618.8	7.68	34.1	19.4	330.8
Minimum	1,011	10.8	65.0	130.0	7.20	22.4	27.0	45.0



The data provided is more recent, however, there are the following limitations that cause inaccuracies to occur when utilizing this dataset.

- Over the 2-year period, samples were taken once per month, the number of samples is low while preventing seasonal variability from being seen and understood.
- The samples are 24hr flow proportional samples, meaning that the values are the average concentrations over the day. Given that the data points are averages, any further statistical calculations would be compounding statistical inaccuracies.
- The source data for these 24hr composites were not provided so the diurnal variance that takes place is not available for review.
- The weather data on the days when the samples were carried out is not provided, thus, we do not have the ability to understand whether there was a storm (thus infiltration) in the catchment or not.

When the influent concentration data is converted into influent loads using the design flowrate for the plant, there was a substantial difference between the loads using these concentrations and the loads using 2019 concentrations. In the cases of BOD, COD, Solids and Total Phosphorous pollution parameter cases, the 2022/2023 concentrations correlated to larger loads than 2019. However, the inverse is true for the Total Nitrogen load. When comparing the pollution parameter ratios for the loads developed from the 2022/2023 data, it is clear that the Total Nitrogen load is not within the expected range when compared to the other parameters. A calculation of the expected Total Nitrogen load based on the IW-TEC-700-99-04 Specification, using the TKN contribution per head in Table 3 multiplied by the total population equivalent provided a load that fell within the expected range. Thus, the TN load used in the design is based on the use of the specifications' estimated loading per head while the remaining loads are based on the measured average of the influent concentrations seen between 2022 and 2024.

Understanding of the influent data and the plant's treatment capacity is essential to understanding the effluent concentrations measured at the plant. The measured effluent data does not provide a Total Inorganic Nitrogen measurement, this would cover the concentrations of Nitrite and Nitrate, leaving the plant.

The above observations indicate that the influent will be, for the most part, treatable via conventional methods, however on occasion the variability in influent constituent values, particularly the BOD:P ratio and excess nitrate in the anaerobic zone, may compromise the final effluent standards. The final design solution and process enhancements selected shall therefore be adequately robust and flexible to react to these variable conditions.

3.4 Sludge Import Assessment

A Sludge Import Assessment Report was prepared by WS Atkins Ireland Ltd in September 2020 to quantify the volume of sludge brought to Mortarstown WwTP. The volume of sludge has varied over the years based on a review of records dating back to 2013.

Carlow County Council (CCC) transfer liquid sludge from the smaller plants to either Mortarstown, Tullow or Bagenalstown depending on the location and proximity of the smaller plant. In 2017 and 2018 nearly all sludges were brought to Mortarstown as CCC were instructed by Uisce Éireann not to import sludges to the Tullow or Bagenalstown WwTP. This policy changed in 2019 with reduced sludge volumes being imported to the Mortarstown WwTP.

Sludge imports to Mortarstown WwTP from other facilities are generally from smaller sites like pump stations that are visited infrequently. In previous years sludge imports from sites like Ken Black Pump Station, Glen na Baru, Ashfield and Kilree St Pump Station would have occurred during upgrades of these existing pump stations and these upgrades have all since been completed. Therefore, in the assessment of current sludge imports to Mortarstown loads from sites listed as 'other facilities' have not been included and imports from Wastewater



Discharge Licence (WWDL) Plants, Certificate of Authorisation (COA) Plants and Water Treatment Plants (WTP) have been accounted for only.

The Bagenalstown WwTP has been recently upgraded and this WwTP has not been designed as a sludge import facility. Therefore, the upgrade to the Mortarstown WwTP will be designed to cater for the imported sludge volume which would historically have been received by Mortarstown WwTP plus Bagenalstown WwTP. A summary of the sludge volume imported at Mortarstown and Bagenalstown WwTPs is provided below.

Table 3-8 - Annual sludge import volume (Mortarstown and Bagenalstown WwTPs)

Parameter Sludge Volume (m ³)	2019	2018	2017	2016	2015	2014	2013
WWDL WwTP	5,276	5,590	5,980	6,279	6,065	4,667	4,199
COA WwTP	2,530	3,614	3,757	3,526	2,943	2,276	2,060
WTP	2,015	1,794	1,926	1,840	1,892	1,390	1,350
Total	9,821	10,998	11,663	11,645	10,900	8,333	7,609

Based on the data obtained from CCC and summarised in the above table the average annual volume delivered to both Mortarstown & Bagenalstown WwTP between 2013 and 2019 was calculated at 10,138m³.

3.5 Summary of Performance Requirements

Design loadings, as determined in the *Design Population Equivalent Review Technical Note* were estimated on the following basis:

- Future domestic load to the plant is 58,922 p.e., based on 49,974 p.e. for domestic and non-domestic and 8,948 p.e. for trade.
- Demand of 225 L per day per person, which comprises 175 L/p.e./day consumption and an allowance for 50 L/p.e./day for infiltration.
- Mortarstown WWTP has been hydraulically sized for Full Flow to Treatment but biologically sized for 1.25 x Dry Weather Flow (DWF), where DWF is the demand per person multiplied by the total population equivalent.
- Stormwater flowrate has been calculated as per the requirements of the Uisce Éireann Inlet Works Specification IW-TEC-700-99-02.

The design loadings are summarised in Table 3-9. Where new or upgraded assets are required as part of the upgrade, they are to be designed to accommodate these loadings.

Table 3-9 - WWTP design loadings (2052)

Population Equivalent (p.e.)		Hydraulic Loading (m ³ /day)		Plant Loadings (kg/day)	
Domestic	38,494	DWF	13,163	BOD	3,780
Non-Domestic	5,762	3*DWF(FFT)	39,488	TSS	5,445
Trade	9,110	Formula A Flow	90,200	Total Nitrogen	677
Total p.e. (25 year Design Horizon, 2052, including 10% headroom exl. Industrial)	58,426			Total Phosphorous	132



The treated effluent targets were determined by the WAC assessment as summarised in Section 3.2 and included in Appendix B.

4. Detailed Design

As part of the FSR issued in August 2018, several treatment options and processes were assessed for the Mortarstown WwTP to meet the statutory requirements and future demands of the plant. The options considered are summarised as follows:

▪ Preliminary Treatment

The option of providing preliminary treatment at the existing Kilkenny Road Main Lift Pump Station was considered. This would reduce the operating costs of pumping with the pass forward flow being reduced to 3DWF. It was concluded that there was inadequate space available at the existing pumping station site to accommodate the works and that the invert level of the incoming sewers meant that the preliminary treatment structures would have been very deep.

Two options for the provision of preliminary treatment at the WwTP were then considered.

- A below ground structure
- An above ground (elevated) structure

A below ground structure would result in high operational costs associated with (additional) forward feed pumping to primary treatment and storm storage. The option of providing an elevated inlet works to facilitate gravity flow through the treatment process, thus negating the need for additional pumps, was concluded to be the best option.

▪ Enhanced Biological Treatment

Nitrification is achieved in secondary treatment processes where there is sufficiently long sludge age to facilitate growth of nitrifying micro-organisms. At the 10-yr design horizon loading of 52,500 p.e., it was calculated that the sludge age based on total solids would be less than 10 days and thus inadequate to achieve ammonia discharge consent of 2mg/L. It was concluded that reducing the load (by means of a primary treatment stage) to the secondary treatment process would allow the required sludge age to be achieved.

▪ Primary Treatment

A well-designed primary treatment process can reduce the influent organic load by 25 to 30% and the solids load by 50% – 60% which results in reduced aeration requirements. Primary settlement tends to be an economically viable solution where the p.e. is > 30,000 and can often result in a lower capital cost than upgrading secondary treatment process tanks and air blower systems. This option was therefore deemed more economically viable than that of constructing additional secondary bioreactor volume.

▪ New Final Settlement Tanks with deeper side wall depth

The side wall depth in the existing final settlement tanks at Mortarstown WwTP is 1.2m which is very shallow and can result in poor operational performance when low-density activated sludge is present. Deeper tanks provide greater process flexibility and larger margin of safety when adverse change to sludge settleability is experienced, or occasional blanket expansion is experienced by hydraulic fluctuations. Current best practice regarding circular horizontal flow secondary settlement tanks with diameters of 20.0m or less is to design for a minimum side-wall-depth of 3.3m and recommended side wall depth of 3.5m.

With a side wall depth of 3.5m, the MLSS concentration in the bioreactors could be increased up to 4,500 mg/L allowing for increased operational flexibility and process robustness.



4.1 Design Description

The detailed technical assessment of the various process options available concluded that all flows to the WwTP should be subjected to preliminary treatment comprising duty/standby fine screening, grit removal and storm water storage. The screened and degritted wastewater will undergo preliminary settlement to reduce the organic and solids loading to the secondary state of treatment. Biological treatment for carbonaceous and nitrogenous removal will be based on an expansion of the existing activated sludge process. Phosphorus removal will be achieved during the A2O process, however any residual phosphorous will be removed using chemical precipitation and all treated effluent will discharge by gravity into the River Barrow.

On conclusion of a comprehensive assessment of options available which included regular dialogue between the ESP, the Employer, and the Local Authority the following scope of works were agreed at the close of 'Gate AG1':

Existing Kilkenny Road Pumping Station

The existing Kilkenny Road pumping station will be decommissioned. The existing building structure will remain. The existing above ground steel gantry structure, access stairs and pumps will be removed from site and repurposed. Incoming flows will be diverted via the existing below ground holding tank to a newly constructed manhole positioned south of the existing PS, conveying flows to the new gravity microtunnel. Existing overflows at the Kilkenny Road PS will be retained in accordance with the current Wastewater Discharge Licence (EPA WwDL Ref: D0028-01) and utilised in extreme events where the new gravity microtunnel may be at maximum capacity.

Microtunnel Gravity Trunk Sewer

A 785m microtunnel gravity sewer (Ø1650mm internal diameter) will be constructed from the south side of Kilkenny Road Pumping Station to the wet well of the new inlet pump station adjacent to the new inlet works of the upgraded WwTP. The microtunnel will be routed under the R448 Kilkenny Road before it traverses under a treelined verge and local access road (to UÉ owned property) to connect to the WwTP.

New Inlet Pump Station (PS) (replaces existing Kilkenny Road PS)

- The provision of 1 no. terminal pump station (supplemented by the WwTP standby generator).
- The provision of 4 no. raw sewerage pumps inclusive of Mechanical, Electrical, Instrumentation, Control, and Automation (MEICA) works.
- The provision of 1 no. odour control unit.
- The provision of 1 no. flow meter chamber.

Mortarstown WwTP

- Provision of a new foul pumping station for local agglomeration adjacent to existing inlet works (supplemented by the WwTP standby generator).
- Provision of new fuel storage tank (5,000L storage capacity) and standby diesel generator to service the WwTP (roofed).
- Provision of new inlet works to include fine screening, mechanically raked by-pass screen, screening compaction and conveyance to skips, grit removal, grit classification and conveyance to skips. The new inlet works will be provided with an odour treatment unit.
- Provision of 2 no. new stormwater storage tanks and 2 no. new stormwater return pumps.
- Existing final settlement tanks and associated Return Activated Sludge (RAS)/ Waste Activated Sludge (WAS) to be retained, cleaned and decommissioned.
- Provision of 4 no. new primary settlement tanks and scraper systems.



- Provision of 4 no. new primary sludge pumps.
- Provision of a new scum pump.
- Provision of 4 no. new air blowers and modifications to existing air delivery pipework
- Provision of a new air blower building (roofed).
- Provision of new fine bubble diffused air system in existing aeration tanks.
- Provision of 2 no. new final settlement tanks with half-bridge scrapers.
- Provision of a new RAS/WAS pumping station and station fitted with 2 no. RAS pumps and 2 no. WAS pumps.
- Structural refurbishment of the existing picket fence tanks.
- Mechanical and electrical refurbishment of existing picket fence thickener and conversion of second existing tank to a sludge blending tank.
- Provision of 2 no. additional picket fence thickener tanks.
- Provision of 1 no. belt press, polymer prep unit and polymer dosing pumps in the existing sludge dewatering building.
- Provision of a new pumped sludge transfer system.
- Provision of upgrades to the existing sludge import facility.
- Provision of minimum 6 no. new odour control units
- Provision of upgrade to existing chemical storage tank and dosing facility
- Provision of 1 no. new outfall chamber and outfall pipe.
- Modifications to existing administration building.
- Provision of MEICA and SCADA upgrades.
- New storage shed and associated gantry (roofed).
- Demolition of existing inlet works structure.
- Existing service relocations.
- General civil site works.
- Future storm tank (not part of this planning consent).
- Future aeration tank (not part of this planning consent).
- Future final settlement tank (not part of this planning consent).
- Provision for PV solar panels,
- Diversion of existing ESB 38kv HV overhead lines and 10kV/20kV MV line on site (carried out by ESB).

The selected and derived parameters to support the design of proposed process are presented within the design calculations. All critical process and hydraulic design parameters are listed within same. For non-repetition, these values are not extracted from the calculation documents, please refer to 'Design Calculations for the WwTP' in Appendix C. Design drawings for all buildings, plant and other developments proposed in the works are provided in Appendix E. A detailed description of proposed works from the interception point of the microtunnel gravity sewer to the final effluent outfall is provided in the following sections.

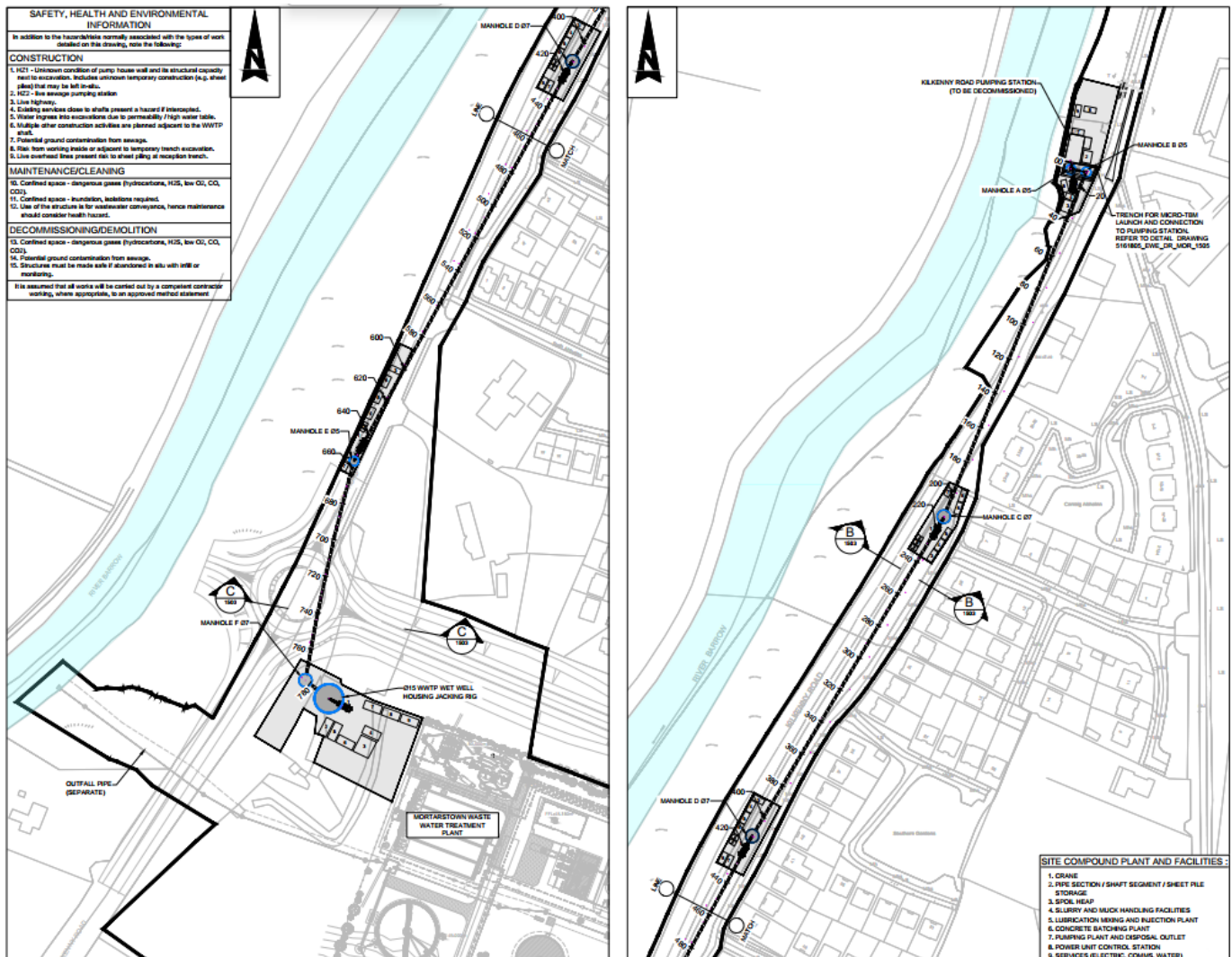
4.1.1 Microtunnel Gravity Sewer

In the previous versions of the Specimen Design Report and in the earlier reports, a new pumping station was planned to be constructed south of the existing Kilkenny Road PS. However, a Special Area of Conservation qualifying interest, namely 'priority alluvial forest' habitat was identified south of the existing PS in a woodland survey study, which was carried out by an independent expert. Consequently, AtkinsRéalis conducted a detailed '*5161805DG0392-Kilkenny Road Pumping Station Site Selection Report*' (SSR) to find a suitable site location for construction of new pumping station. The SSR assessed 8 no. locations in this regard and the most favourable location identified was the available area west of the new inlet works of the upgraded WwTP.



The preferred site for the pumping station requires gravity flow to the new PS. Due to the excessive depth of the gravity sewer (6 – 12m), conventional open-cut trench excavation is unviable especially along the busy R448 road. Therefore, AtkinsRéalis issued '5161805DG0409-Tunnel Option Review Technical Note' assessing several construction methods. The technical note concluded that microtunnelling is the most suitable technique for installation of the pipeline between the existing Kilkenny Road PS and the New Pumping Station. Further to this technical note, a detailed design of the microtunnel gravity sewer has been carried out which is provided in Appendix D.

The microtunnel gravity sewer is approximately 785m in length with the discharge point at the New Inlet Pumping Station. Diameter of the gravity sewer has been determined as Ø1650mm to cater the Formula A flow rate of the 25-yr design horizon and to comply with the minimum pipe flow velocity of 1.03m/s as per Table 5.6 of UÉ Standard IW-TEC-800-01. For the minimum velocity calculations, the daily peak flow of 2.5DWF has been adopted. The gradient of the gravity sewer has been determined as 0.002043. The maximum flow velocity corresponding to 2047 Formula A flow of 1,139l/s is calculated as 1.61m/s, whereas in terms of the minimum velocity, current 2.5DWF of 258l/s resulted a velocity of 1.06m/s. The microtunnel comprises 3 no. launch shafts (at the WwTP site, Manhole F and Manhole C), 2 no. reception shafts (at the south of the Kilkenny Road PS and Manhole E) and 1 no. intermediate shaft (Manhole D) along R448 Kilkenny Road. The shafts are located to satisfy both UÉ's maximum distance between manholes requirement of 200m and tunnel boring machine (TBM) manufacturer's maximum jacking length requirement. However, due to multiple constraints along the tunnel route, the 200m maximum spacing could not be achieved between manholes D and E.



4.1.2 New Inlet Pump Station (Replaces Kilkenny Road PS)

4.1.2.1 Introduction

Initially, it had been proposed to upgrade the Kilkenny Road Pumping Station by constructing a new PS in the area at the south of the existing PS. As described earlier, this location was later reviewed due to ecological and environmental constraints identified during surveys. Therefore, it is proposed to construct a new PS west of the new inlet works at the upgraded WwTP. The new PS is designed for 4 no. pumps configured on a duty/assist/assist/standby basis to deliver a future 2052 design horizon Formula A flow of 1,139 l/s (4,100 m³/h). Each pump will be rated to deliver 389 l/s (1,400m³/hr) so that 3 no. pumps configured on a duty/assist/standby basis will service the current (2023) Formula A flow of 695 l/s (2,503m³/hr).

The designs have been undertaken in line with the relevant Uisce Éireann Technical Standards, Codes of Practice and Specifications.

4.1.2.2 Pumping Station Design Flow Rate

The PS Dry Weather Flow (DWF) and PS Formula A Flows were determined and finalised in line with IW-CDS-5030-03 Code of Practice, IW-TEC-700-99-02 and Flow Survey Data. The delivery pipes of each pump are sized on the basis of achieving a maximum pipe velocity of 1.3m/s at the Future Formula A flowrate. Pump flow rate calculations are based on the technical note *CIP 5 - Kilkenny Road Pumping Station and Rising Main Assessment* and as accepted in the meeting no. 5161805MINUTES0305 held on 6th October 2021. Given the new PE values as discussed earlier, the flow rate figures in the minutes of this meeting have been prorated in accordance with the updated PE.

The new PS is designed for 4 no. pumps but need only 3 no. pumps (duty/assist/standby) to service the current Formula A flow. As the anticipated flows to the PS increase, a fourth pump will be required.

Table 4-1 - PS design Flow rate data

Parameter	Value	Ref
Current PS Dry Weather Flow (DWF)	103 l/s (370 m ³ /h)	Flow based on recent calculations with the updated PE values.
Current PS Formula A Flow	695 l/s (2,503 m ³ /h)	Flow based on recent calculations with the updated PE values.
2037 Design Horizon PS Dry Weather Flow (DWF)	137 l/s (492 m ³ /h)	Flow based on recent calculations with the updated PE values.
2037 Design Horizon PS Formula A Flow	1,055 l/s (3,800 m ³ /h)	Flow based on recent calculations with the updated PE values.
2052 Design Horizon PS Dry Weather Flow (DWF)	152 l/s (548 m ³ /h)	Flow based on recent calculations with the updated PE values.
2052 Design Horizon PS Formula A Flow	1,139 l/s (4,100 m ³ /h)	Flow based on conclusions of Flow Review Report (Old 4,700m ³ /h for 67,000PE prorated to 58,500PE)
Minimum Selected PS Pass Forward Flow based on achieving	500 l/s (1,800 m ³ /h)	IW-TEC-800-02 PS pipeline velocity to be between 0.75 and 2.5m/s



minimum pipe velocity in excess of 0.75m/s	
Current. No. of Pumps and Pump operational configuration	3 No. Duty/Assist/Standby
2037 Design Horizon. No. of Pumps and Pump operational configuration	4 No. Duty/Assist/Assist/Standby
2045 Design Horizon. No. of Pumps and Pump operational configuration	4 No. Duty/Assist/Assist/Standby

4.1.2.3 Pump Station Configuration Options Chamber

The size of the pumps dictated that the proposed pump station would be configured as a wet well/dry well type pump station. The circular well is a 15.0m diameter circular concrete chamber with a dividing wall including a 6m segment for the wet well and an 8.6m segment for the dry well.

4.1.2.4 Pump Station Wet Well Sizing

The PS wet well effective volume is the volume in the wet well between the pump start and the pump stop level. The minimum effective volume required will increase as the PS pass forward flowrate increases as needed to meet the future design horizon loadings. A minimum effective volume of 63m³ was calculated for the current loading and a minimum effective volume of 103m³ was calculated for the 2052 design horizon loading. The calculated minimum effective volumes are based on the pumps operating at a fixed design flowrate with the number of pump motor starts being limited to a maximum 10 number of starts per hour.

Table 4-2 - PS Wet Well Effective Volume

Parameter	Symbol	Unit	Value	Ref
Max allowable Pump Starts per hour	Z		10	IW-TEC-800-02 Section 7.13
Current: PS Design Pass Forward Flow	Q	m ³ /h	695 l/s (2,503 m ³ /h)	Table 4-1 above
Design Horizon 2052: Pass Forward Flow	Q	m ³ /h	1,139 l/s (4,100 m ³ /h)	Table 4-1 above
Current: Minimum Required Wet Well Effective Volume	Vh	m ³	63	$Vh = Q \div (4 \times Z)$
Design Horizon: Minimum Required Wet Well Effective Volume	Vh	m ³	103 (Circular)	$Vh = Q \div (4 \times Z)$
Wet Well Plan Area Proposed	A	m ²	60 (Circular)	A 15.0m diameter circular concrete chamber with a 6m segment for the wet well is proposed.
Minimum Distance between the Pump Start and the Pump Stop level Proposed		mm	2000	An adjustable distance of 2000mm is selected between Pump Start and Pump Stop which equates to a wet well volume of 120m ³ .

It is noted that the pumps will be fitted with VSDs, thus allowing pumps to be controlled as follows:



- a. Pump Start / Stop level with a Varying Flowrate between levels
- b. Pump Start / Stop Out level with a Fixed Flowrate between levels

It is recommended that controls will include staggered starting and stopping of the pumps.

4.1.2.5 Pump Selection

Preliminary sizing of the pumps was carried out, based on the following:

1. Free discharge of the WwTP Inlet Works at an elevation of 52.317 (mOD).
2. PS Wet Well level is at the low-point level of 37.287 (mOD).
3. A single pump design flowrate of 389 l/s (or 1,400 m³/h)
4. PS Forward Feed Flowrate of 1,139 l/s (4,100 m³/h)
5. 1 No. operational ø900mm NB Cement Lined Ductile Iron (EN598) pipe, 58m in length

A Total Pump Head of 15.6 m is calculated (includes 10% allowance).

The collection network is a combined system and there are several petrol stations located within the catchment. In accordance with UÉ Flammable Liquids in Drainage Sewers (FLIDS) Assessment Worksheet the collection network and its pump station are characterised as Medium Risk and it is anticipated that the PS wet well will be classified as Zone 1 Internal and Zone 2 External requiring suitably rated ATEX pumps.

4.1.2.6 Existing Stormwater Overflows at Kilkenny Road Pump Station

The design intent is to retain the existing 675mm Stormwater Overflow in the existing Kilkenny Road PS wet well and utilise it as an Emergency Overflow, this will be provided with fine screening. There is also a 550mm Stormwater Overflow immediately upstream of the pumping station on the incoming 600mm sewer. On the basis of the assumed pipe velocities, the capacities of both of the existing stormwater overflow pipes have been estimated as follows:

1. The 675mm Pipe, when flowing full and laid to gradient that generates 1.5m/s pipe velocity will carry 2,000m³/hr
2. The 550mm Pipe, when flowing full and laid to gradient that generates 1.5m/s pipe velocity will carry 1,200m³/hr

Based on above estimates, the two pipes, will carry 3,200m³/hr when flowing full, this is adequate for the current 2503m³/hr Formula A flow but not the future 2052 Formula A flow of 4100m³/hr.

To allow the future Design Flow of 4,100m³/hr to be carried, an upstream head would be required, i.e., surcharging. If both overflow pipes are retained, at a surcharge depth of 1m, the expected flows would be 2,850m³/hr in the 675mm pipe and 1,850m³/hr in the 550mm pipe.

If only the 675mm overflow pipe is retained, a surcharge depth of 2400mm is estimated for the 4100m³/hr flow, which is not feasible. Therefore, the following conclusions were determined:

1. If the existing 675mm pipe is not increased in size, the existing 550mm pipe should be retained.
2. If the existing 550mm pipe is made redundant, the existing 675mm pipe should be upgraded to a 900mm pipe or an additional new 600mm overflow pipe should be constructed beside the existing 675mm pipe.

As the finished surface levels of the microtunnel shafts and the new WwPS are at the same or above the surface level of the existing Kilkenny Road PS, the existing overflows can be maintained without risk of surcharging along the microtunnel, in the event of the total pump station failure during a storm event. It therefore is proposed to retain the existing 675mm and 550mm pipes.



4.1.3 Mortarstown WwTP

4.1.3.1 Preliminary Treatment – Inlet Works

Wastewater pumped from the inlet pump station will enter the treatment works (up to 4,100m³/h for the 2052 design horizon) at the northwest boundary of the site and discharge into a flow splitting chamber located upstream of screening. Flowrate and flow totals will be recorded by flow monitor 'F1'.

The flow splitting chamber will also accept flows from a new local foul pump station designed to pass combined flows (up to 300m³/hr) from smaller pump stations located in smaller distinct collection networks. Flow rate and flow totals will be recorded via flow monitor 'F2'. The existing inlet treatment works shall be decommissioned, demolished, and replaced with a new inlet works which will be designed in accordance with Uisce Éireann Technical Standard IW-TEC-700-99-02. The inlet works will be elevated to facilitate gravity flow throughout the works.

The inlet works will consist of 4 no. fine screens and a single mechanical bypass screen. Downstream of the screens, 2 no. grit removal units (crossflow detritor types) complete with grit pumps and a grit classifier will be installed. Flows in excess of FFT will overflow at the inlet works outlet chamber and pass forward to the new stormwater tanks. FFT will be sampled at Sample Point 'SP1' after screening. Flows from stormwater return and the existing Leachate Storage Tank & PS will be re-introduced downstream of the sample point to ensure that they do not misrepresent the influent sample.

The screens will be supplied with a common screenings launder with wash water supply (from the washwater borehole) to clean and convey screenings to closed disposal skips. All screenings will be washed, separated, and deposited in skips for removal off site. Grit will be removed from the base of the unit and pumped to a Grit Classifier. The Grit classifier and washer will be provided with an enclosed screw delivery to a disposal skip. Offensive odours at the inlet works will be contained by covers and conveyed by an air extraction system to a dedicated odour treatment system.

For additional detail on inlet works see Drawing Ref. 5161805_EWE_DR_MOR_5140 & 5141.

4.1.3.2 Preliminary Treatment – Stormwater Storage

Flows in excess of FFT will overflow the inlet works downstream of screening and grit removal. The excess flows will pass to the new stormwater storage tank system which will have an effective storage capacity of 6,231m³ which is equivalent to 2.95 hours storage of Formula A – FFT at 58,500 p.e.. If a storm event persists, and the volume of excess flow exceeds the stormwater storage tank capacity, the screened and de-gritted wastewater will overflow and gravitate to the WwTP outlet chamber and discharge via a licensed discharge location to the River Barrow.

The existing 1,560m³ final settlement tanks will be repurposed as stormwater storage tanks and supplemented by the two new stormwater storage tanks with 4,650m³ effective storage. In the event that the capacity of the new and existing storm tanks is fully utilised, stormwater will overflow to the River Barrow and be recorded via flow monitor 'F7'. Once the storm event has abated, the stored stormwater will be returned to the inlet works by a duty/standby stormwater return pump set at a flowrate of 1DWF or 548 m³/hr. Stormwater return pumping will be initiated when the measured flow to the inlet works drops below 2 DWF or 1,097m³/hr.

For additional detail on storm tanks see Drawing Ref. 5161805_EWE_DR_MOR_5142 & 5143.

4.1.3.3 Primary Settlement

Full flow to treatment (1,645m³/hr for the 2052 design horizon) shall pass from the inlet works to 4 no. newly constructed primary settlement tanks. The primary tanks will be rectangular horizontal flow type with chain and flight scrapers for sludge collection in collection hoppers. The tanks will have a maximum surface loading rate of 1.25 m/h



with all tanks in service and an organics/solids removal efficiency of 30%/60%. The surface loading rate will be less than 1.65m³/m²/hr at FFT when one tank is out of service. Progressive cavity or rotary lobe pumps will transfer the 3%DS primary sludge from the tanks' sludge collection hoppers to the sludge blending tank. The pumps will have a capacity of approximately 12.5m³/hr and will operate for approximately twelve hours per day at maximum load.

The primary settlement tanks will be covered with openings provided for maintenance and inspection. A sludge scraper and surface scum skimmer will be provided to enable skimming and desludging of the tanks. The tanks will be provided with a suitable odour control system.

For additional detail on primary settlement tank see Drawing Ref. 5161805_EWE_DR_MOR_5144 – 5146.

4.1.3.4 Secondary Treatment – Biological

The current A2O biological process will be retained. The A2O process is an adaptation to the conventional activated sludge process which is modified to biologically remove nitrogen and phosphorous. The anaerobic tank allows Phosphorous Accumulating Organisms (PAOs) to absorb phosphorous from the wastewater before completing denitrification and nitrification in the anoxic and aerobic tanks respectively. Orthophosphate will also be removed through coagulation with ferric sulphate in the aerobic stage of the process. A schematic of the A2O biological process is presented in Figure 4-2 below. The FSR has assessed the design and size of the existing anaerobic zones and determined that they are suitably sized for 60,000p.e. loading, so no upgrade works are currently needed at the anaerobic zones.

Carbonaceous BOD removal occurs in the aerobic tanks. The proposed process will recirculate mixed liquor to convey microorganisms and nitrates created during the nitrification process from the aerobic tank to the anoxic tank where the recycle stream will be mixed with influent.

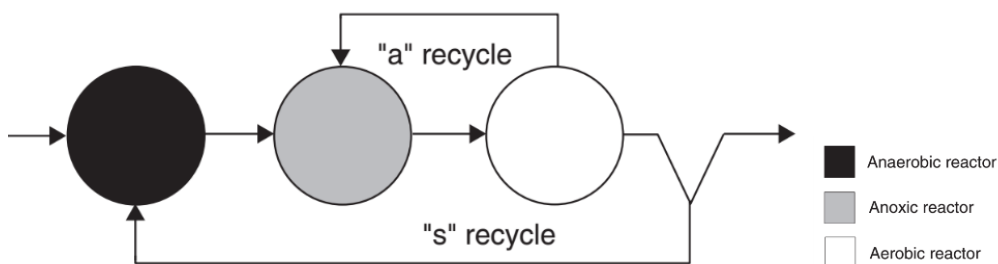


Figure 4-2 - Modified Pre-D and A2/O Process

The River Barrow was assigned a “moderate” status waterbody by the EPA for the period 2013-2018. The dilution available in the river is less than the Notionally Clean River model and as such requires the proposed ELVs to reflect this with more stringent values.

Overall nitrogen removal may be limited by factors such as carbon source availability, process kinetics, anoxic or aerobic zone sizes, and return or recycle flowrates and hydraulic baffling. Therefore, these parameters are carefully considered in design. The influent wastewater receives high strength wastewater from a local micro-brewery which shall serve as the carbon source for bacteria thereby negating the need for an external carbon source (e.g., methanol), return activated sludge from the settlement tanks shall provide micro-organisms, and the anoxic recycle pumps shall provide nitrate as an oxygen source.

Flows will pass from the primary tanks to the existing flow splitting chamber, upstream of biological treatment, at a peak rate of 1,645m³/hr (excluding return liquors). The flowrate to each anaerobic reactor will be monitored by new flowmeters with flow control provided by modulating actuated penstocks.



The reactor retention times in each biological stage are estimated as follows: -

Anaerobic reactor	1.35 hrs @ 1 DWF
Anoxic reactor	1.35 hrs @ 2 DWF
Aerobic reactor	8.30 hrs @ 1 DWF

The design assumes that 75% of the P will be removed biologically with the remaining P removal requirements being achieved through chemical dosing at a rate of 26 L/hr. The existing chemical storage tank will be replaced, and upgrade works will be limited to critical infrastructure such as dosing pumps and dosing lines.

Replacement of the existing fine bubble air diffusers is included in the scope of works. New 70kW air blowers are included as well as modifications to the air header to facilitate tapered aeration and reduce energy consumption.

The air blowers will be designed for a peak SOTR (Standard Oxygen Transfer Rate) of approximately 737 kg/hr O₂ and airflow rate of 3,614 Nm³/hr. Upper and lower DO concentration set points will be provided so that the average DO concentration can be maintained at 2.0 mg/l.

Four variable speed process air blowers will be provided. The air blowers will be sized and configured on a duty/assist/assist basis with a common standby air blower in the event of failure of one of the duty air blowers. Assuming a blower back pressure of 50 kPa and a blower efficiency of 65% the duty power of each blower is calculated at 77.2 kW. The air blower motors will be VSD controlled and will operate to maintain a pre-set target Dissolved Oxygen levels in the tanks.

Process air will be delivered to the aerobic reactors via a common delivery air main with air flows to each of the aeration tanks being controlled by actuated valves, pressure sensors and dedicated dissolved oxygen sensors installed in each of the aeration tanks. A new blower building will be constructed to house the proposed air blowers with space allocated within for a future blower of similar size. A lifting gantry will be provided to facilitate removal of the blowers to a loading area opposite the main access door. A pedestrian access door will be provided at the front of the building and sky lights will be included to provide natural lighting.

Return Activated Sludge will be recycled from the final settlement tanks and mixed with the incoming influent (downstream of the new primary settlement tanks) at a rate of between 0.75 DWF and 1.25 DWF (VSD controlled). The commingled influent shall pass to the anaerobic reactors to facilitate the combined biological removal of phosphorus and nitrogen.

The anaerobic stage is a complete mix system with 1 No. Mixer installed in each of the anaerobic reactors to provide full mixing of the contents and to maintain a velocity to prevent solids settlement. The commingled influent will have a total retention time of 0.75 hours in the anaerobic zone at the FFT from 58,500 p.e.

The liquor from the anaerobic reactors will pass to anoxic reactors to facilitate the removal of nitrogen from the system, where it will be mixed with the internally recirculated mixed liquor. Each internal mixed liquor recirculation pump will be capable of variable return flow of between 1 DWF and 2 DWF.

From the anoxic zone, the mixed liquor will be passed to the aeration basin which is split into two cells with each cell comprising of a lattice of fine bubble air diffusers.

4.1.3.5 Secondary Treatment – Chemical

Phosphorous exists in three main forms in wastewater:



- ortho-phosphate,
- polyphosphate, and
- organic phosphate.

During aerobic treatment the latter two forms are converted to ortho-phosphate which is the easiest form to precipitate when using chemical addition. Whilst most of the phosphorus will be removed biologically in the A2O process, any residual phosphorus will be removed by chemical dosing. The chemical dosing location for the chemical precipitation of phosphorus is proposed at the aeration tank i.e., simultaneous precipitation, as polyphosphates and organic phosphorus are less easily removed than orthophosphorus.

Adding iron salts after secondary treatment (where organic phosphorus and poly-phosphorus are transformed into orthophosphorus) is considered to be optimum in terms of P removal. The chemical precipitation system will be designed in accordance with Uisce Éireann Design Standard IW-TEC-700-05 'Chemical Precipitation of Phosphorus'.

4.1.3.6 Secondary Treatment – Final Settlement and Activated Sludge Pumping

Flows from the biological process will pass via the existing outlet chamber to a new flow splitting chamber upstream of secondary settlement. Secondary settlement shall consist of 2 no. conventional radial flow tanks (32mØ) with full bridge scrapers and a central sludge collection hopper. The tanks are designed to treat flows up to 58,500 PE at a peak biological mixed liquor suspended solids concentration of 3.4 kg/m³. Sludge will be drawn from the tanks to a sludge pump station and returned upstream of the biological process at a variable rate of between 0.75 and 2.5 DWF. Excess sludge will be passed to the sludge blending tank at a rate of 60m³/hr and mixed with primary and imported sludge. The treated and settled wastewater will gravitate to an open channel Parshall flume fitted with an ultrasonic ('F4') level sensor to record flowrates prior to discharging to the final effluent chamber and thereon, via a licensed discharge location, to the River Barrow discharge outfall. An autosampler ('SP2') will be positioned at the final effluent chamber to take a composite sample of the final effluent. A pH/temperature sensor will also be installed to monitor the final effluent pH.

The effluent from each aeration stream will gravitate to 2 no. new final settlement tanks. The proposed settlement tanks will be designed for upward flow velocity of 1.00 m/h at the peak hydraulic loading of 39,488 m³/day and shall have a side wall depth of 3.9m.

Long solids retention times in final settlement tanks can present a risk to gas production (N₂, N₂O, and CO₂) through denitrification. If the nitrogen gas production time is less than or equal to solids retention time within the settlement tanks, conditions for rising sludge may be initiated. The best means to mitigate this is to optimise cBOD removal and denitrify wastewater prior to settlement. A denitrification stage has been included in the proposed process.

For additional detail on final settlement tank see Drawing Ref. 5161805_EWE_DR_MOR_5148 – 5150.

4.1.3.7 Sludge Facility – Sludge Dewatering and Storage

The maximum solids production for the works is estimated to be 4,095 kgDS/day which equates to a specific sludge yield of 69g/p.e.. The breakdown of the solids production is identified as follows: -

▪ Primary sludge production	2,086 kgDS/day
▪ Secondary sludge production	1,859 kgDS/day
▪ Precipitant sludge	150 kgDS/day

The existing sludge import facility will be upgraded in accordance with IW-TEC-700-99-06 to accept sludge from local treatment plants. The anticipated daily imported sludge volume is 45m³ assuming a dry solids concentration of 0.85% and sludge mass of 380 kgDS/day. Imported sludge will be screened at a rate of 20 l/s to remove any rags



and debris and discharged into an underground storage tank (min 45m³ capacity) with forward feed pumps to pump to the sludge blending tank.

All primary, secondary and imported sludge will be combined at the sludge blending tank to ensure the sludge load is balanced to smooth out variations in flow to downstream processes and to ensure a homogenous mixture of sludges with a consistent (dry solids) per centage. The sludge blending tank will have a retention time of 15 hrs at peak daily sludge volume.

Mechanical thickening of sludge is not proposed; hence blended sludge will be gravity thickened using the existing 6.0mØ picket fence thickener and supplemented by 2 no. new 7.5mØ picket fence thickener. The thickeners are intended to provide buffering of varying sludge feeds and provide a more consistent feed to dewatering plant, allowing the mechanical dewatering plant to run continuously for a full working 'day' shift. It is anticipated that the picket fence thickeners will thicken the homogenised sludge to approx. 2.5%DS. The picket fence thickeners shall allow for the storage of up to 3 days homogenised sludge to increase the operational flexibility of the entire dewatering facility. In addition, this supplementary storage will allow for maintenance of the dewatering plant to be undertaken without interfering with the smooth operation of the main treatment works.

Thickened sludge will be pumped directly to both the existing and the new belt press for dewatering to a cake concentration of 18-20%DS. All sludge cake (dewatered sludge) will be disposed from the building via the new dewatered sludge cake transfer system to be installed in the existing sludge dewatering building.

The centrate from dewatering and supernatant from thickening (17m³/hr excl. washwater) will gravitate to a new pump station. The tank will be sized to ensure liquors are returned at a constant rate over a 24-hour period. A by-pass will be included to temporarily direct flows to the import sludge tank for periods of maintenance. The filtrate arising from thickening and dewatering of sludge will be returned directly to the secondary biological process to prevent rising sludge problems in the primary tanks. The tank will have a by-pass to the sludge import tank for cleaning and maintenance.

Works will include the provision of 3 No. covered and forced-ventilated skips (6 changes per hour as a minimum). The skips will be suitable for holding the dewatered sludge contents allowing for 7 days storage. The skips will be suitable for collection by standard skip removal vehicles and will be designed for an operating life of 25 years. The skips will have an openable hatch on the roof to facilitate filling with the sludge conveyor and shall also have an integrated auger to allow for even distribution / filling without the need for moving the skip during the fill process. The skips will have a minimum volume capacity of 20m³ each.

An internal stainless steel screw conveyor with a stainless-steel chute/hopper will transfer sludge from the sludge dewatering units and transport the cake outside the sludge press building into external sludge skips. The conveyor will be of minimum 300mm Ø with discharge height 2.5m, capable of delivering up to 400kgDS/hr of dewatered sludge to the sludge skips. Separate conveyors will be supplied for discharging into each of the 3 no. sludge skips.

For additional detail on the sludge facility see Drawing Ref. 5161805_EWE_DR_MOR_5153 – 5156.

4.1.3.8 Sludge Import

Future sludge imports have been based on an arbitrary year-on-year increase in population of 1.25%. The resultant sludge import population equivalents and annual sludge volumes are as follows:

Table 4-3 - Future Sludge Import Volumes

Parameter	Capita	Volume (m ³)
Current	5,050	10,138
10 Year	5,718	11,479



25 Year	6,889	13,830

The site access road is designed to accommodate 40 ft articulated road tankers. A road tanker, upon entering site will continue to access the existing certified weighbridge prior to proceeding to the upgraded sludge import facility adjacent to the existing sludge dewatering building.

The existing sludge import facility will be upgraded in accordance with IW-TEC-700-99-06 to accept sludge from local treatment plants, with an anticipated volume of 45 m³/day. Imported sludge will be screened and stored in a new underground tank, then pumped to the sludge blending tank, where all sludge streams will be combined to ensure a balanced and homogenous mixture. Blended sludge will be gravity thickened using the existing 6.0mØ picket fence thickener and two new 7.5mØ thickeners.

The proposed layout is a conventional design, with a sludge screen accepting tank imports via tanker coupling and discharging screened sludge to an underground tank. Screened sludge shall discharge directly into the imported sludge storage tank with a capacity in excess of one tanker load. From there it will be pumped to the sludge blending tank. A mixer shall be provided within the sludge blending tank to maintain the mobility of imported sludges and to homogenize sludge collected from the main WwTP (i.e., primary sludge and waste activated sludge).

Homogenised sludge from the sludge blending tank shall have a dry solids concentration of approx. 0.85%DS and shall be pumped to the picket fence thickeners. Sludge will be dosed enroute with a polyelectrolyte principally to improve the quality of the supernatant and to aid in the entrapment of FOG and scum.

4.1.3.9 Administration Building

The existing administration building layout will be modified to include a larger control room. The proposed arrangement will facilitate the installation of new Form 4 control panels without compromising existing operations. All redundant panels will be removed from site and disposed of. The existing store will be repurposed to include a new office and laboratory.

For additional information see Drawing Ref. 5161805_EWE_DR_MOR_5162.

4.1.3.10 Onsite Storage

A new storage shed (ca. 25m x 13m) will be constructed to the north of the sludge dewatering building as part of the proposed WwTP upgrade works. The shed will be used as the primary storage location of machinery and parts for the WwTP.

In addition, the disused blower building will be repurposed as additional storage facility for general materials and spares.

4.1.3.11 Onsite Chemical and Fuel Storage

The following chemical materials and fuels will be stored at site during the operational:

- 2no. Ferric Sulphate (Fe₂(SO₄)₃) tanks, 15,000l total (i.e. 2no. 7,500l tanks)
- 3no. Polyelectrolyte 1,000l tanks
- 1no. Diesel fuel tank, 5,000l

All onsite chemical / fuel storage tanks will be suitably banded.



4.1.3.12 Final Effluent Monitoring

At the notch weir of the final settlement tanks, treated effluent overflows and passes by gravity through a flowmeter chamber and onto a sampling chamber from where a flow proportional sampler will collect samples. The flowmeter shall be installed with a bypass to facilitate servicing without interrupting plant flow. The sampling chamber shall be designed and constructed in accordance with IW-TEC-700-99-08 equipped with a pH monitor.



4.1.3.13 Hydraulic Design

Main Stream

Hydraulic design of the main process stream is constrained by the top water level in the biological process of 48.640 mOD. This level cannot be raised as an increase in level may dislodge the air header due to buoyancy effect. As such the treatment works are designed around this top water level (TWL). The key levels are as follows:

Inlet Works	50.439 mOD (IL)
Primary Settlement	49.730 mOD (TWL)
Aeration Tank	48.640 mOD (TWL)
Final Settlement	48.170 mOD (TWL)
Combined Effluent Chamber	47.162 mOD (Operating Water Level)
Flood level (1:100-year)	46.25 mOD (at outfall)

Stormwater Stream

Similar to the main process stream the stormwater stream is constrained by the top water level in the existing final settlement tanks (repurposed stormwater tanks) of 47.700 mOD. All associated levels are designed to ensure that flows can be conveyed without adjusting this level. The key levels associated with the stormwater stream are as follows:

Inlet Works	50.439 mOD (IL)
New Storm Tank	48.659 mOD (TWL)
Combined Effluent Chamber	47.162 mOD (Operating Water Level)
Flood level (1:100-year)	46.25 mOD (at outfall)

4.1.3.14 Stormwater Drainage Network Extension

The WwTP has an existing stormwater collection system which flows into the existing final effluent chamber. The upgrade works will extend the layout of the surface water drainage system where new pipes and gullies will be connected to the existing system. The system will be connected to the new effluent chamber. Surface water drainage from the site will be directed through an oil interceptor, which is designed to remove hydrocarbons, oils, grease and suspended sediments before the water is discharged via the existing outfall to the River Barrow.

Refer to Drawing Ref. 5161805_EWE_DR_MOR_5190 & 5191 for details of stormwater drainage layouts.

4.1.3.15 WwTP Site Lighting (External)

An Outdoor Lighting Report was prepared by AtkinsRéalis by using Lighting Reality (2025) design software, as presented in full in Appendix G.

The Outdoor Lighting Report has been developed in consultation with bat and biodiversity specialists and is in line with the guidelines and legislation for the protection of bats with an aim of minimising disruption and disturbance to local bat populations. As included within the report, the 'Guidance Note 08/23; Bats and Artificial Lighting at Night -



Institute of Lighting Professionals' has been considered with regards to reducing impact on bat population (refer to Appendix 14.2 Outdoor Lighting Report, 2025).

Obtrusive lighting will be restricted by:

- The control of the type of light source by restricting the level of light emitted by the luminaire at high angles between 70 and 90 degrees.
- The use of full horizontal cut off luminaires mounted at a zero-degree tilt angle.
- Some luminaires to be fitted with baffle plates so there is no light spillage on adjacent receptors.
- Lighting controlled by individual photocells and sensors to reduce energy consumption and potential light pollution.

Refer to Drawing Ref. 5161805_EWE_DR_MOR_5195 & 5196 for details of lighting layouts.

4.1.4 Outfall

It is proposed to replace the existing 600mm diameter (licenced) outfall pipe with a new 900mm diameter gravity outfall pipe 250m in length. The new outfall pipe will be constructed to the south side of the existing outfall (ca. 10m from the existing licenced discharge point). The pipe will cross under the R448 by microtunnelling and enter the previously cleared woodland that is adjacent to the existing residential dwellings to the west of the Kilkenny Road. It is proposed that the outfall pipe will enter the river ca. 1.5m below the low water level.

5. Geotechnical Considerations

This section of the report outlines the following objectives::

- Review of the ground conditions at the WwTP site based on available ground investigation information.
- Identify difficult ground conditions at the WwTP site (e.g., soft, SILT / CLAY, loose SAND or GRAVEL, high water table which could affect the construction and post-construction phase of the scheme);
- Consider foundation design and possible requirement for anti-flotation of the tanks at the WwTP site.

5.1 Ground Conditions

Priority Geotechnical Limited (PGL) was engaged by Uisce Éireann to carry out a detailed ground investigation as part of the Mortarstown WwTP and wastewater network upgrade.

The fieldworks were undertaken at Mortarstown between February and March 2021 and a second phase carried out in March to May 2022. The ground investigation initially comprised of:

- Trial Pits (8 No.)
- Cable Percussion Boreholes (6 No.)
- Rotary Boreholes (5 No.)
- Slit Trenching (5 No.)
- GPR of Treatment Plants

Phase 2 was completed within Mortarstown WwTP and surrounding area and along Kilkenny Road (R448) and Green Road/Carraig Abhainn. Phased 2 comprised of:

- Cable Percussion Boreholes (5 No.)



- Rotary Boreholes (5 No.)
- Slit Trenching (11 No.)
- GPR of Kilkenny Road and Green Road/Carraig Abhainn

5.1.1 Mortarstown WwTP

Ground conditions vary across the Mortarstown WwTP site, where topsoil was recorded to depths of between 0.2 and 0.5 mbgl, overlying cohesive glacial deposits comprising silt or clay to depths of between 2 and 3 mbgl. Deeper granular deposits comprising medium dense to dense sands and sandy gravels were recorded to depths of between 14 and 17.1 mbgl.

Phase 2 exploratory holes (RC101 and RC103) recorded sand and gravel layers to a depth of 25 mbgl (43 mOD) west of the existing tanks. Deeper clay deposits were recorded to 11.8 mbgl at one location north of the tanks in BH07, and to 8 mbgl to the west.

Dense limestone boulders (possible bedrock) were encountered below the gravel at 16.5 mbgl to a maximum depth of 21 mbgl southwest of the existing tanks in RC05 and RC06. Medium strong limestone bedrock was encountered north of the tanks at 14.7 mbgl in RC07, and at 14.4 mbgl to the west in RC104.

Made Ground was recorded at one location in the centre of the treatment plant to a depth of 1.3 mbgl.

5.1.2 Geotechnical Assessment

5.1.2.1 New Wastewater Pumping Station

The location of the New Inlet PS is set further from the River Barrow, reducing risks of groundwater intrusion from river seepage. However, the groundwater levels at the WwTP area are still high, which will necessitate dewatering measures during construction.

The ground at the pump station location consists of medium-dense to dense sandy gravels and sandy gravels, which provides a firmer foundation. However, topsoil and loose gravelly sand found at varying depths in the WwTP area may require over-excavation and replacement with suitable engineering fill to ensure foundation stability for the Pump Station.

Groundwater was observed at approximately 6 m below ground level, with casing cutting off groundwater at a depth of 11 m. Appropriate control measures, such as sump pumps or other dewatering techniques, will be necessary to manage groundwater during excavation and foundation works.

In the absence of chemical data, soil/water conditions are assumed that all buried concrete should be designed to Class XC2 (IS EN 206-1) or DS-1 AC-1s.

5.1.2.2 Geotechnical Assessment Mortarstown WwTP

5.1.2.2.1 Inlet Works

The inlet works (formation level of approximately 1 mbgl (49.5 mOD)) will be constructed mainly within ground where SPT-N values are greater than 26 which is indicative of medium dense to very dense material.

A standpipe was installed in RC101 however groundwater monitoring was not undertaken. Groundwater ingress was recorded at 6.0 mbgl (44.8 mOD), therefore it is unlikely that any dewatering techniques will be required during the construction phase of the inlet works.



Table 5-1 - Inlet Works - Founding Level Ground Conditions

Exploratory Logs	Founding Strata	SPT-N value	Depth of Strata mOD (mbgl)	Approx. Base of the Founding Level mOD (mbgl)	GW Ingress mOD (mbgl)
BH101/RC101	Dense sandy GRAVEL	36, 45, 51, 45	49.8 - 47.8 (1.0 – 3.0)	49.5 (1.3)	44.8 (6.0)
BH102/RC102	Medium dense to dense sandy GRAVEL	26, 46	51.5 - 48.8 (0.3 – 3.0)	49.5 (2.3)	Dry

Any potential soft low bearing clay or silt deposits, or made ground, shall be fully excavated and removed to reach competent material at the design formation level of 49.5 mOD for the inlet works. To mitigate against the risk of differential settlement, the inlet works should be founded within the medium dense to dense gravels available.

5.1.2.2.2 Primary Settlement Tank

The primary settlement tank (approximate formation level of 7.5 mbgl (42.0 mOD)) will be constructed mainly within ground where SPT-N values are greater than 16 which is indicative of medium dense material. However, there were localised areas of blowing sands recorded. Blowing sands were encountered between 9.0 and 10.5 mbgl (41.8 and 40.3 mOD) in RC101 which will require consideration during the construction phase.

Limestone bedrock was encountered at 14.2 mbgl (35.4 mOD) in RC104 to the south of the proposed tank.

Shallower groundwater strikes were recorded in RC101 at 6.0 mbgl (44.8 mOD), BH103 at 4.3 mbgl (44.4 mOD) and BH104 at 3.1 mbgl (46.5 mOD). The groundwater levels encountered indicate dewatering techniques will be required during the construction phase.



Table 5-2 - Primary Settlement Tank – Founding Level Ground Conditions

Exploratory Logs	Founding Strata	SPT-N value	Depth of Strata mOD (mbgl)	Approx. Base of the Founding Level mOD (mbgl)	GW Ingress mOD (mbgl)
BH101/RC101	Medium dense slightly gravelly silty SAND	16, 24, 26	44.8 - 40.3 (6.0 – 10.5)	42.0 (8.8)	44.8 (6.0)
BH102/RC102	Medium dense to dense slightly silty SAND	22, 23, 23, 24, 34	46.5 - 37.6 (5.3 – 14.2)	42.0 (9.8)	n/a
BH103/RC103	Dense to medium dense very clayey sandy GRAVEL	29	43.7 - 41.7 (5.0 – 7.0)	42.0 (6.7)	44.4 (4.3), 41.2 (7.5)
BH104/RC104	Loose to medium dense slightly silty SAND (blowing sands)	6, 17	42.1 - 39.1 (7.5 – 10.5)	42.0 (7.6)	46.5 (3.1), 42.1 (7.5)

*Material description or SPT-N values highlighted in red identify soft or loose strata.

Low SPT- N values within the blowing sands at BH104/RC104 are not a true indication of the material properties. The groundwater ingress during drilling has likely resulted in the blowing sands which in turn may impact on the SPT-N value.

Any soft low bearing clay or silt deposits, or made ground, will need to be fully excavated and removed to reach competent material at the design formation level of the primary settlement tank. To mitigate against the risk of differential settlement, over excavation will likely be required to reach competent ensure medium dense to dense gravels available for the foundation.

Blowing sands present in BH104/RC104 indicate that basal heave shall be an issue at this location.

5.1.2.2.3 Stormwater Storage Tank

The stormwater storage tank (approximate formation level of 8.4 mbgl (41.1 mOD)), will be constructed mainly within ground where SPT-N values are greater than 11 which indicates a firm material. However, there are localised areas of soft material e.g. silt or clay to depths of between 0.3 and 6 mbgl (43.2 and 48.9 mOD) in BH07 and BH08 which will require consideration during the construction phase.

Limestone bedrock was encountered at 14.7 mbgl (34.5 mOD) in BH07 to the north west of the proposed tanks.

Shallower groundwater strikes were recorded in RC07 at 4.9 mbgl (47.9 mOD) and 4.9 mbgl (48.3 mOD) in BH08. Groundwater monitoring carried out in April 2021 recorded a standing water level of 4.5 mbgl (44.7 mOD) in BH07 adjacent to and west of the proposed stormwater storage tanks.



Table 5-3 - Stormwater Storage Tank - Founding Level Ground Conditions

Exploratory Logs	Founding Strata	SPT-N value	Depth of Strata mOD (mbgl)	Approx. Base of the Founding Level mOD (mbgl)	GW Ingress mOD (mbgl)
BH07/RC07	Firm brown slightly sandy CLAY. Stiff CLAY at 9.2 mbgl (40 mOD)	11, 13	43.2 - 40.0 (6.0 – 9.2)	41.1 (8.1)	35.3 (13.9), 44.7 (4.5)
BH08	Founding strata not reached. Borehole terminated at 6.4 mbgl (43.3 mOD) in medium dense GRAVEL.	refusal	Borehole terminated at 43.3 mOD (6.4 mbgl)	41.1 (8.7)	44.9 (4.9)
TP06	Founding Strata not reached. Firm slightly sandy gravelly CLAY to 2.8 mbgl (46.7 mOD).	n/a	Trial pit terminated at 46.7 mOD (2.8 mbgl)	41.1 (8.4)	n/a

Any soft low bearing clay or silt deposits, or made ground, will need to be fully excavated and removed to reach competent material at the design formation level of the stormwater storage tank. To mitigate against the risk of differential settlement, over excavation will likely be required to reach competent ensure stiff clay or medium dense to dense gravels available for the foundation.

It should be noted that chiselling was required in each of the boreholes which may have an impact on the depth achieved using sheet piles. The medium cobble content of the gravel in BH08 may impact on the use of sheet piles, creating a potential obstruction if encountered.

5.1.2.2.4 Sludge Dewatering Building

The sludge dewatering building (approximate formation level of 1.0 mbgl (48.5 mOD)) will be constructed mainly within sandy gravelly clay, however SPT-N values were not available at the founding level of the building. Soft to firm clay was encountered in BH07 from a depth of 2.6 to 6 mbgl (46.6 to 43.2 mOD) with SPT-N values of 6 at 3.8 m (45.4 mOD) and 13 at 5 mbgl (44.2 mOD). The presence of soft clay will require consideration during the construction phase.

Two trial pits (TP07 and TP13) recorded slightly gravelly sandy clay with medium cobble content below topsoil to a depth of 1.2 and 2.7 mbgl (48.2 and 46.2 mOD). Soft clay identified within the trial pits is likely to be removed when excavating to the design formation level.

A groundwater strike was recorded in RC07 at 13.9 mbgl (35.3 mOD). Groundwater monitoring was carried out in April 2021 and recorded a standing water level of 4.5 mbgl (44.7 mOD) in BH07 adjacent to and north east of the proposed Sludge Dewatering Building.



Table 5-4 - Sludge Dewatering Building– Founding Level Ground Conditions

Exploratory Logs	Founding Strata	SPT-N value	Depth of Strata mOD (mbgl)	Approx. Base of the Founding Level mOD (mbgl)	GW Ingress mOD (mbgl)
BH07/RC07	Firm slightly sandy gravelly CLAY	n/a	48.9 – 47.7 (0.3 – 1.5)	48.5 (0.7)	35.3 (13.9), 44.7 (4.5)
TP07	Firm slightly gravelly sandy CLAY with medium cobble content	n/a	0.2 – 1.2	48.2	n/a
TP13	Firm slightly gravelly sandy CLAY with medium cobble content	n/a	0.2 – 2.7	46.2	n/a

Any soft low bearing clay or silt deposits, or made ground, will need to be fully excavated and removed and backfilled with suitable aggregate to ensure competent material is present at the design formation level of the building.

Soft clay with a low bearing capacity has been identified below the founding strata between 2.6 to 5 mbgl (46.6 to 44.2 mOD) and needs to be considered during the construction phase. To mitigate against the risk of differential settlement, over excavation will likely be required to reach competent stiff clay or medium dense to dense gravels for the foundation.

5.1.2.2.5 New PFT (Picket Fence Thickener)

The new Picket Fence Thickener (PFT) tank (approximate formation level of 1.5 mbgl (47.5 mOD)) will be constructed mainly within sandy gravelly clay, however SPT-N values were not available at the founding level of the building at 1.5 mbgl (47.5 mOD). Soft to firm clay was encountered in BH07 from a depth of 2.6 to 6 mbgl (46.6 to 43.2 mOD) which will require consideration during the construction phase.

Two trial pits (TP07 and TP13) recorded slightly gravelly sandy clay with medium cobble content below topsoil to a depth of 1.2 and 2.7 mbgl (48.2 and 46.2 mOD). Soft clay identified within the trial pits is likely to be removed when excavating to the design formation level.

A groundwater strike was recorded in RC07 at 13.9 mbgl (35.3 mOD). Groundwater monitoring recorded a water level of 4.5 mbgl (44.7 mOD) in BH07 adjacent to the proposed PFT tank.

Table 5-5 - New PFT – Founding Level Ground Conditions

Exploratory Logs	Founding Strata	SPT-N value	Depth of Strata mOD (mbgl)	Approx. Base of the Founding Level mOD (mbgl)	GW Ingress mOD (mbgl)
BH07/RC07	Soft to Firm slightly sandy gravelly CLAY	n/a	47.5 – 46.6 (1.5 – 2.6)	47.5 (1.5)	35.3 (13.9), 44.7 (4.5)
TP07	Founding strata not reached. Firm slightly gravelly sandy CLAY with	n/a	49.2 – 48.2 (0.2 – 1.2) Trial pit terminated at 1.2 m	47.5 (1.9)	n/a



	medium cobble content				
TP13	Firm slightly sandy CLAY with medium cobble content	n/a	46.7 – 46.2 (0.2 – 2.7) Trial pit terminated at 2.7 m	47.5 (1.4)	n/a

Any soft low bearing clay or silt deposits, or made ground, will need to be fully excavated and removed and backfilled with suitable aggregate to ensure competent material is present at the design formation level of 1.5 mbgl (47.5 mOD). Soft clay with a low bearing capacity has been identified below the founding strata between 2.6 to 5 mbgl (46.6 to 44.2 mOD) and needs to be considered during the construction phase. To mitigate against the risk of differential settlement, over excavation will likely be required to reach competent stiff clay or medium dense to dense gravels for the foundation.

5.1.2.2.6 Sludge Blending Tank

The new sludge blending tank (formation level of 1.8 mbgl (47.0 mOD)) will be constructed mainly within sandy gravelly clay, however SPT-N values were not available at the founding level of the building. Soft to firm clay was encountered in BH07 from a depth of 2.6 m (46.6 mOD) to 6 (43.2 mOD) which will require consideration during the construction phase.

Two trial pits (TP07 and TP13) recorded slightly gravelly sandy clay with medium cobble content below topsoil to a depth of 1.2 and 2.7 mbgl (48.2 and 46.2 mOD). Soft clay identified within the trial pits will be removed when excavating to the design formation level.

A groundwater strike was recorded in RC07 at 13.9 mbgl (35.3 mOD). Groundwater monitoring recorded a water level of 4.5 mbgl (44.7 mOD) in BH07 adjacent to the proposed Sludge Blending tank.

Table 5-6 - Sludge Blending Tank – Founding Level Ground Conditions

Exploratory Logs	Founding Strata	SPT-N value	Depth of Strata mOD (mbgl)	Approx. Base of the Founding Level mOD (mbgl)	GW Ingress mOD (mbgl)
BH07/RC07	Soft to Firm slightly sandy gravelly CLAY	n/a	47.5 – 46.6 (1.5 – 2.6)	47.5 (1.5)	35.3 (13.9), 44.7 (4.5)
TP07	Founding strata not reached. Firm slightly gravelly sandy CLAY with medium cobble content	n/a	49.2 – 48.2 (0.2 – 1.2) Trial pit terminated at 1.2 m	47.5 (1.9)	n/a
TP13	Firm slightly sandy CLAY with medium cobble content	n/a	46.7 – 46.2 (0.2 – 2.7) Trial pit terminated at 2.7 m	47.5 (1.4)	n/a

*Material description or SPT-N values highlighted in red identify soft or loose strata.

Any soft low bearing clay or silt deposits, or made ground, will need to be fully excavated and removed and backfilled with suitable aggregate to ensure competent material is present at the design formation level of 1.5 mbgl (47.5 mOD). Soft clay with a low bearing capacity has been identified below the founding strata between 2.6 to 5



mbgl (46.6 to 44.2 mOD) and needs to be considered during the construction phase. To mitigate against the risk of differential settlement, over excavation will likely be required to reach competent stiff clay or medium dense to dense gravels for the foundation.

5.1.2.2.7 Centrate Pump Sump

The Centrate Pump Sump (approximate formation level of 4.4 mbgl (45.0 mOD) will be constructed mainly within a soft to firm sandy gravelly clay or silt which will require consideration during the construction phase. Over excavation to a more competent founding material at 5 mbgl or deeper may be required to reduce the risk of settlement.

One SPT-N value of 6 was recorded within the founding strata of the Centrate Pump Sump.

Limestone bedrock was encountered at 14.7 mbgl (34.5 mOD) in BH07 to the west of the proposed pump sump.

Three trial pits (TP07, TP08 and TP13) recorded slightly gravelly sandy clay with medium cobble content below topsoil to a depth of 1.2, 2.8 and 2.7 mbgl (48.2, 46.2 and 46.2 mOD). Soft clay identified within the trial pits will be removed when excavating to the design formation level.

Groundwater strikes were recorded in RC07 at 13.9 mbgl (35.3 mOD) and 4.9 mbgl (44.9 mOD) in BH08. Groundwater monitoring recorded a standing water level of 4.5 mbgl (44.7 mOD) in BH07 to the north west of the Centrate Pump Sump.

Table 5-7 - Centrate Pump Sump – Founding Level Ground Conditions

Exploratory Logs	Founding Strata	SPT-N value	Depth of Strata mOD (mbgl)	Approx. Base of the Founding Level mOD (mbgl)	GW Ingress mOD (mbgl)
BH07/RC07	Soft to firm slightly sandy CLAY Over-excavate to firm CLAY at 5 mbgl (44.2 mOD)	6, 13	46.6 - 43.2 (2.6–6.0)	45.0 (4.2)	35.3 (13.9), 44.7 (4.5)
BH08	Soft to firm slightly sandy slightly gravelly CLAY	5, 11, 17	47.3 - 44.3 (2.5 – 5.5)	45.0 (4.8)	44.9 (4.9)
TP07	Founding strata not reached. Firm slightly gravelly sandy CLAY with medium cobble content	n/a	49.2 – 48.2 (0.2 – 1.2)	45.0 (4.4)	n/a
TP08	Founding strata not reached. Sandy gravelly CLAY with medium cobble content	n/a	(0.2 – 2.8)	45.0 (4.0)	n/a
TP13	Founding strata not reached. Firm slightly sandy CLAY	n/a	48.8 – 47.7 (0.2 – 2.7)	45.0 (3.9)	n/a



with medium cobble
content

*Material description or SPT-N values highlighted in red identify soft or loose strata.

Any soft low bearing clay or silt deposits, or made ground, will need to be fully excavated and removed and backfilled with suitable aggregate to ensure competent material is present at the design formation level of approximately 4 mbgl (45.0 mOD). Soft clay with a low bearing capacity has been identified below the founding strata between 2.6 to 5 mbgl (46.6 to 44.2 mOD) and needs to be considered during the construction phase. To mitigate against the risk of differential settlement, over excavation will likely be required to reach competent stiff clay or medium dense to dense gravels for the foundation.

5.1.2.2.8 Final Settlement Tank

The final settlement tank (approximate formation level of 9.0 m bgl (40.0 mOD)) will be constructed mainly within variable ground described as soft to firm SILT or loose to medium dense GRAVEL.

Soft to stiff SILT with SPT-N values of 7, 8, 19 were recorded in RC05 approaching and at formation level. Loose to medium dense SAND or GRAVEL with SPT-N values of 6, 7, 9, 11, 22 were recorded in RC06 and RC105. Soft silt and loose gravels and sand will require consideration during the construction phase. Over excavation of soft SILT to 12 mbgl (38.1 mOD) may be required to found on competent material.

Groundwater strikes were recorded at 7.6 mbgl (42.5 mOD) in RC05, 6.2 mbgl (43.4 mOD) in RC06 and 6.5 mbgl (43.5 mOD) in RC105. Groundwater monitoring recorded a standing groundwater level of 5.5 mbgl (44.5 mOD) in BH05 to the northwest of the proposed final settlement tank indicating that dewatering will be required during the construction phase.

Table 5-8 - Final Settlement Tank – Founding Level Ground Conditions

Exploratory Logs	Founding Strata	SPT-N value	Depth of Strata mOD (mbgl)	Approx. Base of the Founding Level mOD (mbgl)	GW Ingress mOD (mbgl)
BH05/RC05	Soft to stiff SILT	4, 7, 8, 19	41.1 – 38.1 (9.0 -12.0)	40.0 (10.6)	42.5 (7.6)
BH06/RC06	Loose to dense silty GRAVEL	5, 6, 7, 13, 36	40.1 – 33.1 (9.0 – 16.5)	40.0 (9.6)	43.4 (6.6)
BH105/RC105	Loose to medium dense very silty SAND	6, 7, 11	42.8 - 37.5 (7.2 – 12.5)	40.0 (10.0)	43.5 (6.5)

*Material description or SPT-N values highlighted in red identify soft or loose strata.

Any soft low bearing clay or silt deposits, or made ground, will need to be fully excavated and removed and backfilled with suitable aggregate to ensure competent material is present at the. Over excavation of soft silty sand to medium dense boulders at 12 mbgl (38.1 mOD) may be required to found on competent material.

5.1.2.2.9 RAS/WAS Pump

The RAS/WAS pump (approximate formation level of 11.5 mbgl (38 mOD)) will be constructed within variable ground described as firm silt or loose to medium dense gravel.

Loose to medium dense gravel and loose to medium dense sand with SPT-N values of 4, 6, 7, 11 and 15 were recorded in RC05, RC06 and RC105 within the founding material.



Groundwater strikes were recorded at 7.6 mbgl (42.5 mOD) in RC05, 6.2 mbgl (43.4 mOD) in RC06 and 6.5 mbgl (43.5 mOD) in RC105. Groundwater monitoring recorded a standing groundwater level of 5.5 mbgl (44.5 mOD) in BH05 southwest of the proposed RAS/WAS Pump indicating that dewatering will be required during the construction phase.

Table 5-9 - RAS/WAS Pump – Founding Level Ground Conditions

Exploratory Logs	Founding Strata	SPT-N value	Depth of Strata mOD (mbgl)	Approx. Base of the Founding Level mOD (mbgl)	GW Ingress mOD (mbgl)
BH05/RC05	Soft to firm SILT	4, 7, 8, 19	41.1 – 38.1 (9.0 – 12.0)	40.0 (10.6)	42.5 (7.6)
BH06/RC06	Loose to dense silty GRAVEL	5, 6, 7, 13, 36	40.1 – 33.1 (9.0 – 16.5)	40.0 (9.6)	43.4 (6.6)
BH105/RC105	Loose to medium dense very silty SAND	6, 7, 11	42.8 - 37.5 (7.2 – 12.5)	40.0 (10.0)	43.5 (6.5)

*Material description or SPT-N values highlighted in red identify soft or loose strata.

Any soft low bearing clay or silt deposits, or made ground, will need to be fully excavated and removed and backfilled with suitable aggregate to ensure competent material is present at the. Over excavation of soft silty sand to medium dense boulders at 12 mbgl (38.1 mOD) may be required to found on competent material.

5.2 Reusability of Material

At the time of writing this report it is expected the majority of excavated cohesive material will be unsuitable for reuse on site without some form of drying out. Granular material or weathered rock should be suitable for reuse.



6. Civil and Structural Considerations

6.1 Kilkenny Road Pumping Station

6.1.1 Existing Structures

The existing Kilkenny Road pumping station will be decommissioned. The existing building structure will remain. The existing above ground steel gantry structure, access stairs and pumps will be removed from site and repurposed.

The below ground holding tank will be modified to allow flows to discharge directly to the gravity tunnel connection. Any remaining voids in the existing tank will be made safe during decommissioning.

6.1.2 Sewer Network

It is proposed to undertake minimal modifications to the sewer network at the Kilkenny Road pumping station site however, it would be necessary to divert the existing 225mm diameter gravity sewer connecting the Southern Gardens to the pumping station. By incorporating the sufficiently deep microtunnel gravity sewer, existing sewers can be intercepted and discharged to the treatment plant by gravity.

During construction, incoming flows will be diverted via the existing below-ground holding tank to a newly constructed manhole positioned south of the existing PS, conveying flows to the new gravity microtunnel.

6.1.3 Existing Overflows

Existing overflows at the Kilkenny Road PS will be retained in accordance with the current Wastewater Discharge Licence and utilised in extreme events where the new gravity microtunnel may be at maximum capacity. Overflows will be maintained and protected during the works.

6.2 Microtunnel

The main tunnelling facilities are planned to be located at the main PS shaft in the WwTP area as there is abundant space for accommodation of temporary works. Figure 6-1 shows the anticipated main launch shaft and tunnel works configuration at the treatment plant site.



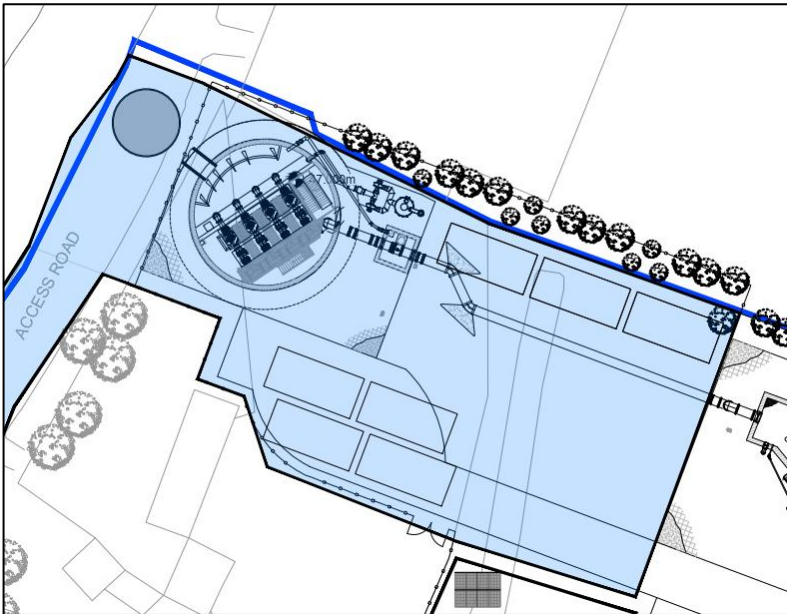


Figure 6-1 - Indicative plan arrangement at the WWTP shaft site

The intermediate shafts require a more compact site and shaft size. An example layout for the intermediate shafts is shown in Figure 6-2. The anticipated activities at the intermediate shafts are:

Manhole D is not required for tunnel construction under this design but remains a requirement for inspection and maintenance access via a permanent manhole. Shaft construction prior to tunnelling is proposed as the preferred sequence, with the MTBM breaking through pre-installed soft-eyes to simplify the construction process and provide the opportunity to utilise these shafts for access during tunnelling for any maintenance and repairment. The site arrangement as shown in Figure 6-2 has been proposed according to a 7 m diameter manhole to facilitate the option to install intermediate jacking rigs, dependent on the jacking thrust requirements for the alignments as proposed. Alternatively, if the shaft is constructed after tunnelling has completed then there is an opportunity to reduce the manhole diameter to 5 m.

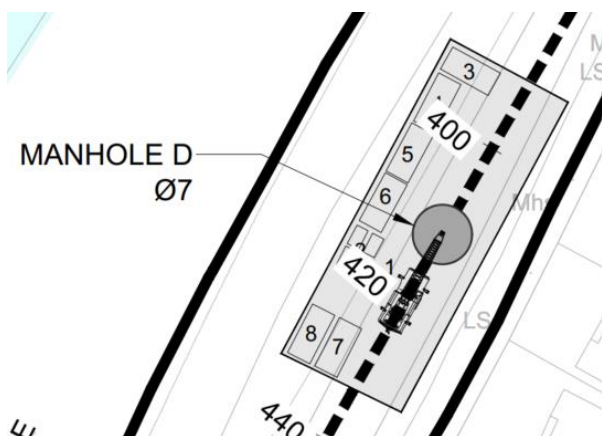


Figure 6-2 - Intermediate shaft construction layout

Further details on tunnel civil works are provided in Appendix D.

6.2.1 Service Diversions

There are existing overhead medium voltage ESB powerlines which transverse the proposed reception shaft location immediately south of the Kilkenny Road PS. AtkinsRéalis has commenced communications for a diversion route with the ESB in accordance with the latest design and generated relevant applications in the ESB portal. The diversion works will be undertaken by ESB in advance of the Works Contract.

6.3 New Inlet Pump Station

6.3.1 Surface Water Drainage

The new inlet pump station at the WwTP site will require a new surface water drainage system with the following drainage infrastructure proposed:

- Kerb and gully drainage system within the WwTP site
- Surface drainage outlet pipe to connection to proposed outfall pipeline of the WwTP.

6.3.2 Potable Water Supply

The new inlet pump station will avail of the WwTP's potable water supply system. An extension of potable water mains from the new inlet works will be required.

6.3.3 Power Supply

The existing Kilkenny Road pumping station information indicates that pumps currently installed as follows:

- 2No. 70Kw Foul Pumps
- 2No. 37.5kw Storm Pumps

Based on an existing MIC of 103KVA at the Pump Station, it indicates that PS Electrical Supply sized for 1 no. x 70Kw Foul Pump & 1 no. x 37.5Kw Storm Pump.

The New Wastewater Pump Station will be based on 3No. Operational 90kW Pumps, 1 No. Operational Odour 7.5kw (estimate) Fan, Building Services Domestic Board (estimate) 5kW, giving a total of (90Kwx 3 + 1x7.5Kw + 1x5Kw = 280kW $\approx$ 350kVA).

As the PS will be located at the WwTP site a 350 kVA (estimate) of additional power supply need to be provided at the WwTP. This power requirement may be subject to change depending on the pump selection process.

It should be noted that the calculated pumping requirements in the first 8 years after commissioning of the pumping station can be catered for with 2 no. Operational 90KW pumps (duty, assist, standby). For these flows an MIC of 260kVA would be sufficient and a further increase can be attained before installation of the second assist pump. The application for increasing the MIC has been submitted to ESB.

6.3.4 Service Diversions

As the new inlet pump station will be located in the treatment plant site, diversions required for the WwTP upgrade works described in Section 6.4.6 apply also for the new PS.



6.3.5 Structural Designs

The new inlet pump station will be constructed by pre-cast reinforced concrete segmental lined caisson of 500mm thickness, Below the 750mm thick base slab, a 4,100mm high concrete sub-base is proposed in order to resist against uplift forces. The internal reinforced concrete wall separating the wet and dry wells is 400mm thick from the base to the upper slab.

In terms of loading to the structure, ground water was considered at 46.62m OD as per flood level with 1 in 1000 (0.1% AEP) annual exceedance probability, soil weight was assumed to be 18 kN/m² and an allowance for a surcharge live load of 10 kN/ m² at ground level was considered. For the outer walls, ground water, soil and live loads were applied to the outer faces and no loads were applied to the inner faces. For the inner wall, to one face water pressure was applied (wet well full of water) and to the other face no water pressure was applied (new pump well dry). For the cover slab, live load was assumed to be applied.

The structural members were designed to resist the worst-case load combination at Ultimate Limit State, which translated to a bending moment and shear force applied to the wall stem connection with the base slab, and an uplift pressure applied to the underside of the base slab. Furthermore, the structural members were also designed to resist the worst-case load combination at Serviceability Limit State, which was expressed by verifying cracking control to water tightness class 1. For this class, the leakage is limited to a small amount with some surface staining or damp patches acceptable.

The uplift verification was carried out in accordance with IS EN1997-1. The uplift was verified under the Ultimate Limit State and consisted of checking that the design value of the combination of destabilising permanent vertical action (ground water pressure) was less or equal to the sum of the design value of the stabilising permanent vertical actions (the weight of concrete in the base, outer and inner walls and cover slab). For the bending and shear verification the IS EN 1992-1-1 was used where the applied and resisting bending moments and forces were compared at the stem of the wall, at 4m height above the slab base, and in the middle and supports of the cover slab. For the cracking control verification, the IS EN 1992-3 was used where the hydrostatic pressure was considered as the height of the new wet well full of water.

6.4 Mortarstown WwTP

6.4.1 Demolition

The following existing plant/structures will be demolished as part of the works:

- Storm tank (area 616m²);
- Inlet works (area 166m²);
- Various small chambers within the site (2 no. chambers, area 3m² and 14m²); and,
- Existing sludge cake transfer facility (area 100m²).

6.4.2 Surface Water Drainage

The Mortarstown WwTP has an existing surface water drainage system which drains the existing roadways. The extension of the site to the west including the proposed WwTP will require a new surface water drainage system. This system includes infrastructure such as filter drainage along the access road, a kerb and gully drainage system within the WwTP site and surface drainage outlet pipe to connect to the proposed storm water overflow pipeline. This includes an oil/petrol interceptor prior to discharge via the existing outfall pipe to the River Barrow.



6.4.3 Potable Water (Mains)

Potable water supply for human consumption and use such as uses in canteen and other welfare facilities is provided from Carlow Town's network mains. The existing potable water supply to the WwTP will be retained to continue the supply of potable water supply to the administration building, emergency shower and eye wash and hydrants at the WwTP site.

6.4.4 Clean Wash Water (Borehole)

The washwater supply to the process units is provided from an existing borehole located in the WwTP site, east of the administration building. The borehole system will be upgraded and washwater network will be expanded to cover the new process units and the inlet pump station during the operation phase.

6.4.5 Power Supply

The site regularly peaks at 260 kW with an annual consumption of over 1.3 million kWh in 2019. As discussed earlier, the new PS will require additional power supply of 260 kVA for the short term and 350 kVA for the long term when the additional assist pump is to be installed. When the new treatment plant is commissioned and operating at design load, the peak demand is estimated to be 620kW (incl. the WwPS) kWh with an annual consumption of 2.4 million kWh.

Taking all these into account, the WwTP will require an increase to the MIC. Consultations are ongoing with ESB regarding the WwTP upgrade and the MIC increase application has been submitted.

6.4.6 Service Diversions

The upgrade and expansion of the Mortarstown WwTP requires the construction of significant infrastructure including 2 no. final settlement tanks to provide secondary sludge removal. The proposed final settlement tanks will be constructed to the west of the WwTP site and as a result it will be necessary to divert the overhead 38kV powerlines and relocate the MV line underground. Consultations have been held with the ESB and several meetings have been attended on site to discuss and agree the extent of the diversion. Proposed diversions are currently under consideration by ESB.

6.4.7 Administration Building

Modifications to the existing administration building layout are proposed at the WwTP site. Modifications to the building will include the following:

- MCC Room
- Laboratory
- Canteen
- Office
- Toilet/Welfare facilities

For details of proposed administration building see drawing 5161805_EWE_DR_MOR_5162.



6.5 Outfall

It is proposed to replace the existing 600mm diameter outfall pipe with a new 900mm diameter gravity outfall pipe approximately 205m in length. The outfall pipe will be constructed to the south side of the existing outfall, the pipe will cross the R448 via microtunnelling and enter the property to the west of the road. While this report is being prepared, Uisce Éireann are following wayleaves and permissions procedures for the outfall pipeline.

A cofferdam / temporary shoring will be required to construct the head wall on the riverbank, it is proposed that the outfall pipe will enter the river circa. 1.5m below the low water level. The cofferdam / temporary shoring will be installed from a barge on the River Barrow to protect the embankment and surrounding trees.

7. Odour Management Plan

Typically, odour levels at sensitive receptors close to WwTP shall not exceed 1.5 OuE m⁻³ as the 98th percentile and 3 OuE m⁻³ as the 99.5th percentile of hourly averages. Measures to achieve these thresholds and prevent odours from the WwTP affecting external and internal areas of close receptors shall be adopted as hereunder described.

7.1 Raw Sewage

Particular attention shall be paid to the detailed design of process units and equipment to prevent the generation of odour from raw sewage wherever possible. Specific measures incorporated in the works shall typically include:

- Short retention times where applicable to reduce the risk of septicity.
- Foul sewage pump station shall be fully enclosed.
- The inlet screens shall be enclosed units providing complete containment at this turbulent point with screenings discharging into a sealed skip.
- The grit trap channels shall be provided with hinged covers providing complete containment at this turbulent point. The grit classifier conveyor and enclosed chute shall discharge into a sealed skip.
- Weirs and free falls shall where possible be kept to a minimum without compromising hydraulic performance. Inlets to the aeration tanks shall discharge subsurface.
- Delivery of imported sludge to the plant shall be within pipelines rather than open channels.

7.2 Sludge

The selected wastewater treatment process and chosen design parameters for such, result in a low odour emission potential from its associated sludge treatment processes. The selected design biological sludge age is sufficiently long that any excess sludge produced will primarily comprise of stabilised solids, in terms of odorous generation potential.

Due to long design sludge ages, the process will run in endogenous respiration mode, meaning the excess sludge generated will be largely stabilised, is not putrescible and readily biodegradable organic matter is significantly removed. This creates a situation where onset of solids decomposition within the sludge process is to a large degree circumventing together with any associated odour generation.

Notwithstanding this, primary sludge will be a cause of odour release and ventilation / odour removal is required in areas where primary sludge is processed.



7.3 Summary

The Table 7-1 is taken from the Air Quality Chapter of the Mortarstown WwTP EIAR and shows the odour emission sources, emission values, and control measures. Further details of the odour control measures can be found in Chapter 7 – Air Quality of the EIAR.



Table 7-1 - Calculated odour emissions from the proposed Mortarstown WwTP facility

Source Identity	State whether	Covered / Uncovered	Dimensions (m)	Surface area	Volume flow (Nm³/hr)	State if process has	Odour conc limit	Odour emission	Odour emission	Notes
New Pumping Station	New	Covered	15	0	-	Abated	-	-	0	see OCU 1
New Inlet Works	New	Covered	50m x 20 m	0	-	Abated	-	-	0	see OCU 2
New Stormwater holding tanks	New	Uncovered	30	1,400	-	Unabated	-	0.10	140	Washdown facilities will be installed on the stormwater tanks and these will be operated
New Primary Settlement Tank	New	Covered	45m x 36 m	0	-	Abated	-	-	0	see OCU 3
Aeration Tanks	Existing	Uncovered	92m x 23m	1,361	-	Unabated	-	1.50	2,042	-
Anoxic / Anaerobic tank	Proposed	Covered	92 m by 7.16m	659		Abated		0	0	see OCU 6
New Final Clarifiers	New	Uncovered	32	1,600	-	Unabated	-	0.15	240	- 2 tanks
Sludge Blending Tank	Existing	Covered	6	0	-	Abated	-	-	0	see OCU 4
Picket Fence Thickener - 1	Existing	Covered	6	0	-	Abated	-	-	0	See OCU 4
Picket Fence Thickener - 2	New	Covered	7.5	0	-	Abated	-	-	0	See OCU 4
Sludge Dewatering Building	Existing	Covered	21.9m x 12.7m	-	-	Abated	-	-	0	See OCU 4
Foul Pump Station	New	Covered	2.5m x 2.5m	0	-	Abated	-	-	0	see OCU 5
Centrate Pump	New	Covered	1.6m x 1.6m	0	-	Abated	-	-	0	see OCU 5
OCU 1 - New WWPS	New	Covered	6.00m high x 300mm dia.	N/A	9,109	-	500	-	1,265	Vented through 8 m stack
OCU 2 - New Inlet Works	New	Covered	4.00m high x 300mm dia.	N/A	2,911	-	500	-	404	Vented through 8 m stack
OCU 3 - New Primary Settlement Tank	New	Covered	4.00m high x 300mm dia.	N/A	9,558	-	500	-	1,328	Vented through 8 m stack
OCU 4 - Sludge Dewatering Building	New	Covered	6.00m high x 300mm dia.	N/A	15,100	-	500	-	2,097	Vented through 8 m stack
OCU 5 - New Local WWPS	New	Covered	2.00m high x 150mm dia.	N/A	400	-	500	-	56	Vented through 2 m stack
OCU 6 - Anoxic / Anaerobic / Flow distribution chambers	New	Covered	-	-	1318	-	500	-	183	Vented through 8 m stack
Total Odour emission rate (OuE/s)	-	-	-	-	-	-	-	-	7,754	-



8. Noise

In arranging the site layout, noise energy emission requirements at the boundary have been taken into consideration with respect to emitted sound levels, tonal effect and local residential exposure limits. Where possible equipment likely to cause noise nuisance shall be either housed within chambers and/or fitted with acoustic enclosures and located as far as practicable from the nearest receptor. Specific measures shall include: -

- All pumps at the inlet pumping station will be installed by considering noise level requirements and located in sealed and ventilated wells thus providing significant noise suppression.
- Aeration blowers will be provided with acoustic enclosures and screened by the aeration blower structure.
- Noise generating equipment will be positioned away from the boundaries and to the centre of the WWTP site.
- Where possible equipment likely to cause noise nuisance will be housed within chambers and/or be fitted with acoustic enclosures.

Typically, plants are designed to ensure that the maximum noise level at the nearest receptor to the site boundary shall not exceed an equivalent continuous sound level of 55 dB(A) by day (08:00 – 22:00) and 45 dB(A) at night (22:00 – 08:00).

Noise models and calculations have been developed demonstrating anticipated noise levels at the nearest Noise Sensitive Locations (NSL) as a part of the EIAR. NSL in proximity to the WwTP are shown in Figure 8-1 which is taken from Chapter 9 – Noise and Vibration of the EIAR. Further details of the noise studies can be found in the Chapter 9 – Noise and Vibration of the EIAR.

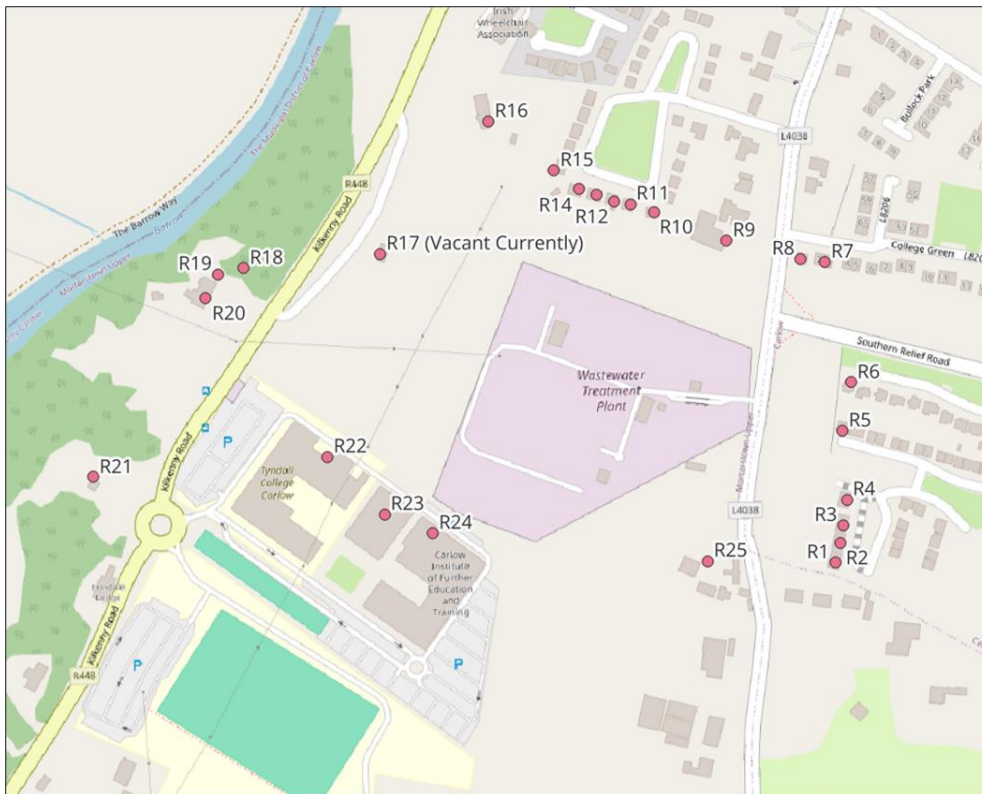


Figure 8-1 - Noise Sensitive Locations

The proposed works shall be delivered by a specialist contractor through a design and build contract and will be subject to noise modelling in compliance with the noise model built and assessed for the EIAR that forms part of the planning application and permit.

9. Energy

In accordance with Uisce Éireann sustainability requirements the ESP has investigated and developed project specific proposals to implement sustainability measures at the design of the proposed works. This section sets out to establish the anticipated energy demand of the proposed development and discuss measures to reduce energy, improving energy efficiency, reduce the cost of energy and utilise energy from renewable and low carbon sources.

9.1 Predicted Energy Consumption

The major energy consumer in wastewater treatment is electrically powered motive equipment, e.g., pumps, blowers, compressors, mixers. AtkinsRéalis has estimated the energy demand of the options proposed in the specimen design using Uisce Éireann Annex 6 (Energy Balance Report) proforma. The site regularly peaks at 260 kW with an annual consumption of over 1.3 million kWh in 2019. The annual electricity bill for the site is €228,244 (2019) at an average unit rate of 16.96 c/kWh. Once the new treatment plant is commissioned and operating at design load the peak demand is estimated to be 620 kW with an annual consumption of 2.4 million kWh.

9.2 Energy Performance

The specified energy performance for the selected motive equipment at peak flow is: -

▪ Foul Pumps:	0.058140 kWh.m ³ /annum
▪ Stormwater Return Pumps:	0.063553 kWh.m ³ /annum
▪ Primary Sludge Pumps:	0.035772 kWh.m ³ /annum
▪ RAS Pumps:	0.052333 kWh.m ³ /annum
▪ WAS Pumps:	0.057136 kWh.m ³ /annum
▪ Import Sludge Pumps:	0.040825 kWh.m ³ /annum
▪ Blended Sludge Pumps:	0.031103 kWh.m ³ /annum
▪ Thickened Sludge Pumps:	0.032486 kWh.m ³ /annum
▪ Dewatered Sludge Pumps:	0.019513 kWh.m ³ /annum
▪ Centrate Pumps:	0.041754 kWh.m ³ /annum
▪ Washwater Pumps:	0.196162 kWh.m ³ /annum
▪ Air Blowers:	0.064176 kWh.m ³ /annum

Running times for the pumps and blowers are estimated (for the purposes of energy usage calculations only). The target energy usage for the WwTP upgrade shall be used to determine the desired efficiency at contract stage. The selected pump motors shall be IE3 efficiency rated, hence the most efficient type available.

Energy usage and specified energy performance is calculated as follows:



Table 9-1 - Energy usage calculations of units

Motive Item	Average Daily Flow (m ³ /hr)	Pump / Blower Capacity (m ³ /hr)	Operation (hrs/day)	Annual Volume (m ³ /annum)	Energy Performance (kWh.m ³ /annum)
Foul Pumps	100.00	300.00	8.0	876,600	0.058140
Stormwater Return Pumps	7.11	534.38	0.3	62,310	0.063553
Primary Sludge Pumps	0.28	21.21	0.3	2,472	0.035772
RAS Pumps	543.75	1,603.13	8.1	4,766,513	0.052333
WAS Pumps	10.13	60.00	4.1	88,756	0.057136
Import Sludge Pumps	1.88	27.00	1.7	16,436	0.040825
Blended Sludge Pumps	5.92	27.00	5.3	51,866	0.031103
Thickened Sludge Pumps	4.47	27.00	4.0	39,191	0.032486
Dewatered Sludge Pumps	0.99	18.00	1.3	8,693	0.019513
Centrate Pumps	5.19	13.57	9.2	45,538	0.041754
Washwater Pumps	10.00	27.00	8.9	87,660	0.196162
Air Blowers, total	3,132.00	3,132.00	24.0	27,455,112	0.064176

Monitoring of the energy usage of the proposed options shall be provided using Energy Performance Indicators (EPIs) and energy monitoring of particular elements of the plant. An energy monitoring system shall be built into the SCADA facility to log run hours from different (major) equipment and to allow comparison with the expected run hours.

Energy performance indicators will be incorporated into the SCADA system. The energy performance indicators will be calculated automatically on the SCADA system, represented graphically and be exportable in sequential text file format.

9.3 Renewable Energy

UÉ target providing a minimum of 10% of energy demand of their facilities from renewable sources. The following renewable energy sources were considered in the order of preference:

- Solar Photo Voltaic (PV) & Solar Thermal
- Wind Energy (e.g Wind Turbines)
- Hydro

AtkinsRéalis undertook a renewable energy assessment to assess the site of the upgraded WwTP and determine the available quantity of renewables that can be installed, to cover the UÉ objective of a minimum of 10 % of the maximum energy demand, to be used by the upgraded Mortarstown WwTP.



Installation of solar PV panels was found to be most appropriate and a further assessment for feasibility was carried out. The studies concluded that the area to the west of the proposed preliminary settlement tanks and final clarifiers which is owned by Uisce Éireann can be used for installation of solar PV panels. The installed power of the system will be 382kW and annual energy amount generated is calculated at 333,363kWh.

Details of the calculations can be found in the Renewable Energy Assessment Report provided in Appendix H.

10. Constructability Analysis

In accordance with Uisce Éireann internal standard IW-AD-EDS-GL-09 - A Guide to Undertaking Constructability Assessments (Rev 1) issued on the 23/06/21, a high level constructability analysis of the proposed solution has been carried out. The risks and mitigations are presented in tabular form for ease of review. Note that many of the risks listed below are identified in the overarching project risk register. As they are specific to constructability, they have been repeated in this section of the report.

Table 10-1 - Constructability Risk Assessment

Risk	Cause	Mitigation
Presence of Overhead Powerlines	Several overhead ESB powerlines transverses the proposed site. Potential to create construction restrictions (no excavators, height restrictors etc.)	Proposal for existing ESB overhead powerlines to be diverted in advance of commencing the construction works. Ongoing consultation is being held with the ESB. Diversion works, to be carried out by ESB, will be undertaken in advance of the contractor mobilising to site.
Working adjacent river	Works required for construction of new final effluent outfall pipes and associated headwalls to connect into the River Barrow	Contractor to ensure appropriate temporary works measures (i.e., trench boxes, dewatering pumps etc.) are in place in advance of construction works.
Working in river	Installation of the cofferdam, required to construct the outfall and associated headwall, is required from a barge.	The proposed location is part of the Barrow Navigation and accessible with a barge. Contractor to ensure all permissions are in place and detailed method statements are submitted for approval prior to commencement of in river works.
Existing Ground Conditions - Soft/Loose Strata	Unstable walls in open excavations within soft or loose strata.	There is a moderate risk of unsupported excavations collapsing during construction especially where a high, water table is encountered. Therefore, trench box and sheet pile techniques will be used to stabilise the deep excavation or pipeline trench walls.



Ground conditions at the Kilkenny Road Pumping Station	Extremely poor ground conditions and a high-water table leading to difficult excavation process and complex temporary works.	It is proposed to use a sheet pile cofferdam for the construction process. This will ensure adequate temporary support during construction and enable an easier dewatering methodology.
Existing Ground Conditions - Insufficient bearing capacity	It is anticipated that soft deposits encountered will have insufficient bearing capacity to support both dead and live loads associated with chambers and pipe network.	Shallow soft material can be excavated and replaced with engineered material using traditional open cut and replace methodologies.
Existing Ground Conditions - Groundwater ingress	Groundwater ingress is expected to affect construction operations	De-watering by means of submersible pumps installed below formation level are recommended for this site.
Disposal of ground water	Disposal of ground water from construction works	To protect all-natural watercourses during the construction phase, environmentally safe area required to pump groundwater to. To be dealt with in Construction Environmental Management Plan
Contamination	Contamination on site, in particular at the proposed outfall pipe. with need for offsite disposal.	Environmental sampling has been undertaken as part of the Site Investigation and Environmental Surveys have identified Japanese Knotweed and Himalayan Balsam at the location of the proposed outfall pipe.
Sewer Network - Critical tie in locations	Connection into existing sewer network	Record drawings available. Employers Requirements Design Build (ERDB) to include narrative that Contractor required to identify and confirm tie-in points (e.g., the pipe material, ovality, size, alignment and condition)
Redundant structures/infrastructure	Approach to existing infrastructure	Full brief on redundant structures/infrastructure etc, i.e., demolition requirements, filling in requirements, etc to be included in contract documentation.
Condition survey of existing approach roads to site (Access Road)	Damage as a result of construction works	Condition survey of existing approach roads to site to be completed in conjunction with the LA roads dept with a view to avoiding conflict later around potential damage to the roadway by construction traffic.



11. HSQE Requirements

11.1 Landscaping

11.1.1 Landscape and Visual

A landscape and Visual Impacts Assessment (LVIA) is used to identify and assess the likely significance of the effects of change resulting from a development. The two components of LVIA are:

- Assessment of landscape effects: assessing effects on the landscape as a resource in its own right; and,
- Assessment of visual effects: assessing effects on specific views and on the general visual amenity experienced by people.

The assessment was carried out with reference to the following:

- Guidelines for Landscape and Visual Impact Assessment (3rd Edition, 2013),
- Carlow County Development Plan 2022-2028,
- Carlow County Landscape Character Assessment and Schedule of Protected Views (Appendix VII of the Carlow County Development Plan 2022-2028),
- Laois County Development Plan 2021-2027,
- Laois Landscape Character Assessment (Appendix 6 of the Laois County Development Plan 2021-2027).

11.1.2 Existing Baseline

The study area is within County Carlow and County Laois. The relevant local landscape character assessments include The Carlow County Landscape Character Assessment and Laois County Landscape Character Assessment. The baseline landscape and visual conditions were established through a combination of desk-based study and field surveys conducted between November 2024 and September 2025.

- Receiving Environment Landscape
 - Carlow County
 - Laois County
 - Urban Fringe
- Receiving Environment Visual
 - Zone of theoretical Visibility
 - Visual receptors

The LVIA is summarised as follows (extract from LVIA prepared by EBLA, 2026);

Receiving Environment Landscape

- The rural landscape in the County Carlow and Laois is generally in good condition, with intact characteristics such as grassland, hedgerows, woodland, and views along the river Barrow contributing to character. The suburban areas are typical suburban areas and generally in good condition. This landscape is judged to be of local importance and low value due to the influence of suburban development.
- The site itself and land immediately surrounding the site within this character area is categorised as a Built-Up Area landscape type that is assigned a sensitivity rating of 1, which is defined as least sensitive to development in the landscape sensitivity mapping within Carlow County Landscape Character Assessment.



Receiving Environment Visual

The Zone of Theoretical Visibility (ZTV) or areas of land from which the development may be potentially visible was estimated using a manual approach using map interpretation, and visual envelope mapping on site to establish the outer limit of land that may be visually connected with the proposal.

The areas identified are generally within 500m from the WwTP site and 150m from the Kilkenny Road Pumping Station and include; the area of the R448 Kilkenny Road corridor immediately west of the WwTP site and up to the Kilkenny Road Pumping station, the area of Green Road immediately east of the WwTP site, the residential areas at The Glen, College Green, Cluain Bui, Maple Court, Tyndall College/Carlow Institute of Further Education. The area of the R448 Kilkenny Road corridor immediately adjacent to the Kilkenny Road Pumping Station site.

Views to the WwTP site from the north and east are limited by intervening built development (including the residential areas at The Glen, College Green and Cluain Bui) and vegetation. Views from the south are limited by intervening built development (including Tyndall College and Maple Court) and vegetation. Views from the west are limited by intervening woodland and vegetation along the River Barrow. Further to the west there is a ridge of high ground at Rossmore (Co. Laois) up to 4.5km from the site, however visibility to the site from here would be limited due to the effect of distance and intervening vegetation.

Views to the Kilkenny Road Pumping Station site/ route of the underground sewer from the west are limited by dense intervening vegetation along the River Barrow. Views to the Kilkenny Road Pumping Station site/ route of the underground sewer from the east are limited by built development along the R448 Kilkenny Road and Green Road.

Visual Receptors : The main WwTP site is largely well-screened by vegetation and development. Visual exposure is limited and localised, primarily along R448 Kilkenny Road, at Kilkenny Road Pumping Station and from select elevated residential windows. Most receptors experience no or very limited views.

11.1.3 Arboricultural Impact Assessment

A Tree Survey Report was prepared by Independent Tree Surveys Ltd. following tree surveys conducted in 2025 . The findings are summarised as follows:

- *'The survey area covered the grounds of the Mortarstown Wastewater Treatment Plant (WWTP), the farmland between the WWTP and Kilkenny Road, parts of the woodland between Kilkenny Road and the River Barrow, housing estate and private grounds and verges along the east side of Kilkenny Road and the woodland and hedges to the south and north of the Kilkenny Road Pumping Station. The survey recorded 3 woodlands, 10 hedges, 23 tree groups and 108 individual trees. Of the 108 individual trees, 2 were graded category A (high value), 32 category B (moderate value), 70 category C (low value) and 4 category U (poor condition).*
- The site comprises a mix of individual and grouped trees, generally of moderate to low arboricultural value, within the WwTP grounds, trees are planted both as individual specimens and as linear belts particularly along the northern and southern boundaries providing effective visual screening despite their relatively low intrinsic value. The surrounding farmland contains scattered poor-quality trees and hedgerows, while more established treelines along the northern boundary include a mix of species such as Ash, Monterey Cypress and Horse Chestnut, alongside Leyland Cypress groups. Additional roadside and residential trees along Kilkenny Road and adjacent properties vary in quality, with some higher-value specimens present, while woodland-edge trees between Kilkenny Road and the River Barrow form part of a broader vegetation network.
- To the west, a continuous woodland belt extends between Kilkenny Road and the River Barrow, incorporating riparian and semi-natural woodland areas of moderate to high value, including mature Willow and Poplar trees, some of which exhibit storm damage. This woodland, though divided into survey areas (W1–W3), functions as a single ecological unit and provides significant landscape and biodiversity value. Riparian Willow trees along the



riverbank are particularly notable for their structural form and contribution to visual amenity and conservation. The northern part of the site transitions into rough pasture and regenerating scrub, bordered by a maintained hedgerow along Kilkenny Road, further reinforcing the site's vegetative screening and semi-natural character.

The Tree Survey has determined recommendations based on the condition of trees as follows:

- *Preliminary management for the trees under present site conditions listed in the survey schedule should be adhered.*
- *The larger trees (Poplar and Ash) in the woodland along the roadside should be reviewed to check their structural condition. All Ash trees should be monitored to check the level of crown dieback from Ash Dieback disease.*

The significance of impacts on the arboricultural environment are assessed as part of the EIAR.

11.2 Biodiversity

The section describes the biodiversity within the footprint of the proposed development, evaluates the importance of ecological features on a geographical scale, assesses the likely effects on key ecological receptors, and identifies measures to avoid, minimise or compensate for potential negative effects. It also outlines ecological enhancement measures to achieve a No Net Loss/Net Gain of Biodiversity in accordance with Uisce Éireann's Biodiversity Action Plan (UÉ, 2021). The Biodiversity assessment was completed on the basis of thorough desk studies and a suite of field surveys (including Fossitt habitat surveys, priority Annex I woodland surveys, aquatic habitat and fisheries surveys, non-volant mammal surveys, and bat surveys), as well as consultation with the National Parks & Wildlife Service.

A separate Natura Impact Statement (NIS) has been prepared for the proposed development (AtkinsRéalis Report Ref. 5161805DG0457, 2026). The NIS assesses the implications of the proposed development, individually and in combination with other plans and project, for the integrity of Natura 2000 sites, most notably the River Barrow and River Nore Special Area of Conservation, to inform the competent authority's Appropriate Assessment under Article 6(3) of the Habitats Directive (92/43/EEC).

The proposed development has the potential to give rise to a range of ecological impacts during both the construction and operational phases. Key impacts include habitat loss and fragmentation associated with permanent and temporary land take, which may reduce habitat extent, connectivity and quality, and indirectly affect fauna through the loss of foraging, breeding and sheltering habitat. Construction-related disturbance arising from noise, vibration, visual activity and human presence is anticipated to be localised, temporary and generally limited to within approximately 100m of works. Operational disturbance will be significantly lower, confined to routine activities within the plant, and is expected to be negligible above baseline levels. Artificial lighting associated with both phases has the potential to disrupt natural behavioural patterns, particularly for sensitive nocturnal species such as bats and otters, depending on its intensity, duration and proximity to sensitive habitats.

Other potential impacts include those associated with solar panels, which may affect birds and insects due to reflective surfaces; however, existing evidence of significant ecological effects is limited, and the low ecological value of the proposed grassland location reduces the likelihood of notable impacts. Underwater noise and vibration from piling during outfall construction may temporarily disturb fish and otters, with effects most pronounced in close proximity to the works, although these impacts will be short-term and restricted to periods of active piling. Water quality impacts represent a more significant risk during construction, particularly from sediment, hydrocarbons, concrete and other pollutants, with effects generally expected to be temporary and moderate, but potentially significant in the event of accidental releases. During operation, however, the upgraded wastewater treatment plant is expected to improve water quality in the River Barrow through increased treatment capacity and reduced overflow events, with compliance measures ensuring adherence to environmental quality standards.



The following surveys have been conducted

- Walkover and habitat Surveys
- Woodland habitat Surveys
- Non-volant Mammal Surveys
- Aquatic Surveys

The mitigation strategy follows the mitigation hierarchy and addresses all identified ecological risks associated with both construction and operation. Key measures prioritise protection of water quality through adherence to detailed controls in the Water chapter, including management of sediment, hydrocarbons, wastewater and specialist works (e.g. outfalls and micro-tunnelling). Construction impacts are further reduced through strict timing constraints (e.g. daylight-only in-stream works), minimisation and control of artificial lighting, and implementation of wildlife-sensitive lighting design principles such as dark buffers and low-intensity luminaires. Habitat loss and fragmentation are minimised via adherence to Tree Protection Plans, constrained vegetation clearance, and retention of key ecological features, including mature trees supporting bat roosts. Species-specific mitigation includes pre-construction surveys, seasonal restrictions, exclusion measures, and ecological supervision to protect birds, bats, otter and aquatic fauna. Biosecurity protocols are comprehensive, addressing invasive species and disease risks through cleaning, containment and controlled disposal procedures. Additional measures include fish rescue during cofferdam works, noise control, and maintaining habitat connectivity. Operational mitigation is largely embedded in design, with wastewater treatment improvements expected to safeguard overall water quality.

The enhancement strategy seeks to deliver biodiversity gains in line with national, county and UÉ policies, including green infrastructure objectives and the All-Ireland Pollinator Plan. Central to this is a landscape-led approach incorporating native planting, habitat creation and improved ecological connectivity. Proposed measures include extensive native hedgerow planting, species-rich grassland management (short- and long-flowering meadows), and the creation of wildlife ponds to support aquatic and terrestrial biodiversity. Pollinator-focused interventions are embedded throughout, including reduced mowing regimes, elimination of pesticide use where possible, and provision of nesting habitats such as bare ground areas and bee bricks. Tree and orchard planting using native, nectar-rich species will enhance foraging and roosting resources, particularly for bats, alongside targeted features such as bat boxes, veteranisation of trees, and potential enhancement of existing structures for roosting. Birds will be supported through installation of nest boxes and swift bricks. The strategy also promotes long-term ecological management, including invasive species control, adaptive monitoring, and alignment with evolving biodiversity plans. Collectively, these measures aim to achieve a Net Gain in Biodiversity, as demonstrated through the Uisce Éireann BNG Register completed for the proposed development.

The mitigation and enhancement measures secured through both the EIAR Biodiversity chapter and the NIS will ensure that the proposed development, alone or in combination with other plans and project, will not give rise to any significant negative impacts on Biodiversity or any adverse effects on the integrity of the River Barrow and River Nore SAC or any other Natura 2000 site.

11.3 Preliminary Safety & Health Plan

A preliminary safety and health plan has been developed for project. Refer to document Ref: 5161805DG0458 – Preliminary Health and Safety Plan – Mortarstown in Appendix I for further details.



11.4 Preliminary Traffic Management Plan

Traffic movements and volumes have been addressed as part of the EIAR. The Chapter 10 – Traffic and associated assessment have been carried out in accordance with European Union and National level policy, and the following local level policy documents and best practice guidance documents:

- Carlow County Council - Development Plan 2015 – 2021;
- Environmental Protection Agency – Guidelines on the information to be contained in Environmental Impact Assessment Reports - 2022;
- Transport Infrastructure Ireland - Traffic and Transport Assessment Guidelines 2014; and,
- Transport Infrastructure Ireland - PAG Unit 5.3 Travel Demand Projections 2016.

The following tasks are considered during the preparation of the Traffic Chapter:

- Assess surrounding road and transport infrastructure;
- Identify plans for future road infrastructure and transport upgrades;
- Source historical traffic counts to quantify the base line traffic scenario;
- Determine trip generation, distribution and assignment associated with the proposed development;
- Establish future years and associated traffic flows; and,
- Quantify the predicted traffic impact of the proposed development.

A traffic management plan will be developed by the Contractor as part of tender submission.

12. Summary of Investigative Studies Informing Detailed Design

12.1 Woodland Habitat Surveys

A combination of desk studies, general habitat surveys, specialist woodland habitat surveys, detailed topographical surveys and reviews of flood data carried out in 2022 and 2023 identified areas of the Annex I priority habitat type 'Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)' (91E0) and areas of other woodland habitat types (which to varying degrees support this habitat) along the River Barrow in the vicinity of the proposed project. In addition to the sensitivity of alluvial forest in its own right, it is also a qualifying interest of the River Barrow and River Nore SAC, meaning that the avoidance of adverse effects on the integrity of this habitat is critical in terms of the projects progression through the Appropriate Assessment process under Article 6(3) of the Habitats Directive. Consequently, the presence of this habitat and supporting habitats was a major consideration in the options selection studies for both the pumping station and outfall, as well as in the Natura Impact Statement (NIS) that is submitted as part of the planning application.

12.2 Invasive Species

During 2021, 2022 and 2023, multi-disciplinary ecological surveys by AtkinsRéalis and targeted surveys by invasive species specialists identified a number of stands of invasive non-native plant species in the vicinity of the proposed project. Most notable, these included dense areas of the legally restricted plants Japanese Knotweed (*Reynoutria japonica*) and Himalayan Balsam (*Impatiens glandulifera*) along the proposed outfall route between the Kilkenny Road and the River Barrow, as well as other areas of Himalayan Balsam along the river corridor. Other, non-



restricted species were also present in small numbers/extents around the study area, but these are not considered major constraints on the project.

The Japanese Knotweed identified during the surveys was also subject to targeted treatment and monitoring over the last 3 years and has been significantly reduced in extent (i.e. treated into dormancy through herbicide application). It is likely that the soil in the area previously occupied by Japanese Knotweed will still be required to be treated as contaminated, with Regulation 49 of the European Communities (Birds and Natural Habitats) Regulation, 2011 (as amended) applying. With regard to Himalayan Balsam, as this species is an annual which spreads by seed and which is present over large extents throughout the Barrow catchment upstream of the project, lasting elimination of this species from the project footprint will not likely be feasible, and so the focus will be on preventing further spread to, from or within the works area.

An Invasive Species Management and Biosecurity Plan was prepared for the proposed project by INVAS Biosecurity Ltd and this is submitted with the planning application as an appendix to both the EIAR and the NIS. Both the EIAR and the NIS also contain invasive species management and biosecurity measures, incorporating the plan prepared by INVAS, in their mitigation sections.

12.3 Archaeological Screening Assessment

The Archaeology chapter evaluates the potential impacts of the proposed development on known and potential archaeological resources. As part of the consultation and scoping process, the Department of Housing, Local Government and Heritage requested that an Underwater Archaeological Impact Assessment be undertaken. In response, an underwater archaeological survey was carried out by the Archaeological Diving Company (ADCO) in August 2022 under licence from the DHLGH (Licence Nos. 22D0069 and 22R0225), informing the preparation of the UAIA (ADCO, 2022). An updated assessment based on design modifications was completed in March 2025. The findings are as follows:

- The on-site assessment was systematic and comprehensive, extending well beyond any impacts associated with the proposed outfall structure. No archaeologically significant features, structures, or deposits were observed for either the immediate impact location or the wider assessment area.

The following recommendations have been provided

- No pre-construction mitigation measures are required for the proposed outfall works; however, due to the historical use of the River Barrow as a navigation route, archaeological monitoring is recommended during construction. All excavation and disturbance of riverbed or bankside deposits should be supervised by a suitably qualified archaeologist with expertise in riverine environments, in accordance with the National Monuments Act. An archaeologist should be retained for the duration of relevant works, with adequate notice provided in advance of construction and any subsequent phases. In the event that archaeological material is encountered, works must cease in the immediate area to allow for inspection, recording, and, if necessary, excavation. Appropriate resources, including a standby archaeological team, secure site facilities, and sufficient funding for potential excavation and post-excavation works, should be provided.

12.4 Preliminary EIA Requirement

An EIA is mandatory as the proposed upgrades to Mortarstown WwTP and Kilkenny Road Pumping Station will exceed the threshold of 10,000 PE, in accordance with the requirements outlined in part 11(c) 'other projects' and the thresholds set out under part 13 of Schedule 5 Part 2 of the Planning and Development Regulations as amended 2001-2019.



The EIAR has been completed based on the final scope of the project and is submitted as a part of the planning application.

12.5 Flood Risk Assessment

AtkinsRéalis was commissioned by Uisce Éireann to prepare a Flood Risk Assessment in support of the development of the Mortarstown WwTP and Kilkenny Road Pumping Station, in accordance with Section 8.2.6 of the Terms of Reference for the 2017-2021 Investment Plan Wastewater Consultancy Services Lot 5 Project. The assessment was conducted by IE Consulting in 2025.

The findings from the assessment is as follows:

- The Site-Specific Flood Risk Assessment (SSFRA) was undertaken in accordance with the *Planning System and Flood Risk Management Guidelines (DoEHLG, 2009)*, appropriate to the scale and nature of the proposed development. The assessment identifies fluvial flooding from the River Barrow as the primary flood risk to the proposed outfall pipe and headwall, with no significant risk from pluvial or groundwater sources. Detailed hydraulic modelling, including a Digital Terrain Model and 2D HEC-RAS simulations, confirmed that the site lies within Flood Zones A and B.
- As the development is classified as water-compatible, it is not subject to the Justification Test. Modelling results demonstrate that the proposed works will not adversely affect the existing hydrological regime or increase flood risk to adjacent lands. Overall, the flood risk associated with the development is considered low, and the proposal is deemed appropriate from a flood risk perspective.

12.6 Asbestos Survey Report

An independent Asbestos survey was undertaken at the WwTP by OHSS Safety Consultants on 25th June 2018 to identify the possible presence of asbestos with the WwTP. Asbestos containing materials were identified in a number of areas which are detailed in the report. The Asbestos Survey Report can be found in Appendix F. A summary of the findings is as follows:

- A range of asbestos-containing materials (ACMs) were identified within the Mortarstown Wastewater Treatment Plant. These include asbestos in floor tiles and associated bitumen within the control building, bitumen pads beneath the canteen sink, and linings to penstock gates across the inlet works, FDC chambers, and outlet areas. Asbestos-containing mastic was identified in expansion joints within the aeration tanks, with similar materials presumed to be present in older concrete tanks, chambers and vessels. In addition, asbestos is presumed to be present in certain pipework, including storm tank and outlet infrastructure, as well as within underground asbestos cement pipes across the site.



13. Principle Design References

The following standards and specifications have been used to inform design and equipment selection:

- Uisce Éireann Technical Standard – General M&E Specification - Document No: IW-TEC-200-01 (Revision 5.0)
- Uisce Éireann Technical Standard – Instrumentation, Control and Automation - Site SCADA and HMI Specification - Document No: IW-TEC-400-001
- Uisce Éireann Technical Standard – Automation and Control Specification 1 - Site SCADA and HMI Specification - Document No: IW-TEC-400-003
- Uisce Éireann Technical Standard – Energy Efficient Design Standard - Document No: IW-TEC-600-04
- Uisce Éireann Technical Standard – Commissioning, Testing and Handover – Document No: IW-TEC-600-05
- Uisce Éireann Technical Standard – Chemical Storage Systems - General Specification- Document No: IW-TEC-600-06
- Uisce Éireann Technical Standard – Design Standard for Explosive Atmosphere Compliance- Document No: IW-TEC-600-08
- Uisce Éireann Technical Standard (Draft) – Chemical Precipitation of Phosphorus- Document No: IW-TEC-700-05
- Uisce Éireann Technical Standards – Inlet Works & Stormwater Treatment (wastewater) – Document No.: IW-TEC-700-99-02
- Uisce Éireann Technical Standard - Flow measurement standard (wastewater) - Document No: IW-TEC-700-99-01
- Uisce Éireann Technical Standard – Waste Water Gravity Sewers- Document No: IW-TEC-800-01 (Revision 2.0)
- Uisce Éireann Technical Standard – General Civil Engineering Specification- Document No: IW-TEC-800-02 (Revision 4.0)
- Uisce Éireann Technical Standard – Storm Water Overflows – Document No: IW-TEC-800-03
- Uisce Éireann Technical Standard – Pumps – Document No: TEC-1000-03-02
- Uisce Éireann Technical Standard – Variable Speed Drives – Document No: TEC-1000-03-



APPENDICES

Appendix A. Design Population Equivalent Review



Technical Note

Project:	IW Consultancy Services Lot 5		
Subject:	Mortarstown WWTP & Kilkenny Road PS – Design Population Equivalent Review Technical Note		
Author:	Cúán O hÓgáin		
Date:	22/10/2023	Project No.:	5161805
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1. Introduction

This Technical Note relates to the Mortarstown WWTP upgrade project. The original project design population equivalent (pe) loading is primarily based on the 2016 census data. The original 10-year post-construction design year of 2030 and the 25 year post-construction design year is 2045 were based on the project being delivered in 2020.

This Technical Note has been prepared to update the original project pe loadings based on the 2022 census data, the changed post -construction design years and any known changes to the industrial, institutional, and commercial loadings within the catchment.

2. Post Construction Design Horizon Years

The original project 10-year post-construction design year of 2030 and the 25 year post-construction design year of 2045 are based on the project being delivered in 2020.

Based on today's date of October 2023, and allowing time for planning, tendering, design, construction and commissioning a new post construction date of 2027 is proposed with a resulting new 10 year post-construction design year of 2037 and a new 25 year post-construction design year of 2052.

3. Original Project Loadings

Project loadings were originally determined and presented in the Motarstown WWTP Upgrade Feasibility Study Report (FSR) issued by Atkins in August 2018, these project loadings were reviewed, finalised, and agreed per as per sign off loadings at the bottom of Table 1 below in May 2019.

Table 1: Original Project Loadings (Ref Gate 1-2 Handover and FSR Sign Off)

Element	Existing (2018/2019)	10 Year Design Horizon	25 Year Design Horizon
	Population Equivalent (PE)Loadings		
Domestic Population	24,855	35,477	
Commercial	3,679	5,530	
Educational	2,496	3,886	
Hospital & Nursing Homes	263	374	
Tourism (excluded if less than educational loading)	909	1,296	
Industrial	2,772	3,681	
DPI not connected	0	765	
Total Loading (Excluding Industrial for Design Loadings)	34,947	47,328	
Headroom Allowance	0	7,099	
Total Design Loading	34,038	49,713	
FSR Review Adjustment	1,499	839	
FSR Sign Off Loading	35,537	57,651	66,818
Original Project Design Loading	35,537	58,000	67,000

4. Current Proposed Loading

A proposed updated current loading to the WWTP has been estimated based on the 2022 census data and any known changes to the industrial, institutional, and commercial loadings within the catchment as detailed below.

Domestic Population:

The original FSR Domestic Population figure of 24,855 used to determine the original existing domestic population aligns closely with 2016 census figure for the total population of the Carlow (24,272), Tinryland (378) and Kernanstown (214) catchments with a population of 24,864, indicating that the census data for sum of these three catchments is a good measure for the domestic population loading for the overall catchment. The 2022 census data recorded a total population of 27,958 for these three catchments (Carlow 27,351, Tinryland 338 and Kernanstown 269).

Original Domestic Population:	24,855
Current Proposed Domestic Population:	27,958

Commercial Loading

Commercial Loading was estimated on the basis of 16% of the of the domestic population loading (as detailed above) or 4,473 pe.

Original Commercial load estimate:	3,679 pe
Current Proposed Commercial Population Loading estimate.	4,473 pe

Educational:

Primary and Secondary education pe. load

For the purposes of this Technical Note, the external primary and secondary educational load is assumed to have changed in line with the % change in the 5-19 year old population cohort between the 2016 and the 2022 census years.

2016 census data for 5-19 year old population for Carlow/Tinryland and Kernanstown: 5,297

2022 census data for 5-19 year old population for Carlow/Tinryland and Kernanstown: 6,068

The 5-19 year old population change % over the 2016 to 2022 period equates to an increase of 14.5%

Original external loading for primary and secondary educational load: 1,178pe

Current external primary & secondary educational load: 1,349pe

Third Level Institutional educational load:

For the purposes of this Technical Note, the external third level institutional educational load is assumed to have changed in line with the % change in the 15-19 year old population cohort between the 2016 and the 2022 census years.

2016 census data for 15-19 year old population for Carlow/Tinryland and Kernanstown: 1,616

2022 census data for 15-19 year old population for Carlow/Tinryland and Kernanstown: 2,062

The 15-19 year old population change % over the 2016 to 2022 period equates to an increase of 27.5%

Original external loading for primary and secondary educational load: 1,899pe

Current external primary & secondary educational load: 2,423pe

Original (external) Education Population Loading estimate: 3,077 pe

Total Current (external) Education Population Loading estimate: 3,772 pe

Institutional Loads:

For the purposes of this Technical Note, the institutional load is assumed to have changed in line with the % change in the overall catchment population between the 2016 and the 2022 census years.

2016 census population data for Carlow/Tinryland and Kernanstown: 24,864

2022 census population data for Carlow/Tinryland and Kernanstown: 27,958

The census population change % for the catchment over the 2016 to 2022 period equates to an increase of 12.4%

Original institutional load estimate: 263pe

Current institutional loading estimate: 295pe

It is noted that since the Project Brief was completed, a pre-connection application for nursing home with a load of approx. 130/140PE has been lodged, this increase shall be accommodated in the catchment growth projection.

Tourism Loads:

As the estimated educational loading is anticipated to be greater than the tourism loading, the tourism loading is excluded from the overall project loading figure.

Industrial Loads:

A review of data provided by UÉ connections indicated that no significant changes to the industrial loading had occurred since the original FSR was compiled and the Industrial Loading of 2,772PE in the original FSR is retained.

It is reported that the loads that the industries are reporting as discharged are significantly less than that licenced, however the licenced load limits are adopted for the project loadings.

Original industrial load estimate: 2,772 pe

Current institutional loading estimate: 2,772 pe

The original FSR Project loadings and the proposed new updated project loadings are presented in Table 2 below.

Table 2: Original Project Loading and Proposed updated Project Loading)

Element	Existing (2018/2019) 25 Year Design Horizon	Proposed Population Equivalent (PE) Loadings
	Population Loadings	
Domestic Population	24,855	27,958
Commercial	3,679	4,473
Educational	2,496	3,772
Hospital & Nursing Homes	263	295
Tourism (excluded from overall project loading as less than educational loading)		
Industrial	2,772	2,772
DPI not connected	0	
Total Loading	34,947	39,270
Total Design Loading	34,038	39,270
FSR Review Adjustment	1,499	
FSR Sign Off Loading	35,537	
Original & Proposed Project Design Loading	35,537	39,270

An updated current 2023 project design loading of 39,270 pe is proposed for the project.

5. Proposed Design Horizon Loadings

The 10-year and the 25-year design horizon loadings have been estimated based on the proposed current project loading and the following growth rates and UÉ forecasting and headroom criteria;

- The census population change % for the catchment over the 6 year period between the census in 2016 and the 2022 equates to an increase of 12.4% or an annual increase of 2.06%. An annual growth rate of 2.06% rather than the original FSR growth rate of 3.61% is proposed for the current year to 2028 (in line with UÉ forward planning Team Projections).
- An annual growth rate of 1.14% is proposed for the design horizon years to 2028 to 2035 (in line with UÉ forward planning Team Projections).
- An annual growth rate of 0.75% is proposed for the design horizon years to 2035 to 2050 (in line with UÉ forward planning Team Projections).
- An annual growth rate of 0.75% is assumed for the design horizon years to 2050 to 2055.
- A headroom allowance of 10% has been adopted, with the headroom allowance specifically excluding the industrial loading which will be addressed on a case by case basis with UÉ connections.

The design horizon project loadings are presented in the attached spreadsheet and are summarised in Table 3 below:

Table 3: Proposed Current Project Loading and Design Horizon Loadings

Element	Proposed Population Equivalent (PE) Loadings	10 Year Design Horizon (2037)	25 Year Design Horizon (2052)
	Population Loadings		
Domestic Population	27,958	34,413	38,494
Commercial	4,473	5,666	6,338
Educational (external)	3,772	4,778	5,344
Hospital & Nursing Homes	295	374	418
Industrial	2,772	2,772	2,772
Total Design Loading	39,270	48,002	53,366
Headroom Allowance (10%) excluding Industrial		4,523	5,059
Proposed Project Design Horizon Loadings	39,270	52,525	58,426

6. Summary

Based on review of the project loadings and census data, the following project design loadings are proposed:

- Current Design Loading: 39,270pe
- Post Construction Completion Date: 2027
- 10 year design horizon year 2037 with design horizon loading of 52,525 pe
- 25 year design horizon year 2052 with design horizon loading of 58,426 pe

Appendix B. WAC Assessment





CIP 5 - MORTARSTOWN WWTP

Notice

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1. Introduction

Uisce Éireann intend upgrading the existing Mortarstown WWTP from a current design capacity of 36,000 PE to a future forecasted 25 year design horizon loading of 58,500 PE. The Mortarstown WWTP services Carlow Town and environs and the plant is located 2.2km south of Carlow Town on the eastern bank of the River Barrow. The purpose of this report is to provide details of the water quality environment of the discharge and set out the calculations carried out to determine appropriate future Environmental Limit Values (ELVs) for the upgraded WWTP.

The upgrade project aims to increase the treatment capacity of the WWTP; replace equipment and electrical control equipment nearing the end of their working design life and address deficiencies related to stormwater storage volumes and shallow walled final settlement tanks.

The upgraded WWTP will discharge treated effluent to the River Barrow (WFD code IE SE 14 196) at grid reference 271,179E 174,892N. The existing Ø600mm outfall pipe will be replaced by a new Ø900mm outfall pipe discharging via a concrete headwall constructed to UÉ specifications. The impact of the future discharges on water quality in the River Barrow will be assessed using a Tiered Assessment approach as set out in the Uisce Éireann Interim Technical Guidance on Water Quality Impact Assessment in the Freshwater Environment (UÉ-AMT_GL-028).

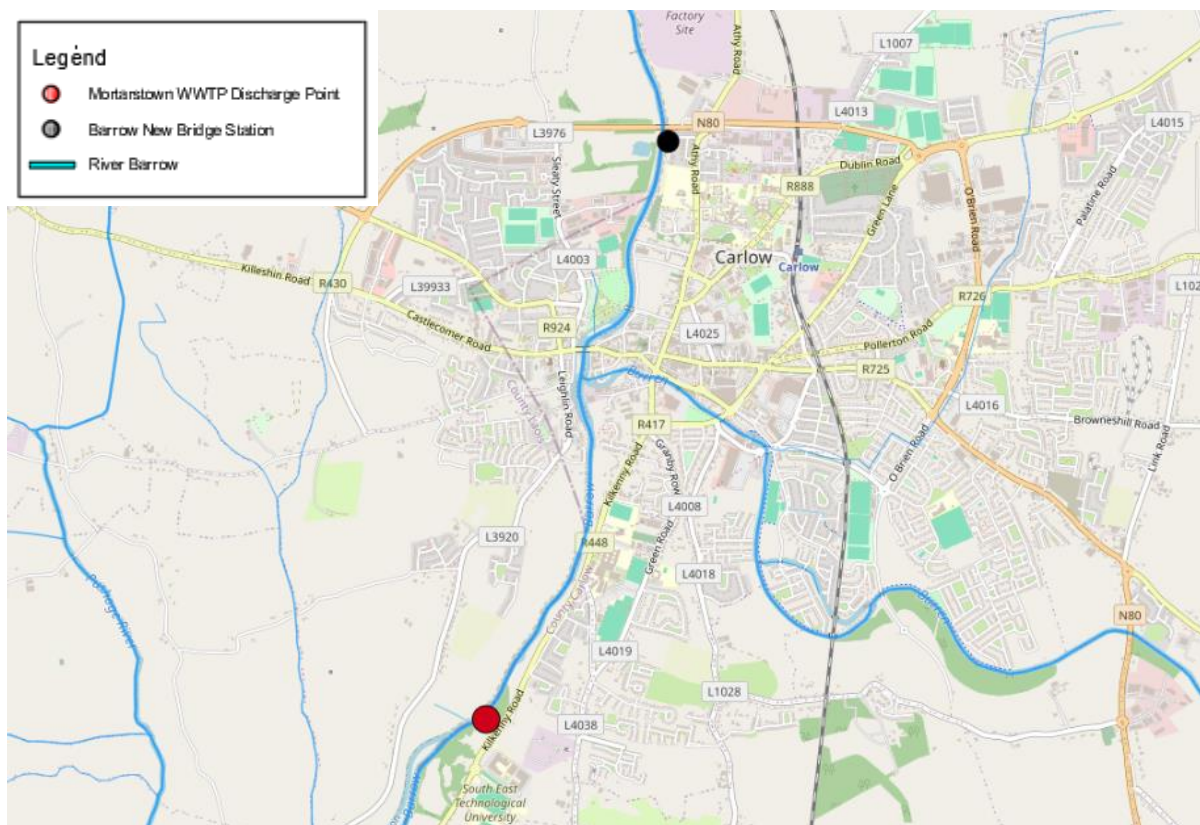


Figure 1-1 - Location of Mortarstown WwTP Discharge Outfall

1.1 Tiered Assessment Framework

An assessment of the impacts of the discharge from Mortarstown WWTP can be made using the Tiered Assessment Approach, as set out by the European Commission¹ and as adopted by Uisce Éireann's own Technical Guidance. The guidelines set out an approach to assessing the impact of discharges, using risk-based methods, where the level of complexity of the assessment is commensurate with the level of risk posed by a discharge.

The UÉ tiered approach for watercourses consists of five Tiers:

- Tier 0: check to see if the effluent is likely to contain a contaminant of concern. If so, check to see if the contaminant is present at levels above the Environmental Quality Standard (EQS), i.e. the maximum permitted concentration in the receiving waterbody.
- Tier 1: Check to see if discharging the contaminant(s) of concern at levels above the EQS are likely to have a significant impact on the receiving waterbody given existing ambient concentrations.
- Tier 2: An initial assessment of water quality impacts and required ELVs is made based on a simple mass balance approach (Tier 2a). If this is found to give unrealistic results, or if the resulting ELVs cannot be achieved in a cost-effective and proportionate manner, the water quality impact is further simulated using a Monte Carlo analysis (Tier 2b).
- Tier 3: If the Tier 2 assessment methods indicate that achievable ELVs cannot be applied to the discharge, or sensitive receptors are likely to be impacted upon, the mixing zone is further assessed based on achievable levels of wastewater treatment and using complex models to establish the extent of the mixing zone and duration and frequency of impacts.
- Tier 4: If the Tier 3 analysis suggests that the impacts will be significant, an investigative study is undertaken to examine the concentrations of the contaminant(s) reaching receptors, the characteristics of the receptors, their vulnerability and the ecotoxicity of the contaminants.

At each stage of the Tiered Assessment, the discharge assessment is either completed (if environmental impacts are appropriate and acceptable) or referred for additional assessment at the next stage. In the case of Mortarstown WWTP, the level of required analysis did not progress beyond a Tier 2 assessment.

The two methods of Tier 2 calculation are described below.

1.1.1 Simple Mass Balance Method

Simple mass balance calculations can be carried out for any given set of river quality, river flow, effluent quality and effluent flow conditions. For the purposes of assessing impacts of wastewater discharges against targets in legislation (see Section 2) two sets of calculations are typically required, the first to assess against environmental compliance with 95%ile EQS targets (carried out using low Q95 river flows) and a second calculation to assess environmental compliance against mean EQS targets (carried out using mean river flows). The calculation is shown in Equation 1.

$$C_{downstream} = \frac{Q_{eff}C_{eff} + Q_{river}C_{river}}{Q_{eff} + Q_{river}}$$

Equation 1-1 - Mass Balance Equation

¹ Technical Guidelines for the Identification of Mixing Zones, pursuant to Art. 4(4) of the Directive 2008/105/EC, European Commission, Brussels, 22 December 2010, C(2010) 9369



Where: Q_{eff} is the average effluent flow rate (m^3/s) and C_{eff} is the effluent pollutant concentration (mg/l)

Q_{river} is the flow in the watercourse upstream (m^3/s) and C_{river} is the average ambient river pollutant concentration upstream of the outfall (mg/l)

$C_{\text{downstream}}$ is the resultant downstream water quality for each pollutant in the watercourse (mg/l)

The simple mass balance approach assumes that 95%ile concentrations in the river occur downstream of a discharge at the same time as Q_{95} river flows due to lack of dilution capacity within the watercourse at times of low flow. This approach also assumes that mean concentrations in the river occur downstream of a discharge at the same time as mean river flows. Because of this method of schematising river quality conditions, simple mass-balance may be considered a conservative approach compared to other methods of modelling which are capable of considering a much wider combination of flow and quality conditions in rivers and effluent.

1.1.2 Monte Carlo Analysis Method

If the ELVs determined on the basis of the simple mass balance (Tier 2a) approach are found to be unrealistic or give rise to ELVs that cannot be achieved in a cost-effective and proportionate manner, then the water quality impact can be simulated in greater detail using a Monte Carlo analysis (Tier 2b).

Whilst the simple mass-balance calculations are easy to apply, they do not consider the full range of river and effluent flow conditions or the range of potential quality conditions which may occur in a watercourse upstream or downstream of a discharge. The simple mass balance approach is also not able to easily take account of correlations between inputs, such as correlations between river and effluent flow rates or between effluent flow rate and effluent pollutant concentrations. These factors can be overcome using a Monte Carlo approach whereby complex statistical problems are represented using multiple different combinations of potential scenarios selected randomly from across the probability curves of both datasets. In this context, Monte Carlo analysis uses multiple combinations of watercourse and effluent flows and concentrations in order to assess the impact of the discharge over the full range of potential watercourse flow and quality conditions. This gives a more complete analysis of the impacts of a discharge on the watercourse quality and can also be adapted to account for correlations in datasets, however it does require more input data compared to a simple mass-balance approach.

Uisce Éireann have developed methods to facilitate both simple mass balance (UÉ-AMT-FM-007) and Monte Carlo analysis (UÉ-AMT-FM-008) when assessing the impacts of a WWTP discharge on receiving water quality. A simple mass balance approach has been applied to assess the impacts of the Mortarstown WWTP discharges on water quality in the River Barrow and calculate the ELVs required to deliver the appropriate level of protection to downstream water quality.

1.2 Report Structure

The report sets out the results of a Tiered Assessment of the Mortarstown WWTP discharge and calculation of ELVs based on simple mass balance Tier 2a assessment method. The Tier 2a calculation method relies on suitable analysis of the available environmental data and information on WWTP effluent flows and quality. The report is structured as follows:

- Section 2 provides a brief overview of legislative framework and list of substances for assessment in the tiered analysis.
- Section 3 sets out the hydrological context of the receiving waters and calculates river flow percentiles.
- Section 4 reviews the available water quality data for the receiving watercourses, checks for correlation between river flow and quality and establishes target downstream concentration values and status.



- Section 5 outlines the available effluent flow and quality data and checks for correlation between river flow and effluent flow rates and between effluent flow rate and quality.
- Section 6 provides the results of analysis at Tiers 0, 1 and 2 (simple mass balance approach).
- The report is summarised in Section 7.



2. Legislative Framework

2.1 Legislation

2.1.1 Urban Wastewater Treatment Directive Regulations

The Urban Wastewater Treatment Directive Regulations 2001² (amended in 2004 and 2010) sets standards to be met in the collection and treatment of wastewater as well as the monitoring requirements for wastewater discharges from urban areas. The Environmental Protection Agency issues licences for WWTP discharges to environmental waters in accordance with the requirements of the UWWTD and the discharge licence for Mortarstown WWTP was most recently granted under this legislative instrument in August 2009 (ref. D0028-01), with technical amendments in October 2011, December 2016 and December 2021. The current ELVs applied to effluent from Mortarstown WWTP are set out in Table 2-1 and compared with effluent quality standards required for a wastewater treatment plant of its current capacity under the UWWTD.

Table 2-1 - Current Environmental Limit Values at Mortarstown WwTP

Parameter	UWWTD Maximum Permitted Value	Current Mortarstown WWTP ELV (WWDA Regs)
Chemical Oxygen Demand (COD) (mg/l)	125	125
Biological Oxygen Demand (BOD) (mg/l)	25	15
Suspended Solids (mg/l)	35	35
pH	--	6.0 to 9.0
Ammonia (mg/l)	--	2.0
Orthophosphate (mg/l)	--	0.80
Total Phosphorus (mg/l)	1.00	1.00

Under the UWWTD, secondary treatment is required for settlements with a PE of 2,000 to 10,000 and with discharges to freshwaters. Tertiary treatment is required for WWTP which serve more than 10,000 PE and which discharge to nutrient sensitive waters. The UWWTD allows for designation of environmental waters as “nutrient sensitive” and additional application of ELVs for total nitrogen and total phosphorus where this designation is applied. It is noted that the River Barrow, “*downstream of Portarlinton sewage outfall, to Graiguenamanagh Bridge*” which incorporates the Mortarstown WWTP discharge point is designated as nutrient sensitive and a total phosphorus ELV has been applied by the current discharge licence in recognition of this.

² Statutory Instruments SI No 254/2001 <https://www.irishstatutebook.ie/eli/2001/si/254/made/en/print> , accessed 12 March 2024



2.1.2 Surface Waters Regulations

The Water Framework Directive (WFD, Directive 2000/60/EC) defines the ecological status of waterbodies as high, good, moderate, poor or bad. Under WFD, member states are required to prevent pollution of waterbodies and work to improve water quality to a minimum of good status, provided this can be done in a cost effective and proportionate manner. The WFD was enacted into Irish Law through the European Communities Environmental Objectives (Surface Waters) Regulations 2009³ (amended in 2015 and 2019 and referred to throughout this report as “the Surface Water Regulations”).

The Surface Water Regulations set standards which can be used to identify the current status of waterbodies and to determine the impacts of the discharge at Mortarstown WWTP on future water quality. The standards are set for ecological community assemblage and for physio-chemical parameters that affect it. Table 2-2 shows the standards for good and high ecological status in rivers. The discharges may directly impact on concentrations of ammonia, BOD, orthophosphate and pH and this will subsequently have impacts on river ecosystems and dissolved oxygen concentrations. This report will consider only direct impacts on river chemistry and will calculate the appropriate ELVs required to ensure protection of river ecosystems and avoid impacts on dissolved oxygen.

³ Statutory Instruments SI No 77/2019 <http://www.irishstatutebook.ie/eli/2019/si/77/made/en/print>, accessed 26 September 2024



Table 2-2 - Water Quality Standards for River Waters under the Surface Water Regulations

Parameter	Classification System	High-Good boundary	Good-Moderate boundary
Macro Invertebrates	Quality Rating System (Q Value)	0.85	0.75
Fish	Fish Classification Scheme 2 Ireland (FCS2)	0.845	0.540
Phytobenthos	Revised form of Trophic Diatom Index (TDI)	0.93	0.78
Macrophytes	Free Macrophyte Index	0.90	0.68
Ammonia (mg/l)	Mean	0.04	0.065
	95%ile	0.09	0.14
BOD (mg/l)	Mean	1.3	1.5
	95%ile	2.2	2.6
Molybdate Reactive Phosphorus (orthophosphate, mg/l)	Mean	0.025	0.035
	95%ile	0.045	0.075
pH	Mean	Hard Water ($\text{CaCO}_3 > 100\text{mg/l}$) = 6-9	
		Soft Water ($\text{CaCO}_3 < 100\text{mg/l}$) = 4.5-9	
Dissolved Oxygen (%)	95%ile value	80-120%	

2.1.3 Wastewater Discharge (Authorisation) Regulations

The Environmental Protection Agency issues licences for WWTP discharges under the Wastewater Discharge (Authorisation) Regulations (2007)⁴ (amended in 2010 and 2024), referred to in Table 1 as the WWDA Regulations. These regulations take account of the above directives to ensure that the discharge of wastewater does not have adverse impacts on the environment. This is achieved by taking a “combined approach,” whereby *“the emission limits for the discharge are established on the basis of the stricter of either or both, the limits and controls required under the Urban Waste Water Regulations, and the limits determined under statute or Directive for the purpose of achieving the environmental objectives established for surface waters.”*

⁴ <http://www.irishstatutebook.ie/eli/2007/si/684/made/en/print>, accessed 19 June 2020



2.1.4 Other Regulations

Additional protection for water quality in rivers can be applied in Ireland under the following legislative instruments:

- The EU Bathing Waters Directive (2006/7/EC, February 2006), transposed into Irish Law as the Bathing Water Quality Regulations⁵ in 2008 with minor amendments in 2011 and 2016.
- The Shellfish Waters Directive (“Directive 2006/113/EC on the Quality Required of Shellfish Waters”) which sets out standards which must be achieved when harvesting shellfish for human consumption and is now incorporated within the Water Framework Directive.
- The 1988 Salmonid Regulations⁶ which have been partly superseded by the Water Framework Directive.
- Habitats Directive (Directive 92/43/EEC): Treated effluent from the Mortarstown WWTP discharges and will continue to discharge to the River Barrow and River Nore Special Area of Conservation (SAC). In order to inform and assist the competent authority in making its Appropriate Assessment (AA) of the proposed Mortarstown WWTP upgrade development under Article 6(3) of the Habitats Directive, a Natura Impact Statement (NIS) will be prepared and submitted to the competent authority. The NIS will assess the implications of the WWTP upgrade project for the integrity of the SAC. As part of this, the outputs of this WAC Report will provide a basis for the assessment of the effects of the future effluent discharge on the aquatic qualifying interests of the SAC, in view of their conservation objectives.

The Barrow River is not designated as a bathing water, shellfish water or for the protection of salmon, therefore the Habitats Directive, of the above related legislative instruments apply when assessing the impacts of the Mortarstown WWTP discharge.

2.2 WFD Waterbodies

Mortarstown WWTP discharges to the Barrow River which is designated under the Surface Waters Directive as river waterbody Barrow_160 (IE_SE_14B012460) and the existing discharge location will be utilised by the upgraded WWTP. The Barrow Catchment includes the area drained by the River Barrow upstream of the River Nore confluence and all streams entering tidal water between the Barrow railway bridge at Great Island and Ringwood, Co. Kilkenny, draining a total area of 3,025km². The largest urban centre in the catchment is Carlow. The other main urban centres in this catchment are New Ross, Graiguenamanagh, Athy, Portlaoise, Mountmellick, Portarlinton, Monasterevin and Kildare. The Barrow main channel rises in the Slieve Bloom mountains and flows through agricultural areas, the towns of Portarlinton, Athy, and Carlow.

The New Bridge Monitoring Station (RS14B012200 upstream of the WWTP Discharge Point) identifies the waterbody as having a Moderate Q Value Status with a Q Value Score of 3-4 in 2023. The Q Value score at this Monitoring Station (RS14B012200) in 2018, 2020 and 2023 has not changed. An examination of the Monitoring Station Data indicates that an upstream Good Q Value Status is monitored at a Monitoring Station upstream of Athy (RS14B011300). Monitoring Stations (RS14B012455, RS14B012600, RS14B012680) downstream of the Mortarstown WWTP Discharge Point) identifies the waterbody as having a Moderate Q Value Status with a Q Value Score of 3-4 in 2018, 2020 and 2023.

⁵ Statutory Instrument 79/2008, <https://www.irishstatutebook.ie/eli/2008/si/79/made/en/print>, accessed 12 March 2024

⁶ <http://www.irishstatutebook.ie/eli/1988/si/293/made/en/print>, accessed 12 March 2021



The available water chemistry data for the River Barrow upstream and downstream of the Mortarstown WWTP Discharge Point is reviewed in Section 4.

2.3 Sensitive Receptors

Treated effluent from the Mortarstown WWTP discharges and will continue to discharge to the River Barrow and River Nore Special Area of Conservation (SAC). As noted in Section 2.1.4, the River Barrow is not designated for protection of bathing waters, shellfish or salmon and improvements to wastewater treatment are not required at this location for the protection of freshwater pearl mussel. There are no Uisce Éireann Drinking Water Abstraction Points identified downstream of the primary discharge. The watercourse is, however, designated as nutrient sensitive. The additional protection required under the UWWTD for nutrient sensitive waters is reflected in the application of the total phosphorus ELV and this is applied irrespective of receiving water quality. The substances of concern for a Teir 0 analysis in Section 6 are therefore limited to ammonia, BOD, orthophosphate and pH based on EQS for rivers as set out in the Water Framework Directive.

2.4 Assessment Methodology

Uisce Éireann have developed a methodology to ensure a consistent approach is taken to water quality impact analysis and the setting of ELVs for WWTP effluent (Interim Technical Guidance for Water Impact Assessments (Freshwater) Document No. AMT-GL-028). This approach seeks to determine an appropriate downstream target status and percentage of available wastewater assimilative capacity which can be taken by a single wastewater discharge. The available assimilative capacity is defined as the difference between the upstream river nutrient concentration and the target EQS.

Figure 2-1 provides a flow chart for identifying the target status for a watercourse as either “Good” or “High” status, and if a notionally clean approach should be applied. The flow chart is applied for both mean and 95%ile water quality, with the final target applied for each nutrient based on the worst-case upstream water quality evaluation outcome.



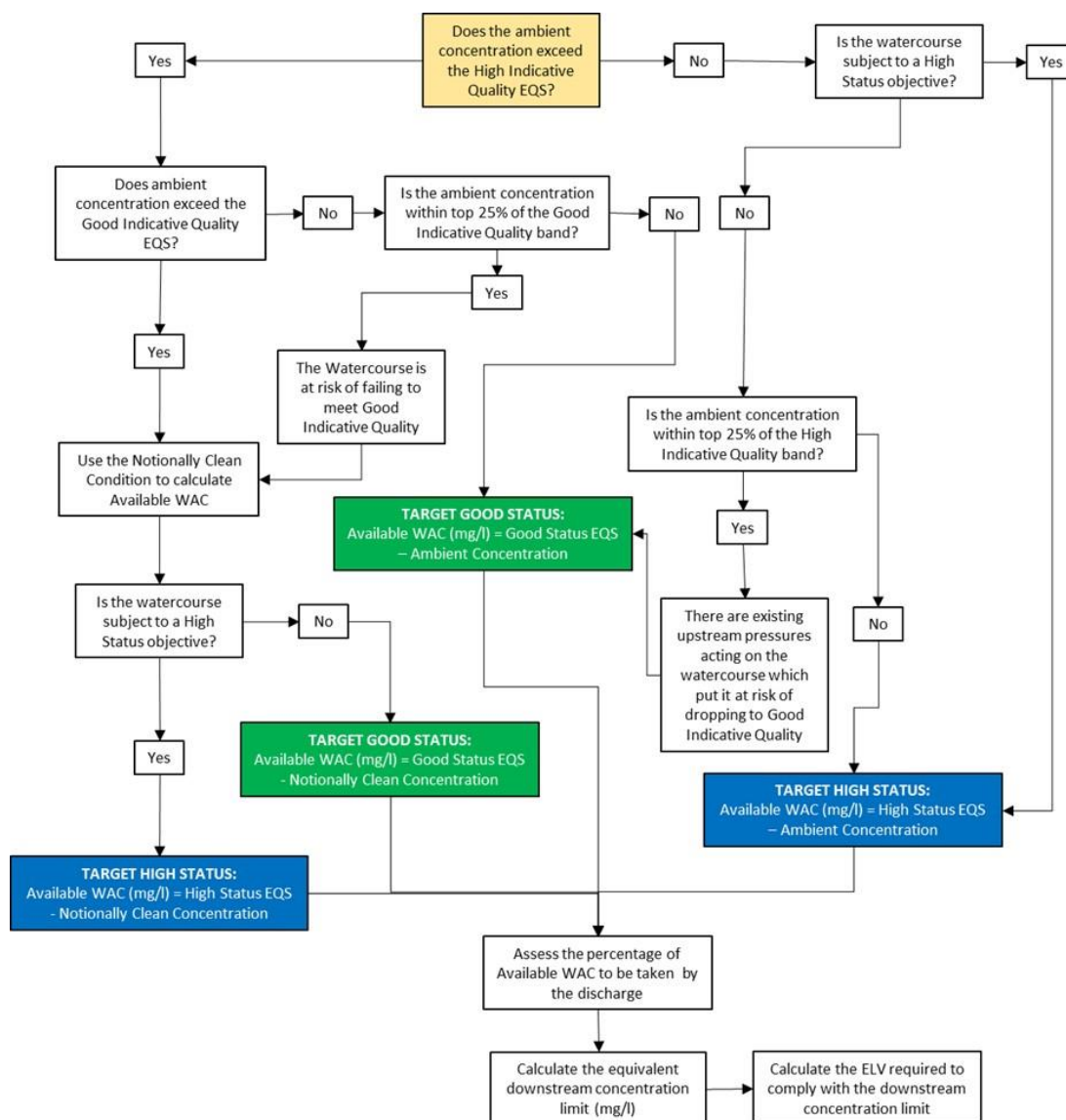


Figure 2-1 - Target Status Flow Chart

The calculation of available assimilative capacity in watercourses is predicated on the assumption that the ambient water quality is less than the EQS for each pollutant. This may not be the case in all circumstances as often a waterbody may have other upstream pressures impacting on water quality. In such circumstances a “Notionally Clean” approach is required to determine appropriate ELVs which are proportionate to the impacts of a wastewater discharge on the environment. The impact of the upstream pressures is “removed” to allow for calculation of ELVs which would deliver compliance with the target status under the Surface Water Regulations if the upstream pressures on water quality were addressed. This is simulated by applying water quality statistics at the upstream location which are equal to 20% of the high status EQS value. These approaches are required to allow for sustainable future operation of wastewater infrastructure in line with the “polluter-pays” principle in the WFD.

The outcome of this process for Mortarstown WWTP, based on the upstream river quality data discussed in Section 4 below, is that A “Notionally Clean” approach was adopted in the calculation of the ammonia and BOD ELV as the ambient river data exceeds the Good Indicative Quality EQS for BOD and ammonia.



For a given WWTP, ELVs are set such that effluent discharges utilise an appropriate percentage of the available WAC based on the sensitivity of the receiving environment. Table 2-3 provides an environmental sensitivity scoring system, which determines this sensitivity based on the characteristics of the receiving environment. The environmental sensitivity score calculated for the Barrow River at Mortarstown WWTP Discharge Point is 15.

Table 2-3 - Environmental Sensitivity Scoring

Factor	Assessment	Score	River Barrow at Mortarstown WWTP Discharge Point
Current watercourse status	Watercourse not at significant risk of WFD classification change	0	
	Watercourse "at risk" of WFD classification change / currently failing to meet Good	5	5
Discharge Location Score			
Downstream Dilution	Q ₉₅ Flow increases by <20% at next confluence (within WFD Waterbody)	0	0
	Q ₉₅ flow increases by 20-50% at next confluence (within WFD Waterbody)	-2	
	Q ₉₅ flow increases by >50% at next confluence (within WFD Waterbody)	-2	
	Q ₉₅ flow increases by >80% at next confluence (within WFD Waterbody)	-4	
Environmental Receptors Score			
Environmental Receptors	Discharge to SPA	5	
	Discharge to Special Area of Conservation	5	5
	Discharge to Bathing Water	5	
	Discharge to Drinking Water	3	
	Discharge to Salmonid River	4	
	Discharge to Shellfish Water	2	
	Discharge to Nutrient Sensitive Water	5	5
	Discharge within 1km of SPA	2.5	
	Discharge within 1km of SAC	3	



Factor	Assessment	Score	River Barrow at Mortarstown WWTP Discharge Point
	Discharge to High Status Objective Waterbody under WFD or the Habitats Directive	10	
	Discharge within 1km of Bathing Water	2.5	
	Discharge within 1km of Drinking Water	1.5	
	Discharge within 1km of Salmonid River	3	
	Discharge within 1km of Nutrient Sensitive Water	3	
	Discharge within 1km of Shellfish Water	1	
			TOTAL 15

Table 2-4 provides the upper limits of the available WAC to be used by a WWTP discharge depending on the environmental sensitivity score and the upstream water quality. Based on the scores calculated above, Mortarstown WWTP should use 30% (at most) of the available WAC. Note the available WAC for BOD and ammonia to be based on the notionally clean condition.

Table 2-4 - Determination of Available WAC Take-Up

Risk Score	Amount of Available WAC to be Taken (Using Ambient Data)	Amount of WAC to be Taken (Using Notionally Clean)
up to 4	Up to 75%	Up to 50%
4 to 9	Up to 50%	Up to 40%
10 to 19	Up to 30%	Up to 30%
19 to 30	Up to 25%	Up to 20%
>30	Up to 10%	Up to 10%



3. Hydrological Analysis

A detailed hydrological analysis has been undertaken in accordance with Uisce Eireann's Technical Guidance for Hydrological Estimation (UE-AMT-GL-022) in order to determine the prevailing river flow characteristics at the Mortarstown WWTP discharge location.

3.1 River Barrow Catchment and Flow Gauges

The Barrow River catchment at Mortarstown WWTP discharge point occupies an area of 2,255.7km² (Figure 3-1). The Barrow New Bridge Station (Stn. No. 14022) is located 3 km upstream of the Mortarstown WWTP discharge point, where the catchment area is 2,069.5km². The difference in catchment area between the gauge station and the discharge point is 8.2% (Figure 3-2). As the difference in catchment areas at the gauge station and the discharge site is less than 10%, therefore the flow duration curve at the gauge station can be applied to the WWTP discharge site with simple scaling to account for the difference in catchment area.

The gauged river flow record at the Barrow New Bridge Station is used to calculate river flow statistics at Mortarstown WWTP discharge point. The Q₉₅ river flow data for the downstream Pushoge River was identified at 0.039m³/s (ref EPA Maps) indicating that the increase in Q₉₅ river flow occurring downstream of the River Barrow/Pushoge River confluence is less than 20% with a 0 score therefore being used as an input to the Environmental Sensitivity Score in Section 2.4.

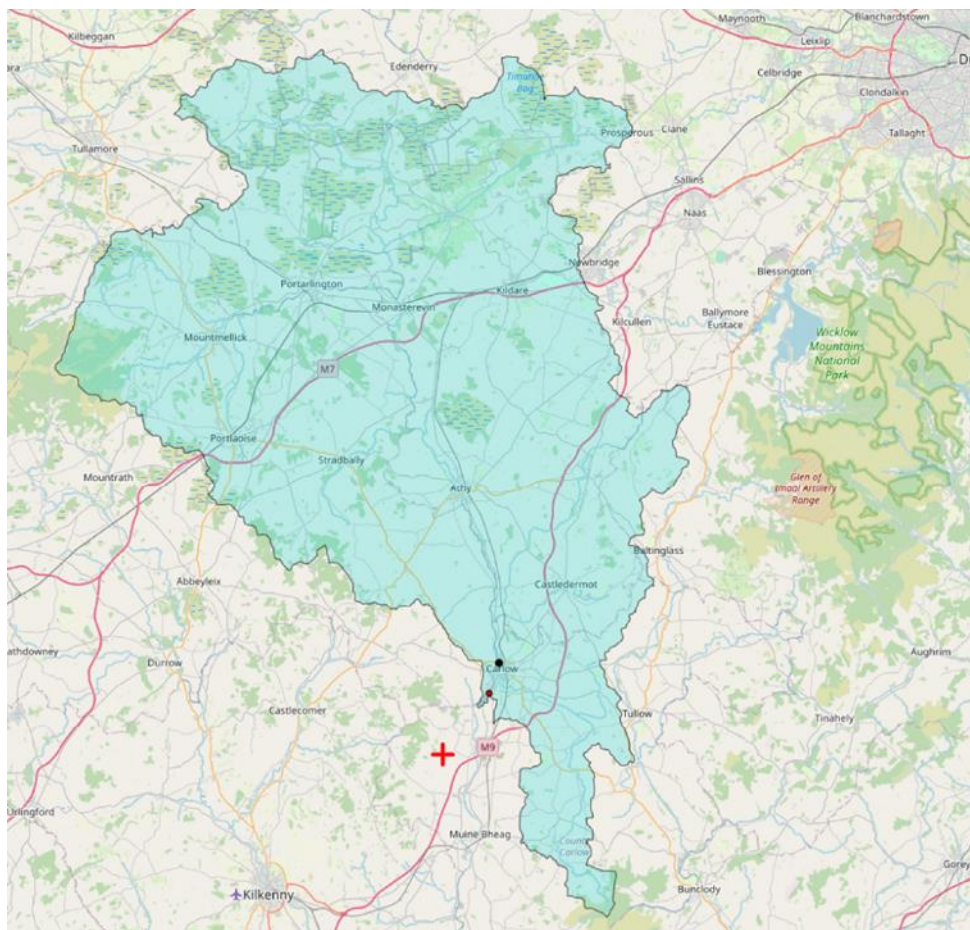


Figure 3-1 - Mortarstown WWTP Discharge Point Contributing Catchment Area

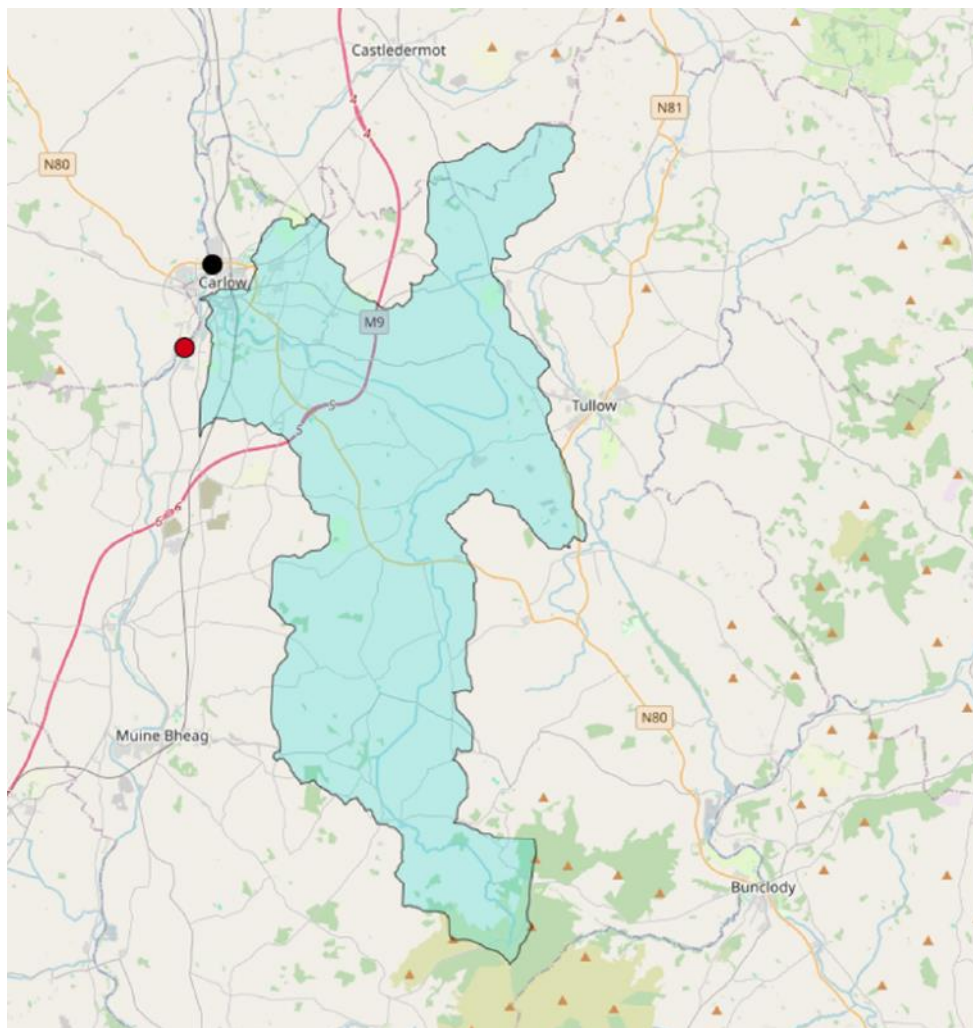


Figure 3-2 - Catchment Area not contributing to Barrow New Bridge Station

3.2 Gauged Flow Data Evaluation

Details of the gauged flow data at the Barrow New Bridge Station are provided in Table 3-1 and the annual flow data and calculated flow percentiles at the gauge station is set out in Appendix A.

Table 3-1 - Gauging Station Details

Station Number	14022
Station Name	Barrow New Bridge
Waterbody	River Barrow
Site Owner	Office of Public Works
Grid Reference	272025, 177741
River Basin District	South Eastern



Catchment Area (km ²)	2,065.5
Data Start Date	21/09/2007
Data End Date	05/11/2024
Daily Data Percent Complete	91.2

The Barrow New Bridge daily flow data timeseries is shown in Figure 3-3 (OPW, 2024) and the gauge data have been reviewed for quality, non-stationarity and the impact of missing data.

The review shows that the majority of the river daily flow data timeseries as being complete with no gaps sufficient to skew the flow duration curve. The review shows that the majority of the river daily flow data timeseries is classified by the OPW as being of an acceptable or fair quality (OPW quality codes 31,36). An ADF test for stationarity indicates that flow data timeseries as having a non-stationarity characteristic in the form of reducing low annual flows, however this non-stationarity is not sufficiently apparent to justify exclusion of older data when calculating whole-record river flow statistics. Anthropogenic (or human based) influences on gauged river flow data at Barrow New Station are not considered to be significant. The upstream Srowland water treatment plant at Athy for example operates at 20 ML/d or 0.23m³/s which is not considered to be sufficiently significant relative to the River Barrow flow to skew the Barrow New Station flow duration curve.

One the basis of these checks, the daily mean flow data from the entire gauge record from the Barrow New Station can be used to produce a flow duration curve and calculate key flow percentiles for the River Barrow at the gauge. Flows at the gauge can be scaled to represent flows in the River at Mortarstown WWTP to account for the increase in catchment area between the gauge and the WWTP discharge point.

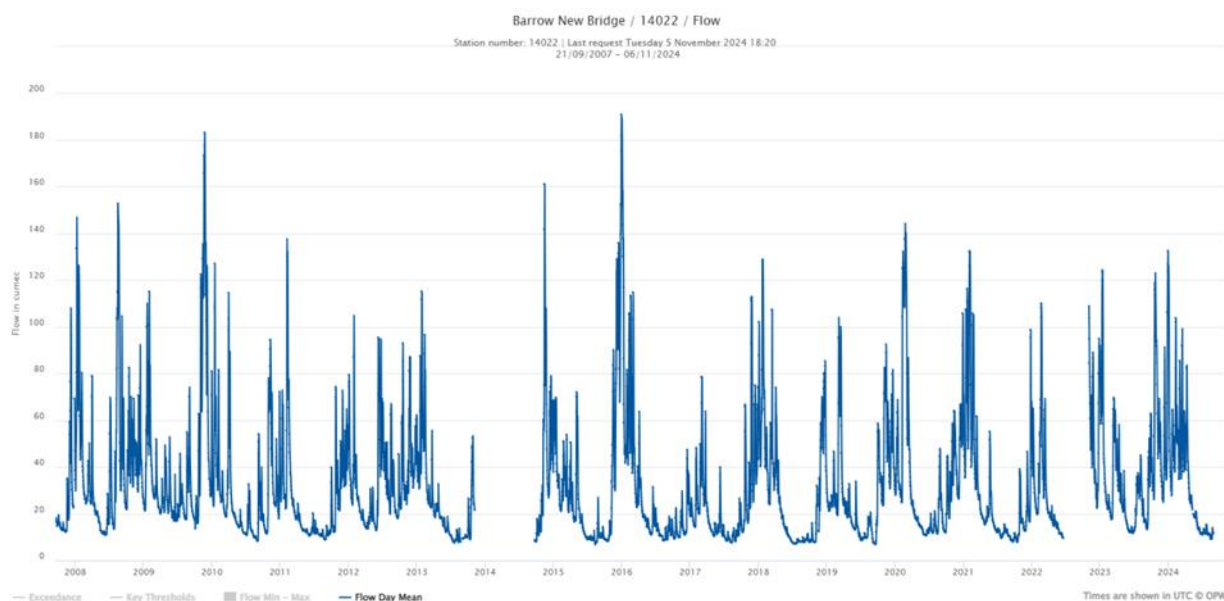


Figure 3-3 - OPW River Flow Timeseries for River Barrow at Barrow New Bridge (Daily Mean Flows from 2008 to 2024)



3.3 Gauged Flow Statistics

Figure 3-4 (OPW, 2024) shows the flow duration curve for the River Barrow at the Barrow New Bridge Station for period 2007 to 2024. River flow statistics have been calculated for the River Barrow at Mortarstown WWTP discharge point by increasing the gauged flows at Barrow New Bridge Station by 8.2% to account for the increase in catchment area between this gauge and the WWTP. Table 6 gives the scaled river flow statistics for the River Barrow at Mortarstown WWTP discharge point.

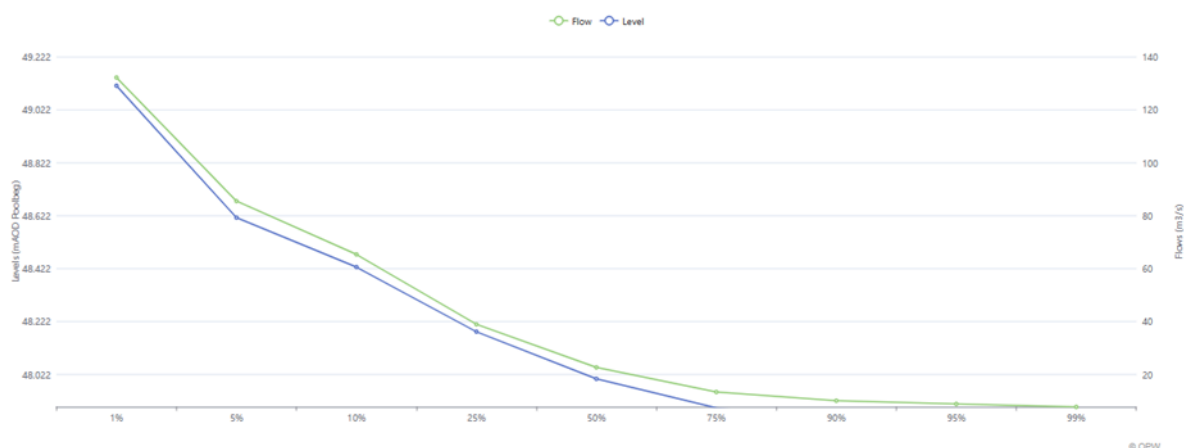


Figure 3-4 - OPW Daily Mean Flow Duration Curves for the River Barrow at Barrow New Bridge Station

Table 3-2 - Flow Duration Curve Statistics for the River Barrow at Guage Station & Mortarstown WWTP Discharge Point

Flow Exceedance Probability (%)	New Bridge Barrow OPW Gauge Station Flow (m³/s)	Mortarstown WWTP Discharge Point Flow (m³/s)
1	132.118	142.952
5	85.439	92.445
10	65.289	70.643
25	38.877	42.065
50	22.589	24.441
75	13.312	14.404
90	10.03	10.852
95	8.792	9.513
99	7.69	8.321



4. River Water Quality Analysis

4.1 Monitoring Locations

River water quality is monitored on the River Barrow at locations upstream and downstream of Mortarstown WWTP discharge point. The upstream monitoring point is RS14B012310 (u/s Mortarstown WWTP), located at Graiguecullen Bridge, ≈1.8km upstream of the primary outfall. The downstream monitoring point is RS14B012460 (d/s Mortarstown WWTP) located at Dolmen Mews, ≈1.0km downstream of the primary outfall. Details of the sampling monitoring point locations are shown in Table 7.

Table 4-1 - Water Quality Sampling Point Details

Upstream Sampling Point				Downstream Sampling Point		
Station ID	RS14B012310			RS14B012460		
Station Name	u/s Mortarstown WWTP			d/s Mortarstown WWTP		
Irish Grid Reference	271637, 176643			270576, 174121		
Substance	Ammonia	BOD	PO4	Ammonia	BOD	PO4
Number of Samples	43	43	43	42	43	43
Date of First Sample	08/01/2020					
Date of Last Sample	14/02/2024					

4.2 River Quality Timeseries

The timeseries of ammonia sampling data at the two sampling points is shown in Figure 4-1. In general, the data shows a consistent ambient concentration of ammonia, with the downstream concentrations being usually slightly higher. Two high concentration values were observed in 2023. There are no obvious trends in the river quality data which would make data from a specific period of time unrepresentative of current conditions, so the entire period of record is suitable for the calculation of water quality statistics in the River Barrow.

Comparing the ammonia concentration at the upstream monitoring point RS14B012310 with the mean river flow recorded at the New Barrow Bridge gauge shows a weak correlation between upstream river flow and the u/s ambient Ammonia quality ($R^2 = 0.117$).



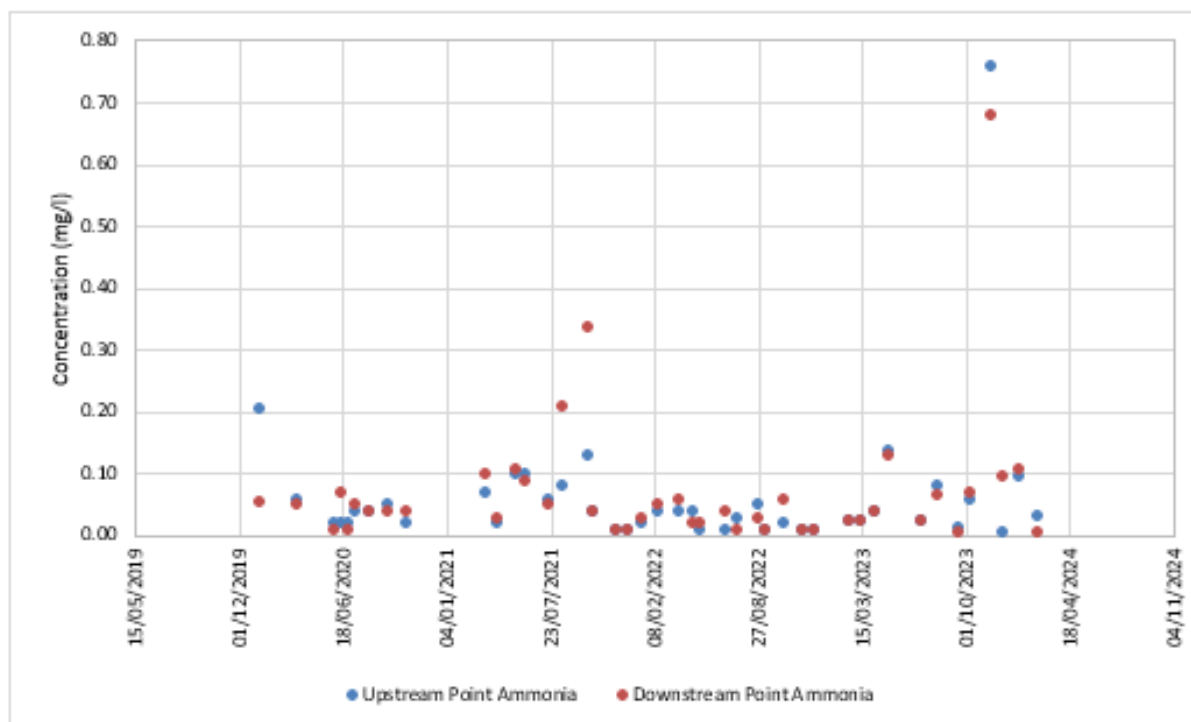


Figure 4-1 - Ammonia Monitoring Data for the River Barrow at Mortarstown WWTP

The timeseries of BOD sampling data at the two monitoring points is shown in Figure 4-2. There is generally limited difference in BOD concentration between the two sampling points, with upstream concentrations either slightly higher or slightly lower than at the downstream location. It is noted that the data shows elevated levels of BOD in 2022 for both upstream and downstream locations, which make the 2022 period less representative of current conditions. In line with typical water quality statistical analyses, values at or below LOD levels have been replaced with proxy values of 50% of the LOD when calculating statistical metrics. The limit of detection is higher than the mean EQS for BOD in rivers so mean BOD concentrations may be overestimated at Mortarstown relative to the EQS. This is not expected to impact significantly on the 95%ile river concentration.

Comparing the BOD concentration at the upstream monitoring point RS14B012310 with the mean river flow recorded at the New Barrow Bridge gauge shows no correlation between upstream river flow and the u/s ambient BOD quality ($R^2 = 0.021$).

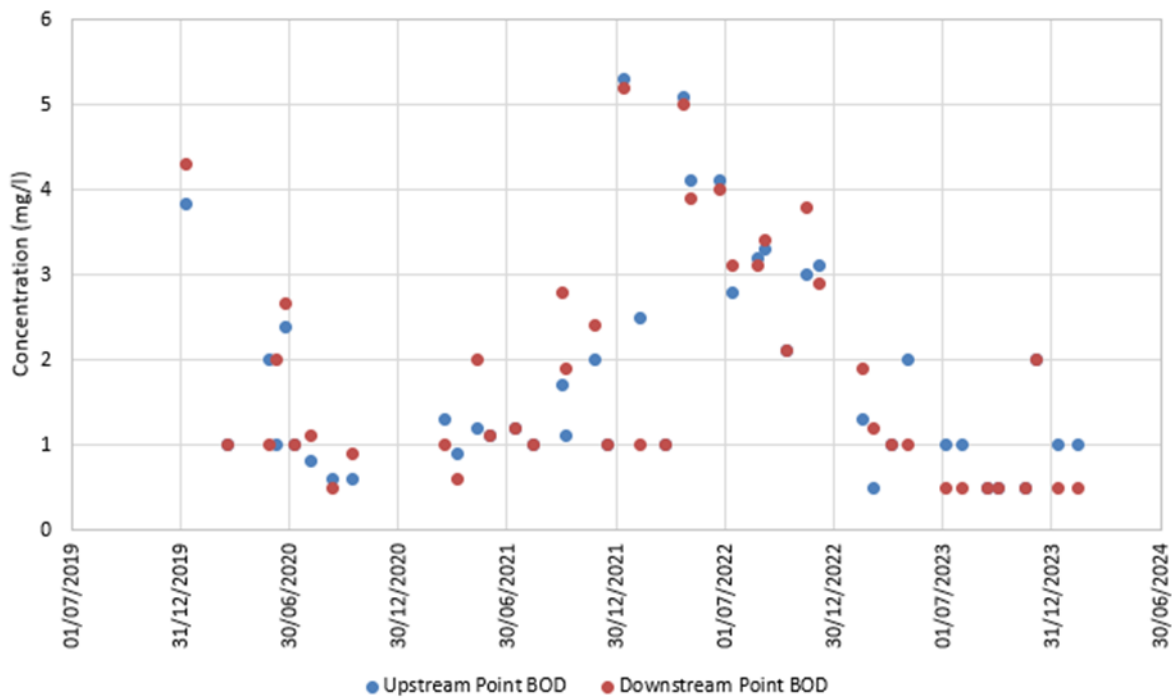


Figure 4-2 - BOD Monitoring Data for the River Barrow at Mortarstown WWTP

The timeseries of orthophosphate sampling data at the two sampling points is shown in Figure 4-3. In general, the data shows a consistent ambient concentration of orthophosphate with little difference between upstream or downstream concentrations. Two higher downstream concentration values were observed in period 2023. There are no obvious trends in the river quality data which would make data from a specific period of time unrepresentative of current conditions, so the entire period of record is suitable for the calculation of water quality statistics in the River Barrow. Comparing the river orthophosphate concentration at the upstream monitoring point RS14B012310 with the mean river flow recorded at the New Barrow Bridge gauge shows a weak correlation between upstream river flow and the u/s ambient river orthophosphate quality ($R^2 = 0.122$).

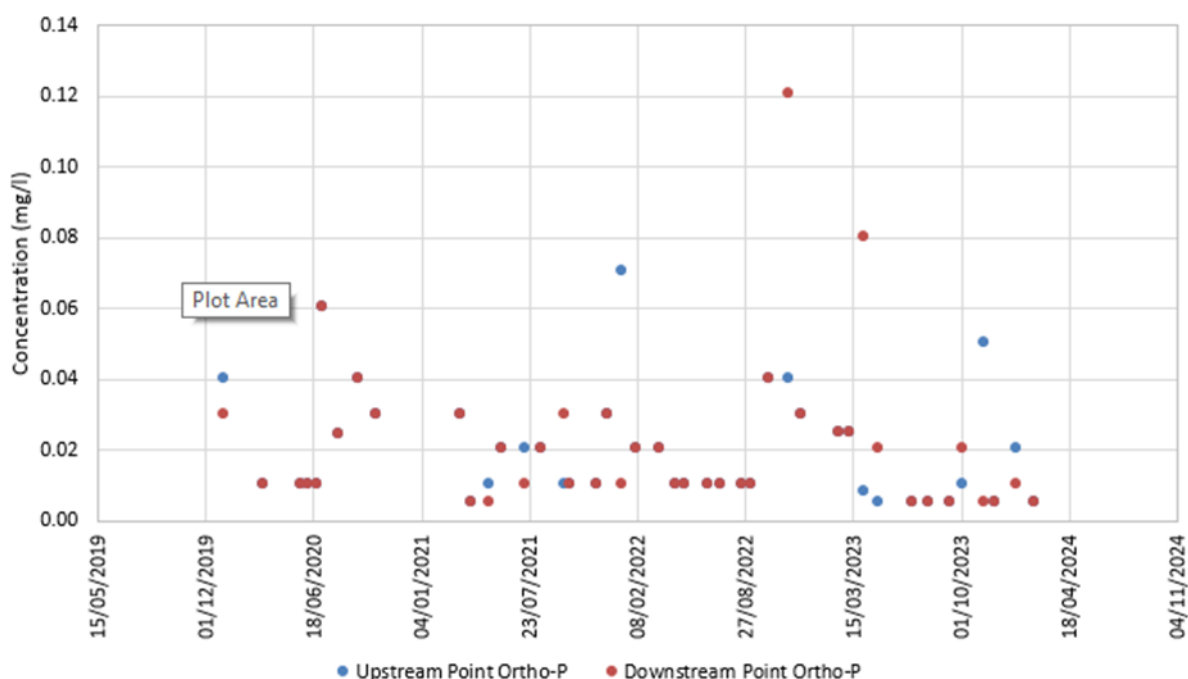


Figure 4-3 - Orthophosphate Monitoring Data for the River Barrow at Mortarstown WWTP

4.3 Ambient Water Quality Data

Table 4-2 sets out the overall water quality statistics for the River Barrow upstream and downstream of Mortarstown WWTP discharge point. Statistics are provided for mean and 95%ile quality for comparison with EQS under the Surface Water Regulations. Values which comply with requirements for high indicative quality are highlighted in blue, values which comply with requirements for good indicative quality are highlighted in green and values which exceed the good status EQS are highlighted in orange.

The difference in water quality statistic values between the upstream and downstream monitoring points at Mortarstown WWTP is generally small.

The EQS for good status for ammonia is within the top 25% of the Good indicative quality band, see Figure 2-1 at the upstream location and is exceeded for both the mean and 95%ile condition at the downstream location.

The EQS for good status for BOD is exceeded for both the mean and 95%ile condition at both the upstream and downstream locations. An analysis of the ambient BOD concentrations excluding the elevated trend in 2022 identified that the BOD EQS for good status for BOD is exceeded for both the mean and 95%ile condition.

The mean EQS for high quality for orthophosphate is maintained at both locations and the 95%ile EQS for good indicative quality for orthophosphate is also maintained at both locations.



Table 4-2 - Water Quality Sampling Point Statistics

Substance	RS14B012310 (Upstream)		RS14B012460 (Downstream)	
	Mean	95%ile	Mean	95%ile
Ammonia (mg/l)	0.063	0.139	0.069	0.202
BOD (mg/l)	1.805	4.100	1.827	4.279
Orthophosphate (mg/l)	0.020	0.049	0.021	0.058

Since the mean and/or the 95%ile EQS concentration for good status is within the top 25% of the good indicative quality band, see Figure 2-1. and is exceeded at the downstream location for ammonia, ELVs cannot be set for effluent from the upgraded Mortarstown WWTP which would secure compliance with good status at the downstream point. This is due to upstream catchment pressures on water quality. As a result, the proposed ELV for ammonia is calculated with reference to the notionally clean condition as described in Section 2.4.

Since the mean and/or the 95%ile EQS concentration for good status is exceeded at the upstream location for BOD, ELVs cannot be set for effluent from the upgraded Mortarstown WWTP which would secure compliance with good status at the downstream point. This is due to upstream catchment pressures on water quality. As a result, the proposed ELV for BOD is calculated with reference to the notionally clean condition as described in Section 2.4.



5. Mortarstown WWTP Effluent Flow and Quality Data

5.1 Effluent Flow Data

Figure 5-1 shows the daily flow rate data for Mortarstown WWTP from January 2020 to April 2023. The observed mean effluent flow is 12,700m³/d (0.147m³/s).

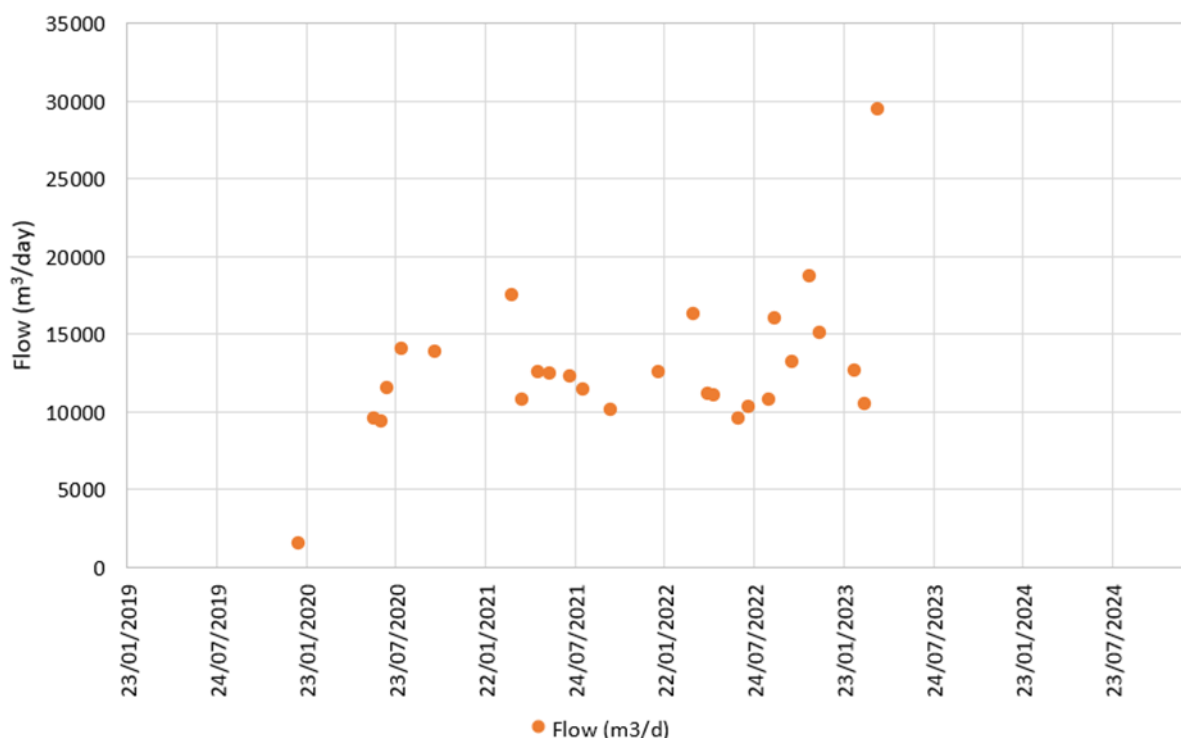


Figure 5-1 - Mortarstown WWTP Effluent Flow Timeseries

Flows at the New Bridge Barrow OPW gauge station were compared with the WWTP Effluent flow data and a weak positive correlation between the two data states was identified ($R^2 = 0.354$). The correlation between river and effluent flow is likely due to rainwater and groundwater ingress into the Carlow sewerage system during times of wet weather, with the weakness in the correlation may be due to the existing upstream storm overflows at the Kilkenny Road Pump Station and the different rainfall response times of the Barrow River Catchment and the Carlow Town sewer catchment network. It is proposed that this weak correlation is not considered in the water quality impact assessment because the upgrade involves the installation of new stormwater storage tanks at the WWTP, which will generally decouple the effluent flow rates and the river flow rates.

The upgraded Mortarstown WWTP has been designed to allow for growth in the agglomeration, with a commensurate increase in effluent flow rates. The design horizon includes a projected increase in population served by the WWTP from the current population equivalent of 39,270 to a population of 58,500 over the next 25 years. Table 9 presents the current dry weather (Q_{80}) effluent flow and anticipated future dry weather (Q_{80}) effluent flow. The mean flow anticipated under this scenario are also given for comparison; these flows were calculated by



applying the PE flow scaling factor to the observed effluent flow dataset. The WWTP Design Flowrates have been calculated on the basis 1.25 x DWF with a unit flow of 225L/PE/day.

Table 5-1 - Current and Future Design Effluent Flow Rates

Design Horizon	Current		25-year	
PE Served	39,270		58,500	
Flow Increase Factor	1.00		1.48	
Effluent Flow Rates	m ³ /d	m ³ /s	m ³ /d	m ³ /s
Current Observed Dry Weather Flow (Q80)	10,368	0.120		
Predicted Future Dry Weather Flow (Q80)			15,344	0.177
Current Observed Mean Flow	12,700	0.147		
Future Design Flow (1.25 x DWF)			16,416	0.190

5.2 Effluent Quality

Figure 5-2, Figure 5-3, and Figure 5-4, show the observed effluent quality data in terms of ammonia, BOD and orthophosphate concentration. As noted in Section 4.2, in line with typical water quality statistical analyses, values at or below LOD levels have been replaced with proxy values of 50% of the LOD when calculating statistical metrics. The effluent data shows compliance with the current ammonia ELV with over 85% of the samples having an Ammonia concentration less than 0.2mg/l. The effluent data shows compliance with the current BOD ELV with over 97% of the samples having a BOD concentration less than or equal to 6 mg/l. The effluent data shows compliance with the current orthophosphate ELV with over 93% of the samples having an orthophosphate concentration less than or equal to 0.5 mg/l.

Table 10 compares the average effluent concentration of substances limited by ELVs in Section 2.1.1 against observed 2020-2024 averages. Mortarstown WWTP complied with the relevant ELVs during this time period. There are weak correlations between effluent flow rate and effluent concentrations of ammonia ($R^2=0.168$) and orthophosphate concentrations ($R^2=0.160$) and no correlation for BOD ($R^2 = 0.023$) showing that the current WWTP functions well under the observed range of effluent flow conditions.



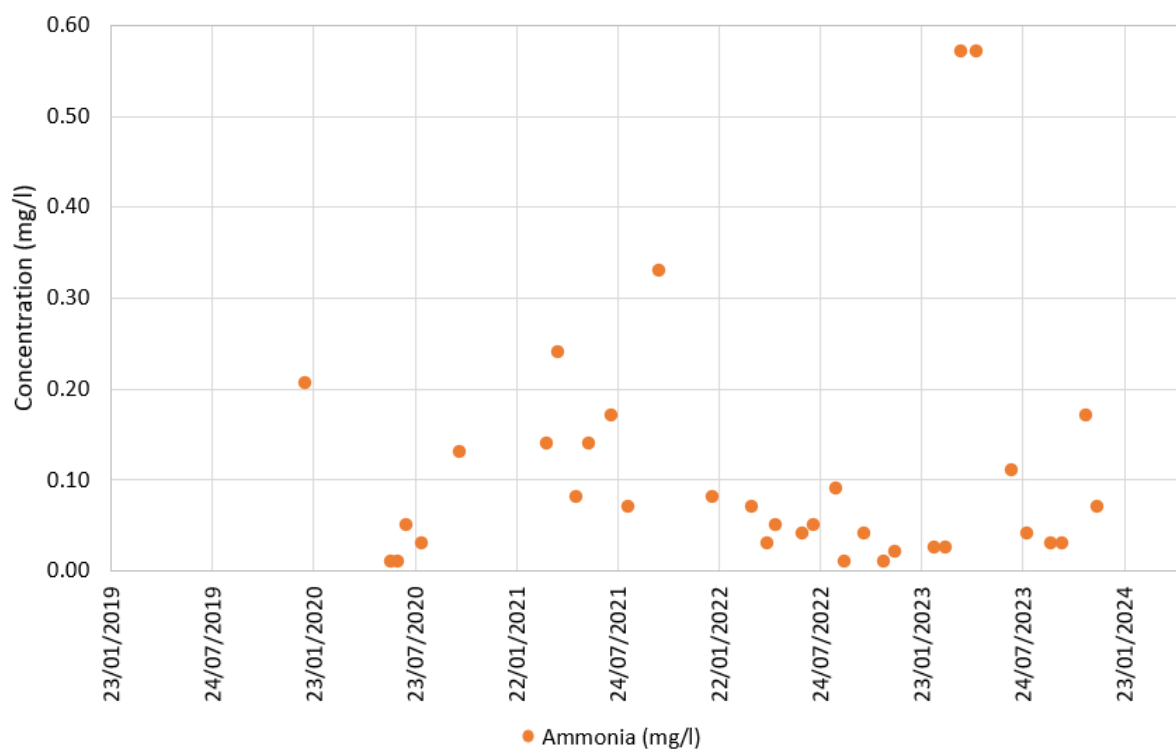


Figure 5-2 - Mortarstown WWTP Effluent Ammonia Concentrations

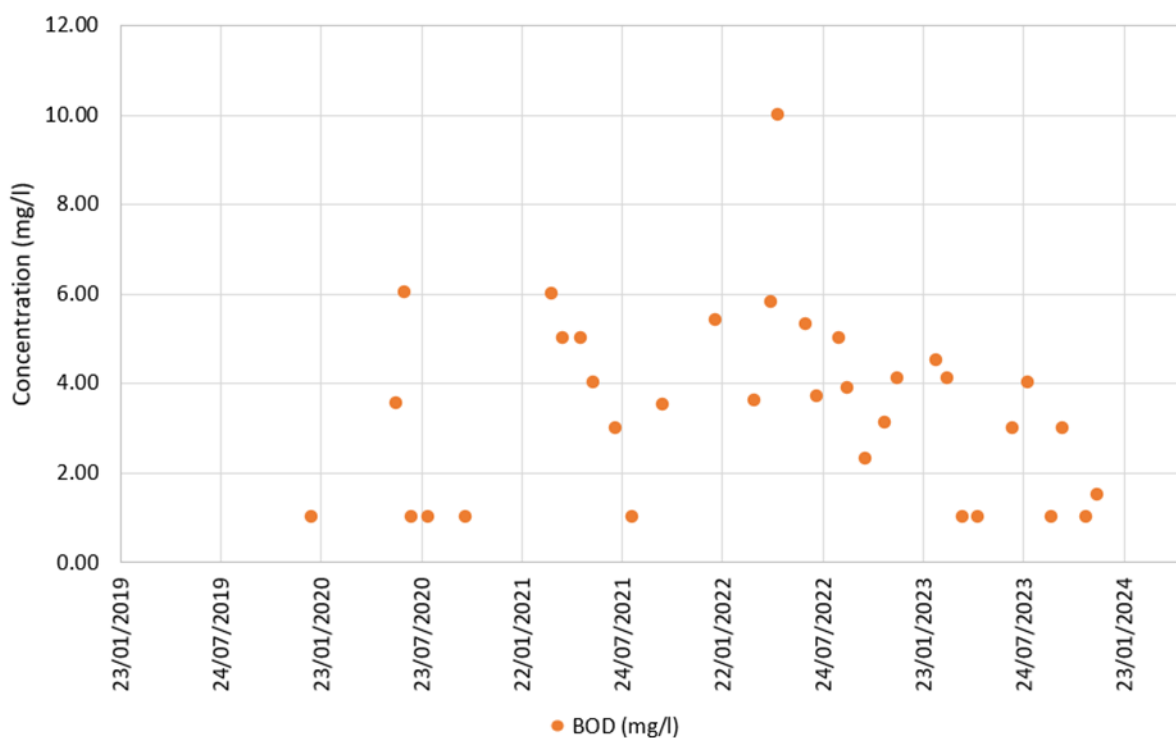


Figure 5-3 - Mortarstown WWTP Effluent BOD Concentrations



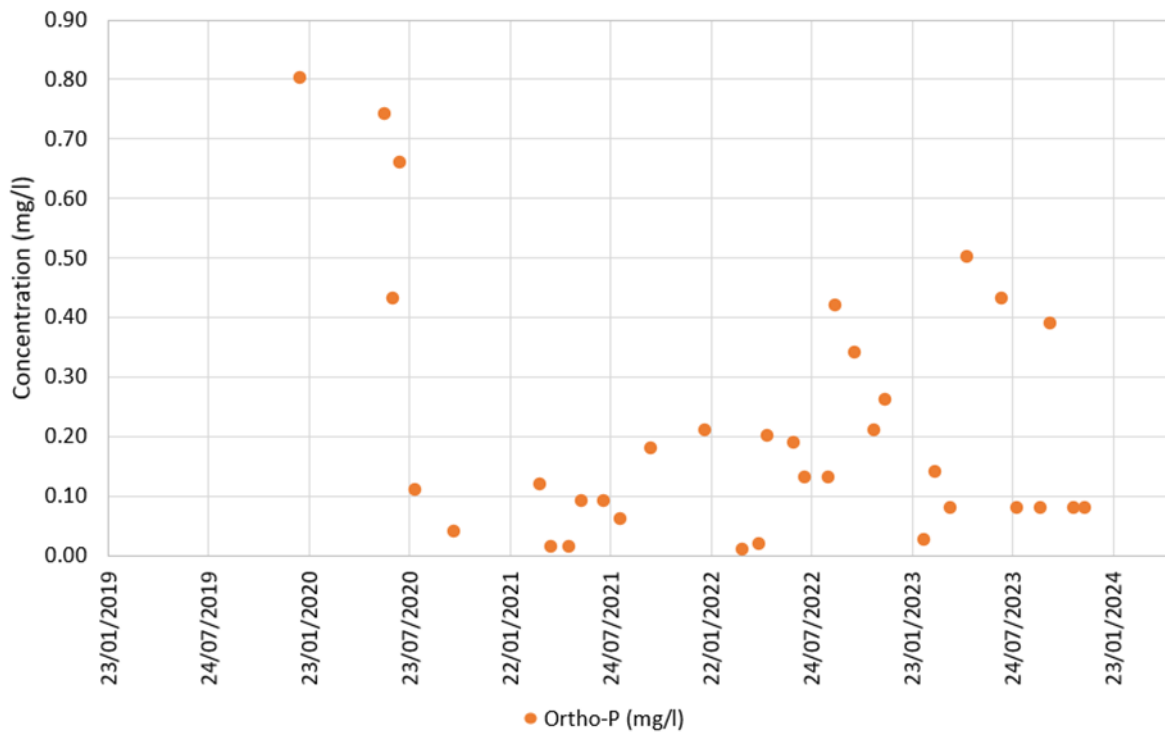


Figure 5-4 - Mortarstown WWTP Effluent Orthophosphate Concentrations

Table 5-2 - Comparison Between Mortarstown WWTP ELVs and Monitored Effluent Quality

Parameter	UWWTD Maximum Permitted Value	Current Mortarstown WWTP ELV	2020-2024 Mortarstown WWTP Treated Effluent Mean
COD (mg/l)	125	125	-
BOD (mg/l)	25	15	3.45
Suspended Solids (mg/l)	35	35	-
pH	--	6 to 9	-
Ammonia (mg/l)	--	2.0	0.11
Orthophosphate (mg/l)	--	0.8	0.216
Total Phosphorus (mg/l)	1.00	1.00	-



6. Water Quality Impact Assessment

The Tiered Assessment approach outlined in Section 1.1 has been applied to the Mortarstown WWTP discharge in the Sections below.

6.1 Tier 0 and 1 Assessments

The Tier 0 and 1 Assessments are initial screening checks to identify substances which require impact assessment. The stages are as follows:

- **Tier 0:** check to see if the effluent is likely to contain a contaminant of concern. If so, check to see if the contaminant is present at levels above the EQS.
- **Tier 1:** Check to see if discharging the contaminant(s) of concern at levels above the EQS are likely to have a significant impact on the receiving waterbody given existing ambient concentrations.

Based on review of the legislative framework in Section 2, substances of concern in Mortarstown WWTP final treated effluent are ammonia, BOD and orthophosphate. Table 6-2 compares average effluent, ambient and EQS concentrations of the substances of concern.

Table 6-1 - Effluent, Ambient and EQS Concentrations of Substances of Concern

Parameter	Mean WWTP Monitored Effluent Concentration	u/s Mean Ambient Concentration (RS14B012310)	Environmental Quality Standard
Ammonia (mg/l)	0.11	0.063	0.065
BOD (mg/l)	3.45	1.805	1.50
Orthophosphate (mg/l)	0.216	0.020	0.035

Table 6-1 shows that effluent concentrations at the existing Mortarstown WWTP for ammonia, orthophosphate and BOD exceed both ambient and EQS concentrations. This will continue at the upgraded WWTP and so these substances will require additional assessment at Tier 2. The pH of the effluent is, and will remain, within the permitted EQS range for rivers and this parameter is therefore screened out at Tier 1.

6.2 Tier 2a Assessment

An initial assessment of the downstream water quality impacts of the Mortarstown WWTP discharge has been made using the simple mass balance approach as set out in Section 1.1.1. Following the methodology of the Uisce Éireann Mass Balance Tool UÉ-AMT-FM-007 downstream mean and 95%ile water quality are predicted based on mean upstream river quality, current mean effluent flow rates and current mean effluent concentrations. The difference between the two calculations is the use of Q_{30} average river flows to predict mean downstream water quality and the Q_{95} low river flow to predict 95%ile downstream water quality. The predicted water quality is compared with observed values in Table 6-2.



Table 6-2 - Downstream Water Quality Statistics predicted using Simple Mass Balance Approach

Parameter	Statistic	Upstream Observed	Downstream Predicted	Downstream Observed
Ammonia (mg/l)	Mean	0.063	0.063	0.069
	95%ile	0.139	0.064	0.202
BOD (mg/l)	Mean	1.805	1.81	1.827
	95%ile	4.100	1.83	4.279
Orthophosphate (mg/l)	Mean	0.020	0.021	0.021
	95%ile	0.049	0.024	0.058

As the ammonia WAC calculations and the BOD WAC calculations are undertaken on the basis of a Notionally Clean approach, the comparison of the downstream predicted concentrations (from the simple Mass Balance WAC Analysis sheet) for ammonia and BOD with the observed data in Table 6-2 is not applicable.

The results in Table 6-2 show that the simple mass balance approach results in a reasonable estimate of the downstream mean water quality for orthophosphate but underestimates the downstream 95%ile water quality for orthophosphate. This is because this approach adopts a simplified representation of upstream river water quality which is the controlling influence on downstream water quality at Mortarstown. As discussed in Section 4, the observed data indicates that the discharges from Mortarstown WWTP have limited impact on downstream water quality under the current scenario.

The simple mass balance approach can be used to calculate ELVs which would give a required downstream water quality corresponding to take-up of the intended percentage of the watercourse's wastewater assimilative capacity (Section 2.4) taking account of the future increases in flow as detailed in Section 5.1. Table 6-3 gives the ELVs required to deliver good indicative quality downstream of the existing discharge point, based on notionally clean upstream water quality (for ammonia and BOD) and using 30% of the available WAC.

Table 6-3 - Required ELVs calculated using Simple Mass Balance Approach

Parameter	Required ELV (Simple Mass Balance Approach), 25-year Design Horizon
Ammonia (mg/l)	2.4
BOD (mg/l)	42.5
Orthophosphate (mg/l)	1.0

The ELVs calculated using the simple mass balance approach are achievable based on biological treatment with nitrification in a WWTP configuration similar to the current WWTP configuration and therefore a Monte Carlo (Tier 2b) analysis is not required Tier 2b Assessment.



6.2.1 Recommended ELVs

Recommended ELVs calculated on the basis of the simple mass balance approach, the UWWTD and the existing Discharge Licence are set out in Table 6-4 below. The calculation is carried out using effluent flows which have been increased by a 30% proportional increase in the dry weather capacity of the WWTP to reflect the increased 25-year design loading. The recommended ELVs are achievable using the existing treatment technology which is a cost-effective and proportionate approach to wastewater management while still providing the required protection of receiving water quality.

Table 6-4 – Recommended ELVs for Mortarstown WWTP

Parameter	ELV
Ammonia	2.0 (in line with the current Discharge Licence)
BOD	25 (in line with UWWTD)
Ortho-P	1.0

The Tier 2 assessment methods show that achievable ELVs can be applied to the discharge and sensitive receptors will not be impacted. Additional analysis of the mixing zone, as would be required in Tier 3 assessment is therefore not required.

7. Summary and Conclusions

Mortarstown WWTP discharges treated wastewater to the River Barrow, 2.2km south of Carlow Town. It is proposed to upgrade the WWTP to increase the treatment capacity of the WWTP; replace equipment and controls nearing the end of their working design life and address deficiencies related to stormwater storage volumes and shallow walled final settlement tanks.

A water quality impact assessment has been carried out in accordance with Uisce Éireann's Technical Guidance⁷ to determine the current water quality impacts of the discharge and to calculate the required ELVs for the upgraded WWTP which will protect the environment from future deterioration in water quality under future loading scenarios, recognising the requirements of the legislative framework.

The water quality of the River Barrow upstream of the WWTP currently fails to comply with good status requirements with respect to BOD and is on the limit with respect to good status requirement for ammonia, therefore the "notionally clean" approach has been applied to BOD and ammonia to account for upstream pressures on water quality and to allow an assessment of the impacts of the WWTP discharges in accordance with the 'Polluter Pays' principle of the Water Framework Directive and in line with current licensing approaches under the WWDA regulations.

The Water Quality Impact Assessment utilised a tiered approach with initial screening at Tiers 0 and 1 followed by a Tier 2a assessment.

⁷ Interim Technical Guidance for Water Impact Assessments (Freshwater) Document No. AMT-GL-028).



The simple mass balance approach was used to calculate ELVs which take an appropriate percentage of the available assimilative capacity in the river, given upstream water quality and the sensitivity of the receiving environment. The calculation is carried out using effluent flows which have been specified to represent the future design capacity of the WWTP. The recommended ELVs calculated using the simple mass balance approach are shown in Table 7-1.

The ELVs determined using the simple mass balance method can be achieved using conventional WWTP technology. It is noted that the ELV for BOD is identified at 25mg/l as per the requirements of the UWWTD.

Table 7-1 – Recommended ELVs for Mortarstown WWTP

Parameter	Recommended Mortarstown WWTP ELVs (mg/l)
Ammonia	2.0 (in line with the current Discharge Licence)
BOD	25 (as per UWWTD)
Ortho-P	1.0



APPENDICES

Appendix A. Annual River Flow Statistics

Annual River Flow Statistics for the River Barrow at OPW New Bridge Barrow Guage Station

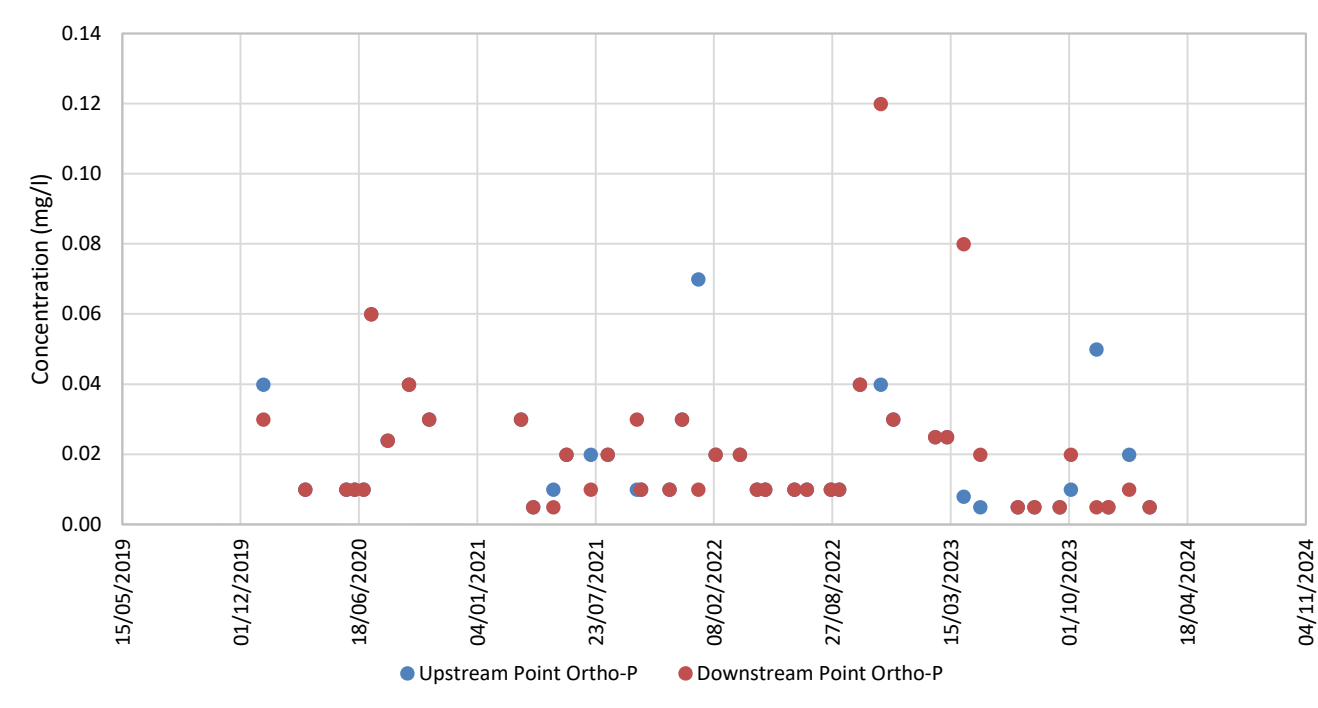
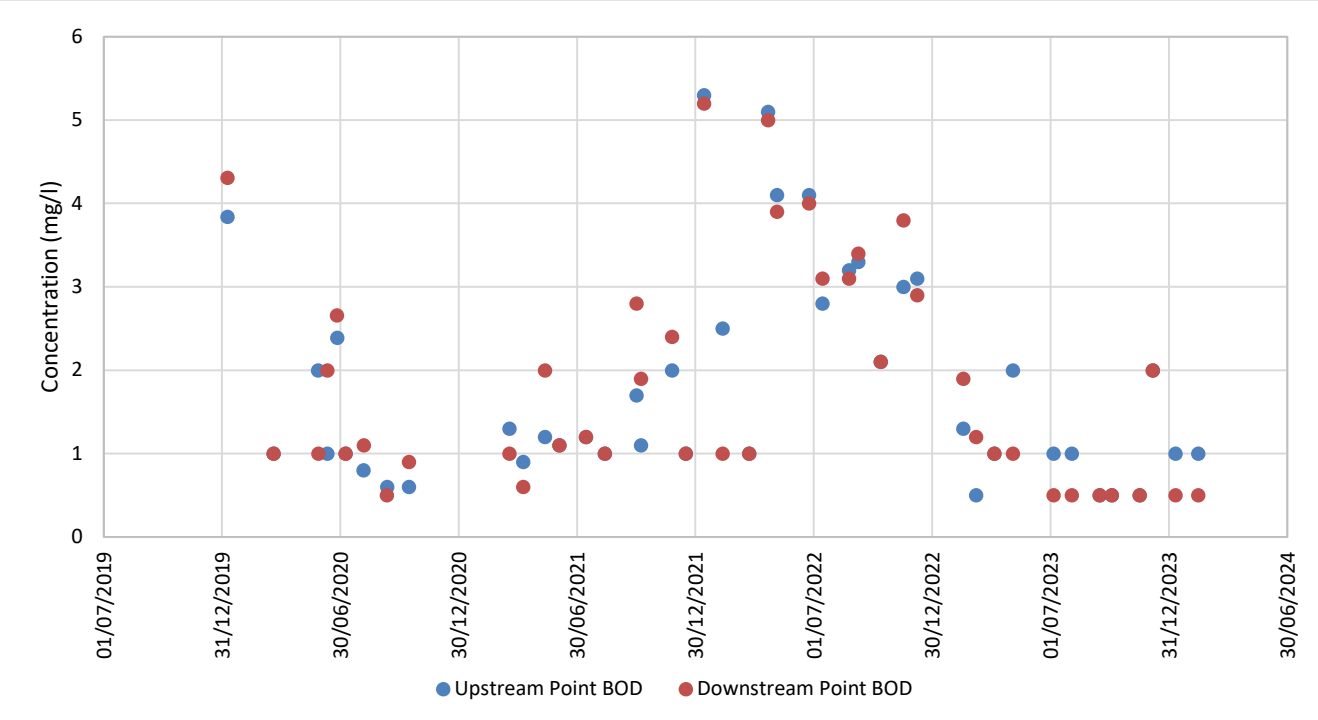
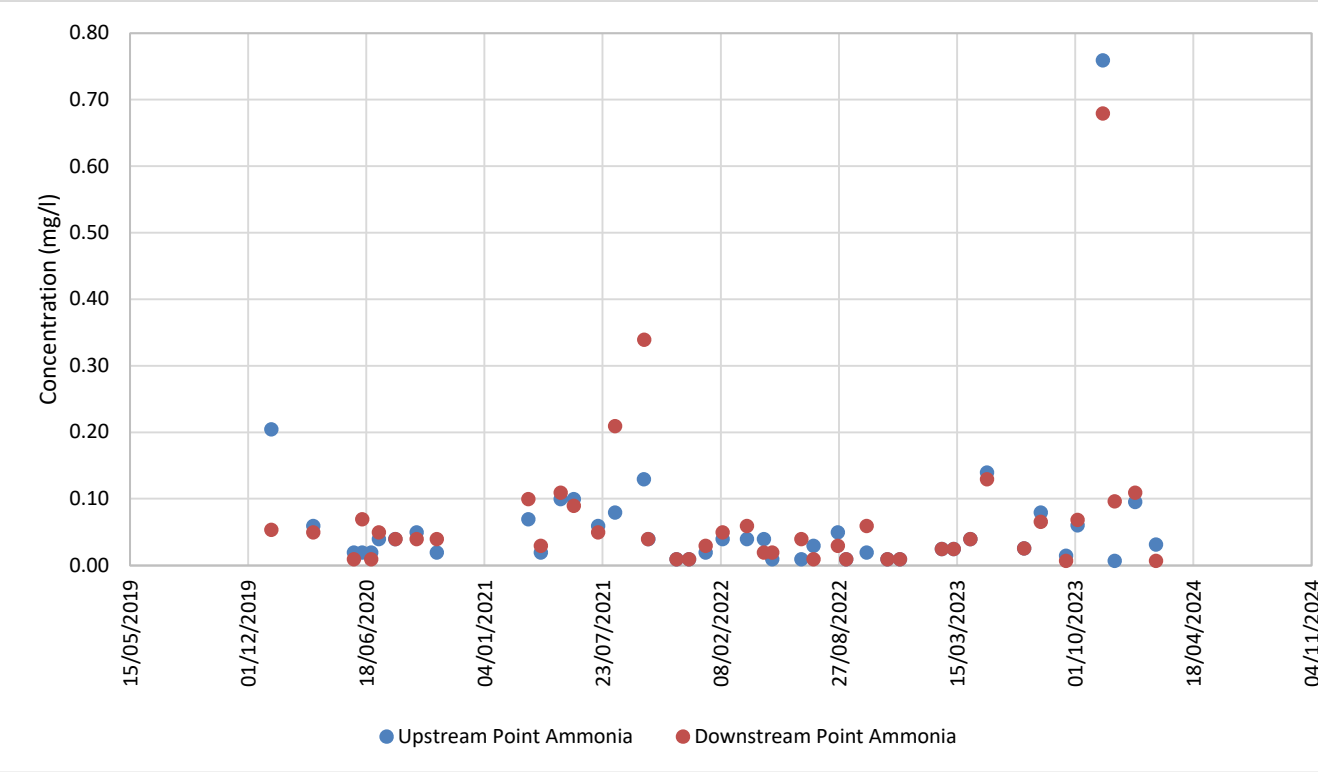
Year	Flow (m ³ /s)												
	Max	Min	Q ₅	Q ₁₀	Q ₂₀	Q ₃₀	Q ₄₀	Q ₅₀	Q ₆₀	Q ₇₀	Q ₈₀	Q ₉₀	Q ₉₅
2007	109.4	11.8	67.5	49.5	31.6	22.9	18.2	16.4	15.4	14.2	13.3	12.8	12.5
2008	157.0	8.1	105.9	77.6	56.0	46.8	39.4	33.4	28.3	24.3	19.6	13.7	11.9
2009	189.1	13.2	122.2	85.0	52.1	39.7	31.8	27.6	24.8	22.4	20.4	18.2	17.4
2010	133.5	7.9	75.5	62.8	37.7	30.0	24.9	21.8	18.5	15.5	12.9	11.4	9.9
2011	139.9	8.3	68.4	51.0	36.8	28.2	22.5	17.4	13.6	12.6	11.8	11.0	10.4
2012	107.0	12.6	79.2	62.5	45.5	38.9	33.6	28.5	25.9	22.0	18.9	16.1	14.3
2013	138.5	6.4	64.0	48.6	33.0	24.8	22.1	18.4	14.1	11.1	9.8	8.9	8.1
2014	176.6	7.5	107.7	80.1	62.6	52.9	38.7	29.7	25.2	16.5	12.8	10.3	8.2
2015	196.7	3.7	110.5	70.1	45.1	33.0	25.4	19.8	15.8	11.0	9.7	8.9	8.5
2016	192.9	8.3	96.5	63.8	40.9	26.9	19.7	16.5	14.2	12.4	11.0	10.2	9.2
2017	113.6	7.2	64.6	46.7	31.8	24.4	20.2	16.3	14.3	12.3	11.0	9.5	8.5
2018	133.0	6.7	76.7	64.7	48.4	38.2	26.9	17.8	11.1	9.0	8.2	7.8	7.5
2019	106.8	6.1	74.1	64.2	44.1	32.3	25.7	23.2	19.7	15.5	12.3	9.5	8.5
2020	147.8	10.1	110.6	66.3	50.0	36.9	29.5	24.9	19.1	15.4	13.4	12.1	11.5
2021	134.5	7.5	97.2	65.6	40.2	27.5	22.0	17.1	15.1	12.8	11.2	9.9	8.8
2022	112.7	8.7	87.1	70.8	55.3	40.2	24.1	26.7	21.5	19.5	16.1	12.6	11.4
2023	136.0	11.3	94.4	68.4	53.2	42.0	32.6	31.5	26.3	22.4	17.7	13.6	12.6
2024	128.0	8.5	83.6	64.0	53.2	43.9	37.0	26.7	18.7	13.4	11.9	11.2	10.9
OPW 07-24			85.4	65.3				22.6				10.0	8.8



Appendix B. Mass Balance Calculation Spreadsheet



OBSERVED DATA									
UPSTREAM POINT					DOWNSTREAM POINT				
Date	Ammonia (mg/l)	Date	BOD (mg/l)	Ortho-P (mg/l)	Date	Ammonia (mg/l)	Date	BOD (mg/l)	Ortho-P (mg/l)
08/01/2020	0.21	08/01/2020	3.84	0.040	08/01/2020	0.054	08/01/2020	4.31	0.030
19/03/2020	0.06	19/03/2020	1.00	0.010	19/03/2020	0.050	19/03/2020	1.00	0.010
27/05/2020	0.02	27/05/2020	2.00	0.010	27/05/2020	0.010	27/05/2020	1.00	0.010
10/06/2020	0.02	10/06/2020	1.00	0.010	10/06/2020	0.070	10/06/2020	2.00	0.010
25/06/2020	0.02	25/06/2020	2.39	0.010	25/06/2020	0.010	25/06/2020	2.66	0.010
08/07/2020	0.04	08/07/2020	1.00	0.060	08/07/2020	0.050	08/07/2020	1.00	0.06
05/08/2020	0.04	05/08/2020	0.80	0.024	05/08/2020	0.040	05/08/2020	1.10	0.024
10/09/2020	0.05	10/09/2020	0.60	0.040	10/09/2020	0.040	10/09/2020	0.50	0.04
14/10/2020	0.02	14/10/2020	0.60	0.030	14/10/2020	0.040	14/10/2020	0.90	0.03
18/03/2021	0.07	18/03/2021	1.30	0.030	18/03/2021	0.100	18/03/2021	1.00	0.03
08/04/2021	0.02	08/04/2021	0.90	0.005	08/04/2021	0.030	08/04/2021	0.60	0.005
12/05/2021	0.1	12/05/2021	1.20	0.010	12/05/2021	0.110	12/05/2021	2.00	0.005
03/06/2021	0.1	03/06/2021	1.10	0.020	03/06/2021	0.090	03/06/2021	1.10	0.02
14/07/2021	0.06	14/07/2021	1.20	0.020	14/07/2021	0.050	14/07/2021	1.20	0.01
12/08/2021	0.08	12/08/2021	1.00	0.020	12/08/2021	0.210	12/08/2021	1.00	0.02
30/09/2021	0.13	30/09/2021	1.70	0.010	30/09/2021	0.340	30/09/2021	2.80	0.03
07/10/2021	0.04	07/10/2021	1.10	0.010	07/10/2021	0.040	07/10/2021	1.90	0.01
24/11/2021	0.010	24/11/2021	2.000	0.01	24/11/2021	0.010	24/11/2021	2.40	0.010
15/12/2021	0.010	15/12/2021	1.000	0.03	15/12/2021	0.010	15/12/2021	1.00	0.03
12/01/2022	0.02	12/01/2022	5.300	0.07	12/01/2022	0.030	12/01/2022	5.20	0.010
10/02/2022	0.04	10/02/2022	2.500	0.02	10/02/2022	0.050	10/02/2022	1.00	0.02
23/03/2022	0.04	23/03/2022	1.000	0.02	23/03/2022	0.060	23/03/2022	1.00	0.02
21/04/2022	0.04	21/04/2022	5.100	0.01	21/04/2022	0.020	21/04/2022	5.00	0.010
05/05/2022	0.010	05/05/2022	4.100	0.01	05/05/2022	0.020	05/05/2022	3.90	0.010
23/06/2022	0.010	23/06/2022	4.100	0.01	23/06/2022	0.040	23/06/2022	4.00	0.010
14/07/2022	0.03	14/07/2022	2.800	0.01	14/07/2022	0.010	14/07/2022	3.10	0.010
24/08/2022	0.05	24/08/2022	3.200	0.01	24/08/2022	0.030	24/08/2022	3.10	0.010
07/09/2022	0.010	07/09/2022	3.300	0.01	07/09/2022	0.010	07/09/2022	3.40	0.010
12/10/2022	0.02	12/10/2022	2.100	0.04	12/10/2022	0.060	12/10/2022	2.10	0.04
16/11/2022	0.010	16/11/2022	3.000	0.04	16/11/2022	0.010	16/11/2022	3.80	0.12
07/12/2022	0.010	07/12/2022	3.100	0.03	07/12/2022	0.010	07/12/2022	2.90	0.03
16/02/2023	0.025	16/02/2023	1.300	0.03	16/02/2023	0.025	16/02/2023	1.90	0.025
08/03/2023	0.025	08/03/2023	0.500	0.03	08/03/2023	0.025	08/03/2023	1.20	0.025
05/04/2023	0.040	05/04/2023	1.000	0.01	05/04/2023	0.040	05/04/2023	1.00	0.080
04/05/2023	0.140	04/05/2023	2.00	0.005	04/05/2023	0.130	04/05/2023	1.00	0.020
06/07/2023	0.026	06/07/2023	1.00	0.005	06/07/2023	0.026	06/07/2023	0.50	0.005
03/08/2023	0.080	03/08/2023	1.00	0.005	03/08/2023	0.066	03/08/2023	0.50	0.005
15/09/2023	0.015	15/09/2023	0.50	0.005	15/09/2023	0.008	15/09/2023	0.50	0.005
04/10/2023	0.061	04/10/2023	0.50	0.010	04/10/2023	0.069	04/10/2023	0.50	0.020
16/11/2023	0.760	16/11/2023	0.50	0.050	16/11/2023	0.680	16/11/2023	0.50	0.005
06/12/2023	0.008	06/12/2023	2.00	0.005	06/12/2023	0.097	06/12/2023	2.00	0.005
10/01/2024	0.096	10/01/2024	1.00	0.020	10/01/2024	0.110	10/01/2024	0.50	0.010
14/02/2024	0.032	14/02/2024	1.00	0.005	14/02/2024	0.008	14/02/2024	0.50	0.005



HYDROLOGY	
Percentile	Flow (m³/s)
0.1	212.862
5	92.445
10	70.643
15	61.133
20	51.720
25	42.065
30	38.627
35	35.057
40	31.594
45	28.024
50	24.441
55	22.506
60	20.450
65	18.394
70	16.555
75	14.404
80	13.200
85	12.118
90	10.852
95	9.513
99.9	7.790

Note: Q₃₀ and Q₉₅ required at minimum

Source of Flow Data
OPW Barrow New Bridge Hydrometric Station

Scaled by 8.2% based on
Catchment Area Analysis

Waste Assimilative Capacity (WAC) Calculation (Rivers)										0.083427083									
Site Information Licence codeD0028-01WWTP NameMortarstown WWTPEmission IDRiver BarrowRiver Waterbody CodeIE_SE_14_196EPA Waterbody NameRiver BarrowUpstream Quality PointRS14B012310Downstream Quality PointRS14B012460 WWTP Licence Details & Current WWTP Performance Current Ammonia ELV (mg/l)2Current BOD ELV (mg/l)15Current Ortho-P ELV (mg/l)0.8Current Effluent Mean Ammonia Concentration (mg/l)0.11Current Effluent Mean BOD Concentration (mg/l)3.452Current Effluent Mean Ortho-P Concentration (mg/l)0.216Current Average Effluent Flow (m³/s)0.147Current WWTP Hydraulic Capacity (m³/s)0.117Current Collected Load (PE)39,270Future Design Horizon (year)2052Future Design Capacity (PE)58,500Future Design Average Effluent Flow (m3/s)0.217 Summary of Required ELVs Ammonia2.4BOD42Ortho-P1.0										Summary Statistics EQS Values High Status EQS Good Status EQS Ammonia BOD Ortho-P Ammonia BOD Ortho-P Ammonia BOD Ortho-P									
River Flow Q₉₅ Flow (m³/s)9.513Average Flow (m³/s)38.627										Environmental Sensitivity Score Good Basis of Future WWTP Flow Calculations									
Target Downstream EQS Target Status Class Mean (mg/l)0.06595%ile (mg/l)0.14										Final EQS Proxy Value (Predicted Downstream Concentration) Mean (mg/l)0.02595%ile (mg/l)0.055									
Current Impact Calculation Design Year Population Equivalent Served by WWTP WWTP Average Effluent Flow Rate (m³/s) Predicted Downstream 95%ile Concentration (mg/l) Predicted Downstream Mean Concentration (mg/l) No. of Available Dilutions										Theoretical Current ELV Impact Calculation Design Year Population Equivalent Served by WWTP WWTP Design Flow Rate (m³/s) Predicted Downstream 95%ile Concentration (mg/l) Predicted Downstream Mean Concentration (mg/l) No. of Available Dilutions									
Required Effluent ELV Calculation Design Year Population Equivalent Served by WWTP WWTP Design Flow Rate (m³/s) Effluent ELV (mg/l) for 95%ile Condition Effluent ELV (mg/l) for Mean Condition No. of Available Dilutions										ELVs Required for Each Design Year Ammonia BOD Ortho-P									

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Appendix C. Design Calculations for the WwTP



MORTARSTOWN WWTP CALCULATION WORKSHEET						
A1. Influent Loading & Treated Effluent Requirements						
Population Equivalent Loading	Symbol	Value	Value	Units	Reference	Notes
Population Equivalent Loading		52,500	58,500	PE		
		10-yr Horizon	25-yr Horizon			
Flows						
Flow Per Person		225.0	225.0	l/person/day		
Dry Weather Flow (DWF)_Daily	Q _{DW,d}	11,812.5	13,162.5	m3/day	Flow per person x PE total	
Dry Weather Flow (DWF)_Hourly	Q _{DW,h}	492.2	548.4	m3/hr		
Dry Weather Flow (DWF)_l/s		136.7	152.3	l/s		
Flow to Full Treatment (FFT = 3xDWF)_Daily	Q _{WW,d}	35,437.5	39,487.5	m3/day		
Flow to Full Treatment (FFT = 3xDWF)_Hourly	Q _{WW,h}	1,476.6	1,645.3	m3/hr		
Flow to Full Treatment (FFT = 3xDWF)_l/s		410.2	457.0	l/s		
Peak Design Flow_Daily		80,690.0	90,200.0	m3/day	Refer to additional Formula A calculation	
Peak Design Flow_Hourly		3,362.1	3,758.3	m3/hr		
Peak Design Flow_l/s		933.9	1,044.0	l/s		
Plant Design Flow Rate		14,765.6	16,453.1	m3/day	DWF x 1.25	
		615.2	685.5	m3/hr		
		170.9	190.4	l/s		
Parameter Influent Loading - Raw Water						
BOD Concentration	C _{BOD,I}	229.08	229.08	mg/l	Measured Value from 2022 to Feb 2024 Sample Data	
BOD Daily Load	B _{d,BOD}	3,382.52	3,769.09	kg/day		
COD Concentration	C _{COD,I}	618.81	618.81	mg/l	Measured Value from 2022 to Feb 2024 Sample Data	
COD Daily Load	B _{d,COD}	9,137.08	10,181.32	kg/day		
TSS Concentration	C _{TSS,I}	330.77	330.77	mg/l	Measured Value from 2022 to Feb 2024 Sample Data	
TSS Daily Load	B _{d,TSS}	4,884.01	5,442.19	kg/day		
TN Concentration	C _{TN,I}	34.12	34.12	mg/l	Measured Value from 2022 to Feb 2024 Sample Data	
TN Daily Load	B _{d,TN}	503.84	561.42	kg/day		
NH3-N Concentration		23.41	23.41	mg/l	Measured Value from 2022 to Feb 2024 Sample Data	
NH3 Daily Load		345.62	385.12	kg/day		
TP Concentration	C _{TP,I}	8.05	8.05	mg/l	Measured Value from 2022 to Feb 2024 Sample Data	
TP Daily Load	B _{d,TP}	118.86	132.45	kg/day		
PO4 Concentration		3.39	3.39	mg/l	Measured Value from 2022 to Feb 2024 Sample Data	
PO4 Daily Load		50.08	55.80	kg/day		
COD/BOD Ratio		2.70	2.70		High Strength Wastewater	
BOD/TP Ratio		28.46	28.46		High Strength Wastewater	
BOD/TN Ratio		6.71	6.71		High Strength Wastewater	
COD/TP Ratio		76.87	76.87		Very High Strength Wastewater	
COD/TN Ratio		18.13	18.13		Very High Strength Wastewater	
NH3/TN Ratio		0.69	0.69			
PO4/TP Ratio		0.42	0.42			
Population Equivalent Parameter Loading						
BOD		57.8	64.4	g/person/day		
COD		156.2	174.0	g/person/day		
TSS		83.5	93.0	g/person/day		
TN		8.6	9.6	g/person/day		
TP		2.0	2.3	g/person/day		
Chosen Design Influent Loads						
BOD Daily Load		3,382.5	3,769.1	kg/day	Chosen based on a conservative approach	
COD Daily Load		9,137.1	9,422.7	kg/day	Chosen based on a conservative approach	
TSS Daily Load		4,884.0	5,442.2	kg/day	Chosen based on a conservative approach	
TN Daily Load		607.9	677.4	kg/day	The UE specification IW-TEC-700-99-04, Table 3 was used as a reference to calculate TN	
TP Daily Load		118.9	132.4	kg/day	Chosen based on a conservative approach	
Specified Final Effluent Quality:						
BOD Concentration	C _{BOD,EST}	15	15	mg/l	WWDL	
COD Concentration	C _{COD,EST}	125	125	mg/l	WWDL	
TSS Concentration	C _{TSS,EST}	35	35	mg/l	WWDL	
Ammonia Concentration	C _{NH3,EST}	2.00	2.00	mg/l	WWDL	
Total Phosphorous Concentration	C _{TP,EST}	1.00	1.00	mg/l	WWDL	
Orthophosphate Concentration	C _{PO4,EST}	0.80	0.80	mg/l	WWDL	
DIN (NH3 + Nitrate + Nitrite) Concentration	C _{DIN,EST}	13	13	mg/l		Not Specified in the Discharge Licence, DIN requirement selected based on TN of 15mg/l as specified by UWWTD and ELV for where discharge to sensitive river where PE greater than 50,000PE and ELV for Ammonia.
TIN (sum of nitrate & nitrite) Concentration	C _{TIN,EST}	11.00	11.00	mg/l		Not Specified in the Discharge Licence, TON requirement selected based on TN of 15mg/l as specified by UWWTD, where discharge to sensitive river where PE greater than 50,000PE
TN (sum of NH3 & TON & Organic) Concentration	C _{TN,EST}	14.00	14.00	mg/l		Not Specified in the Discharge Licence, TN requirement based on TN of 15mg/l selected in line with UWWTD, where discharge to sensitive river where PE greater than 10,000PE
Organic Nitrogen Concentration	C _{OrgN,EST}	1	1	mg/l		Not Specified, Typical final concentration for treated municipal effluent selected (2)

A2. Inlet Screen and Grit Chamber Capacity						
No. of screens at WWTP		1	1	No.		1 No. 6mm band screen (duty) and 1 No. rake bar screen (standby) in the inlet works and 1 No. screen in the storm screening building
Inlet Works Band Screen Hydraulic Capacity		320	320	l/s	The IW Process Optimisation Report identifies a design capacity of 245l/s.	Based on a design capacity of 245l/s the existing 6mm band screen has hydraulic capacity to service peak design flow (based on 3 x DWF) from a PE loading of ≈ 31,000.
Storm Screening Building Screen Hydraulic Capacity		1079	1079	l/s	The IW Process Optimisation Report identifies that Stormwater is pumped unscreened to the Stormwater Holding Tanks, with unscreened overflow from the stormwater tank to outfall.	
No. of Grit Removal Chambers at WWTP		1	1	No.		
Existing Grit Removal Chamber Type		Jeta Type	Jeta Type			
Existing Grit Removal Chamber Diameter		4.2	4.2	m		
Existing Grit Removal Chamber Hydraulic Capacity		670	670	l/s	By extrapolation of figures, based on Jones & Attwood Jeta Grit Trap Data Sheets.	
A3. Primary Settlement Tank						
Proposed Settlement Tank Type		Rectangular Tank	Rectangular Tank			
Minimum Hydraulic Retention Time		2	2	hours	Design Choice	
Maximum Hydraulic Loading Rate		1.25	1.25	m3/m2/hour	Design Choice	
Required Surface Area		1,181.25	1,316.25	m2	Based on receiving Full Flow to Treatment	
No. of Primary Settlement Tanks		4	4	No.	Design Choice	
Primary Settlement Tank Length		45.00	45.00	m	Design Choice	
Primary Settlement Tank Width		8.75	8.75	m	Design Choice	
Primary Settlemet Tank Depth		3.0	3.0	m	Design Choice	
Primary Settlement Tank Sloped Bottom Height		0.8	0.8	m	Design Choice	
Primary Settlemet Tank Length to Width Ratio		3.0	3.0		Preferred between 3:1 and 4:1	
Total Proposed Primary Settlement Tank Surface Area	^ST,EXISTING	1,575.00	1,575.00	m2		
Total Proposed Primary Settlement Tank Volume		5,355.00	5,355.00	m3		
Hydraulic Loading Rate at FFT		0.94	1.04	m3/m2/hour	Based on receiving Full Flow to Treatment	
Hydraulic Retention Time at FFT		3.63	3.25	hours	Based on receiving Full Flow to Treatment	
Hydraulic Loading Rate at FFT with 1 PST out of service		1.88	2.09	m3/m2/hour		
Parameter Influent Loading D/S of PST - Settled Water						
Solids Removal Efficiency		62.2	61.3	%	Calculated using Eq (5-45) from Metcalf & Eddy 5th Edition	
BOD Removal Efficiency		40.1	39.2	%	Calculated using Eq (5-45) from Metcalf & Eddy 5th Edition	
Nutrient Removal Efficiency		15	15	%	Assumed Design Choice	
BOD Daily Load	^d,BOD	2,027.52	2,292.78	kg/day	Calculated Wastewater Loads to the bioreactors	
BOD Concentration	^BOD,I	137.31	139.35	mg/l	Calculated Wastewater concentrations to the bioreactors	
COD Daily Load	^d,COD	5,476.87	6,193.41	kg/day		
COD Concentration	^COD,I	370.92	376.43	mg/l		
TSS Daily Load	^d,TSS	1,844.43	2,104.31	kg/day		
TSS Concentration	^TSS,I	124.91	127.90	mg/l		
TN Daily Load	^d,TN	516.71	575.76	kg/day		
TN Concentration	^TN,I	34.99	34.99	mg/l		
TP Daily Load	^d,TP	101.03	112.58	kg/day		
TP Concentration	^TP,I	6.84	6.84	mg/l		
COD/BOD Ratio		2.70	2.70			
Population Equivalent Polution Parameter Loadings after Primary Settling Tank						
BOD		38.62	39.19	g/person/day	Reverse Calculation to compare Settled Wastewater against the values in Table 1 of the ATV Standard	
COD		104.32	105.87	g/person/day		
TSS		35.13	35.97	g/person/day		
TN		9.84	9.84	g/person/day		
TP		1.92	1.92	g/person/day		

A3. Calculations based on ATV-DVWK-A 131 Standard						
Plant Type		Anaerobic - Anoxic - Aerobic (A2O Process)	Anaerobic - Anoxic - Aerobic (A2O Process)	Discharge Licence D0028-1 ELVs indicates that carbon needs to be removed to meet BOD/COD ELV and Nitrification required to achieve ammonia ELV. There is no ELV specified for Total Nitrogen, indicating that nitrates do not need to be removed, hence no need for denitrification. However the plant is designed on the basis of a Anaerobic-Anoxic-Aerobic or A2O process to meet discharge requirements of UWWTD for plant capacity greater than 10,000PE. The A2O process allows biological removal of Nitrogen and Phosphorous, which in conjunction with Ferric Dosing ensures the ELV for phosphorous discharge are achieved.		
No. of existing Reactors		4	4		There are 4 reactors each having the same configuration	
Existing Anaerobic Reactor Size		212.9	212.9	m3	Taken from the Asset Assessment report	
Existing Anoxic Reactor Size		434.0	434.0	m3	Taken from the Asset Assessment report	
Existing Aerobic Volume - Chamber 1		642.0	642.0	m3	Taken from the Asset Assessment report	
Existing Aerobic Volume - Chamber 2		656.0	656.0	m3	Taken from the Asset Assessment report	
Denitrification Ratio	(VD/VAT)	0.25	0.25			Based on current plant configuration, with VD = 1737m3, VN = 5159m3
Nitrogen Concentration to be Nitrified	$C_{TN,I} - (0.05 \times C_{BOD,I}) - C_{ORG,N,EST} - C_{TN,EST}$	25.13	25.03	mg		Based on Meeting ELV for Ammonia
Nitrogen Concentration to be Denitrified	$C_{TN,I} - (0.05 \times C_{BOD,I}) - C_{ORG,N,EST} - C_{TN,EST} - C_{TON,EST}$	14.13	14.03	mg		Based on Meeting TN limit of 15mg/l in line with UWWTD
Sludge Days Selected	t_{ts}	9.28	9.03	day	Sludge age was modified to allow the existing Aerobic volume to handle the calculated sludge mass.	
XSS/BOD ratio		0.91	0.92		Based on the settled loads coming to the bioreactor	
Concentration of Phosphorous incorporated (normal uptake)	X_p,BMP	1.4	1.4	mg/l	This is P incorporated in conventional extended Activated Sludge Process	
Concentration of Phosphorous incorporated (enhanced uptake)	$X_p,BioP$	2.1	2.1	mg/l	This is P incorporated in A2O Process, with Anaerobic Tank	
Concentration of Phosphorous to be precipitated		2.61	2.56	mg/l	This is remaining P that needs to be precipitated through addition of Metal Salt, Ferric Sulphate	
Kg of Phosphorus to be precipitated		38.53	42.10	kg/d	This is Total Kg of P to be precipitated based on the inlet flow or plant loading at FFT	
Specific Sludge Production						
Sludge Age value@ XSS/BOD ratio of 0.8		0.91	0.91		From Table 5 in ATV Standard	
Sludge Age value@ XSS/BOD ratio of 1.0		1.03	1.03		From Table 5 in ATV Standard	
Sludge Age value@ XSS/BOD ratio of 1.2		1.15	1.15		From Table 5 in ATV Standard	
Sludge Production Rate at the selected Sludge Days at the defined XSS/BOD ratio	t_{ts}	0.95	0.95	kg TS/kg BOD ₅	Though extrapolation of Table 5 figures	
Sludge Production for Carbon (Usdc)	BOD x t_{ts}	1,926.14	2,178.14	kg TS/d		
Sludge Production for Phosphorous (USdp)		353.26	389.44	kg TS/d		
Total Sludge Production (Usdc + Usdp)		2,279.41	2,567.59	kg TS/d		
Total Required Mass of Sludge: MTS,AT	(Usdc + USdp) x t_{ts}	21,144.20	23,174.91	kg TS		
A.4 Anaerobic Reactor Design						
Required Minimum Contact Time Range		0.50 to 0.75	0.50 to 0.75	hour	ATV Section 5.2.3 specifies range of 0.50 to 0.75	
Required Anaerobic Tank Volume		923	1,028	m ³		Based on flow of (QDW,h + 1.0 xQDW,h) flow
Existing Anaerobic Tank Volume		852	852	m ³		The existing Aerobic Tanks are adequately sized for PE loading of 60,000 . The anaerobic tanks comprise 4 No. Tanks each with volume of 212.9m3
Existing Hydraulic Retention Time		0.55	0.50	hour		Adequate contact time provided
A.5 Biological Reactor Design						
SVI	SVI	120	120	ml/g	The existing clarifiers have a shallow sidewall depth of 1.3m, which is not adequate to provide a clearwater zone at tank surface, whilst operating at elevated Mixed Liquor concentrations. Based on favourable settling characteristics, with SVI of 100ml/g a clarifier sidewall depth of XX m is required at 2/3 clarifier radius.	
Mixed Liquor Concentration	SS_{AT}	3.100	3.400	kg/m3	This is the existing operational MLSS Concentration	
Required Reactor Volume: V_R	VR	6,820.71	6,816.15	m ³		
Existing Biological Reactor Total Nitrification Volume	$VN_{EXISTING}$	5,192.00	5,192.00	m ³		
Existing Biological Reactor Total DeNitrification Volume	$VD_{EXISTING}$	1,736.00	1,736.00	m ³		
Existing Biological Reactor Total Volume: V_R	VR=VN + VD	6,928.00	6,928.00	m ³	Operating the Biological Reactors at either 3,100 or 3,400mg/l, provides a mass of sludge and a sludge age corresponding to a design capacity of 52,500 and 58,500 PE. If the Final Clarifier had an adequate sidewall depth, to provide a claezone, the mixed liquor concentration could be increased to 3,800mg/l. Increasing the MLSS concentration provides additional biological capacity to the system.	
Existing Biological Reactor Total Mass of Sludge	$VR_{EXISTING}$	21,477	23,555	kg TS		
Required operating MLSS Concentration to meet demand		3.052	3.345	kg/m3	Calculation check	
A.6 Secondary Settling Tank Design						
Existing Settlement Tank Type		Vertical, Peripheral Drive Scraper, Circular Tank	Vertical, Peripheral Drive Scraper, Circular Tank			
No. of Settlement Tanks at WWTP		2	2	No.		
Existing Settlement Tank Diameter		24	24	m		
Existing Settlement Tank Side Wall Depth		1.29	1.29	m		
Existing Settlement Tanks Combined Surface Area	$A_{ST,EXISTING}$	904.78	904.78	m ²		
Expected Surface Loading Rate		1.63	1.82	m3/m2/hr	At FFT	
Design Surface Loading	q_A	0.90	0.90	m3/m2/hr	At FFT	
Required surface area of the Secondary Settling tank (A_{ST})	$A_{ST} = Q_{WW,h} / q_A$	1,640.63	1,828.13	m ²	At FFT	
Proposed SST Tanks at WWTP		2	2	No.		
Proposed SST Tank Diameter		32	32	m		
Proposed SST Surface Area		1,608.50	1,608.50	m ²		
Surface Loading Rate		0.92	1.02	m3/m2/hr	At FFT	

A.7 Oxygen Requirements						
Oxygen Requirements in line with ATV DVWK-A-131 Standard (at 20 deg)						
Specific Oxygen Consumption Rate: OV_{CBOD}		1.10	1.09	kg O2/kg BOD	Table 7 ATV-DVWK-A131E	
Oxygen for Carbon Removal: O_{VOC}	$OV_{CBOD} \times BOD$	2,230.27	2,499.13	kg O2/d		
Endogenous Respiration for Biomass		1,057.21	1,158.75	kg O2/d		
Oxygen for Nitrification: O_{VON}	$Q_d \times 4.3 \times S_{N4dN} / 1000$	1,595.46	1,770.59	kg O2/d		
Oxygen from Denitrification: O_{VOD}	$Q_d \times 2.9 \times S_{N03dN} / 1000$	604.99	669.26	kg O2/d		
Peak Factor for Carbon: f_c		1.20	1.20		Table 8 ATV-DVWK-A131E	Diurnal Peaking factors for Organics and N
Peak Factor for Nitrification : f_n		2.00	2.00		Table 8 ATV-DVWK-A131E	
Maximum Hourly Uptake: O_{vh}	$(f_c \times (O_{VOC} - O_{Vd,D}) + f_n \times O_{VON}) / 24$	267.08	296.98	kg O2/h		
Convert Field Oxygen Requirements to Standard Oxygen Rate SOR						
Beta Correction Factor : β	O2 solubility of wastewater to tap water	0.95	0.95	Typical Spec Value		
Oxygen Saturation concentration of tap water at field conditions: C_s		9.17	9.17	mg/l		
Operating oxygen concentration in wastewater (DO field): C_w		2.00	2.00	mg/l	Operator DO setpoint	
Oxygen Saturation concentration of tap water at 20 deg: C_{s20}		10.77	10.77	mg/l		
Alpha Correction Factor: α	ratio of mass transfer coefficient in wastewater to tap water	0.7	0.7	Typically 0.6-1.0		
$\alpha \times (\beta \times C_s - C_w) / C_{s20}$		0.44	0.44			
Theta: Φ	Temperature correction factor	1.024	1.024			
Field Temperature: T	Field Temperature	12	12	deg		
T-20	Adjusted Field Temperature	-8	-8			
e^{T-20}		0.83	0.83			
$\alpha \times (\beta \times C_s - C_w) / C_{s20} \times (\Phi^{T-20})$		0.36	0.36			
SOR to AOR ratio		2.77	2.77			
SOR per Aeration Tank		185.05	205.76	kg/h/tank		
Diffuser Oxygen Capacity per metre depth: DOC		17.00	17.00	g O2/Nm3 air/m depth	Interpolated from Didier Technical Spec Sheet	Assumed 6% diffuser density
Existing Submergence depth (less estimated diffuser height of 0.2m)		3.74	3.74	m	From drawing	
Hourly Air Flow to Single Aeration Tank: Nm3/hr	$SOR / (DOC \times H) \times 1000$	2,910.44	3,236.26	Nm3/h		
Standard Aeration Efficiency of Diffusers		3.10	3.10	kg O2/kWh	Taken as typical diffused air value	
Blower Power Required per Aeration Tank		59.69	66.37	kW		70kW Blowers proposed
Total Blower Power Required for 4 Aeration Tanks		238.77	265.50	kW		
Current Blower Power Provided for 4 Aeration Tanks		183.00	183.00	kW		
Existing Blower Capacity		3,369.00	3,369.00	m3 O2/hr	Asset Assessment	
Existing Blower Output to Each Aeration Tank		2,526.75	2,526.75	m3 O2/hr		
A.8 Alkalinity Availability for Nitrification						
Total Ammonia Concentration in Influent Wastewater		23.41	23.41	mg/l	From Table 1 in ATV 131	
Average Alkalinity Availability in Influent Wastewater		-	-	mg/l		
Alkalinity Requirement for Nitrification		187.25	187.25	mg/l	Based on 8 times the influent Ammonia Concentration	
A.9 Stormwater Holding Tank Requirements						
Minimum Stormwater Storage Volume as per IW-TEC-99-02	2 hour retention of Formula A - FFT	3,771.04	4,226.04	m ³	IW-TEC-700-99-02 Section 10.3.2	
Maximum Stormwater Return Pump Rate		492.19	548.44	m ³ /hr	IW-TEC-700-99-02 Section 10.3.4	Not exceeding 1 times DWF if Incoming Flow 2 times
Stormwater Return Time Check		7.66	7.71	hr	IW-TEC-700-99-02 Section 10.3.2	Not to exceed 12 hours
Existing Stormwater Holding Tank Type		Vertical, Peripheral Drive Scraper, Circular Tank	Vertical, Peripheral Drive Scraper, Circular Tank			
No. of Stormwater Holding Tanks at WWTP		1	1	No.		
Existing Stormwater Holding Tank Diameter		24.0	24.0	m		
Existing Stormwater Hoding Tank Side Wall Depth		1.3	1.3	m		
Existing Stormwater Holding Tank Surface Area		452.4	452.4	m ²		
Existing Stormwater Sloped Floor Height		1.4	1.4	m		
Existing Stormwater Holding Tank Volume		793	793	m ³		
Provided Stormwater Volume		6231	6231	m ³		
Hours of storage		3.30	2.95	hrs		

A.10 Sludge Production / Sludge Holding Tank / Sludge Dewatering						
Unit Rate Sludge Production		70.00	70.00	g DS/PE/d	IW-TEC-700-99-04 - Section 12	
Daily Sludge Production at Design Load		3,675.00	4,095.00	kg DS/d		This is the daily mass of WAS sludge generated.
Daily Sludge Volume at Design Load (based on 1% DS)		367.50	409.50	m ³		This is the daily volume of WAS sludge generated.
Hourly Sludge Production at Design Load		153.13	170.63	kg DS/hr		
Solids Design Flux Rate Range for Gravity Thickener		1.00	1.00	kg DS/hr/m ²	Unit Treatment Processes in Water and Wastewater Engineering- Professor TJ Casey- Chapter 16 Sludge Processing and Disposal -Table 16.4; Range 0.6 to 1.0 kg DS/hr/m ²	
Minimum Gravity Thickener Surface Area		153.13	170.63	m ² total		
7 days Sludge Mass		25,725.00	28,665.00	kg DS		Does not include Sludge Imports
7 days Sludge Volume based on 2.5%DS		1,029.00	1,146.60	m ³		Does not include Sludge Imports. Assumed 2.5% DS
Existing Sludge Thickening Tank Type		Vertical, Central Picket Fence, Circular Tank	Vertical, Central Picket Fence, Circular Tank			
No. of Operational Sludge Holding Tanks at WWTP		2	2	No.		
Existing Sludge Holding Tank Diameter		6.00	6.00	m		
Existing Sludge Holding Tank Side Wall Depth		3.6	3.6	m		
Existing Sludge Holding Tank Surface Area		28.3	28.3	m ² per tank		
Existing Sludge Holding Tank Total Surface Area		56.5	56.5	m ² total		
Existing Sludge Holding Tank Sloped Floor Height		0.3	0.3	m		
Existing Sludge Holding Tank Combined Volume		209	209	m ³		
Sludge Dewatering Solids Hourly Loading Rate		643.13	716.63	kg DS/hr	Based on 40 hour week	
Sludge Dewatering Hourly Hydraulic Loading Rate		25.73	28.67	m ³ /hr	based on 35 hour week and 2.5%DS from the Sludge Thickening Tank	
Existing Sludge Belt Press Hourly Solids Capacity		450	450	kg DS/hr		
Existing Sludge Belt Press Hourly Hydraulic Capacity		15	15	m ³ /hr		
A11. Ferric Dosing Required for P Removal						
Daily Kg of Phosphorous to be precipitated		38.53	42.10	kg/hr		
Daily FE requirement (based on 2.7 kg FE/kg P removed		104.04	113.67	kg FE/d		
Ferric Sulphahte Iron Content		0.174	0.174	g/l	Ferric Sulphate 112	
Daily Ferric Sulphate Dosing Requirement		597.93	653.25	l/d		The A2O plant removes the bulk of the phosphorous biologically, Ferric is required only to remove smaller remaining portion of phosphorous.
Required Ferric Sulphate Tank 30 day Storage Volume		17938	19598	l		
Existing Ferric Sulphate Tanks Combined Storage Volume		13000	13000	l		The existing ferric storage tanks are inadequately sized for 30 day storage

Appendix D. Microtunnel Design Technical Note



TECHNICAL NOTE

Kilkenny Road Pumping Station to Mortarstown Wastewater Treatment Works

SUBJECT	PROJECT NO.	DATE
Tunnelling reference design	100111164	22 May 2026
AUTHOR	DISTRIBUTION	REPRESENTING
James Lovell	Kerem Ar Fiona Quigley	AtkinsRéalis Ireland AtkinsRéalis Ireland

Document history

Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
1.0	For inclusion in Specimen Design Report	J Lovell	J Dai	J Daughtry P Chiu	-	2024-11-01
2.0	Redesign for increased pipe diameter	J Lovell	J Piazza	C Shen R Weber	-	2025-09-19
2.1	Tunnel realignment following public consultation	J Lovell	J Piazza	R Weber	-	2025-12-14
2.2	Addition of Manhole F following stakeholder engagement	J Lovell	J. Piazza	R Weber	K Ar	2026-05-22

Client signoff

Client	Uisce Éireann		
Project	Kilkenny Road Pumping Station to Mortarstown Wastewater Treatment Works	Project No.	100111164
Client signature / date			

TECHNICAL NOTE

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TECHNICAL NOTE

Executive summary

A sewer pipe requires installation to accommodate gravity flows from Kilkenny Road Pumping Station (KRPS) to Mortarstown Wastewater Treatment Plant (WWTP). Due to a confluence on site constraints along the proposed alignment, the pipe is proposed for installation using trenchless construction. An assessment of construction method suitability and horizontal alignment constraints has proposed micro-tunnelling as a suitable method for construction of a tunnel to accommodate a 1.65 m I.D product pipe. Construction is proposed in three pipe jack drives, facilitated by a trench excavation at KRPS, a 15 m I.D shaft at the WWTP, and four intermediate shaft sites. At each site, permanent manholes will be required for maintenance access. To confirm the tunnel and shaft construction method suitability and determine the extent of any necessary mitigations, detailed ground investigation alongside the proposed tunnel alignment has been proposed.

TECHNICAL NOTE

1. Introduction

Uisce Éireann proposes to upgrade the Kilkenny Road Pumping Station (KRPS) and Mortarstown Wastewater Treatment Plant (WWTP) to suit the population growth of Carlow. Under current arrangements the town is served by Mortarstown WWTP located 2.2 km south of Carlow town centre on the eastern bank of the River Barrow and has incoming flows from KRPS approximately 1 km to the north. As part of capacity upgrades being made, a new gravity fed sewer is planned between the existing KRPS and a new pumping station at the adjacent to the inlet works at Mortarstown WWTP. The existing pumping infrastructure in KRPS and the existing rising mains between KRPS and WWTP will be decommissioned (Figure 1).

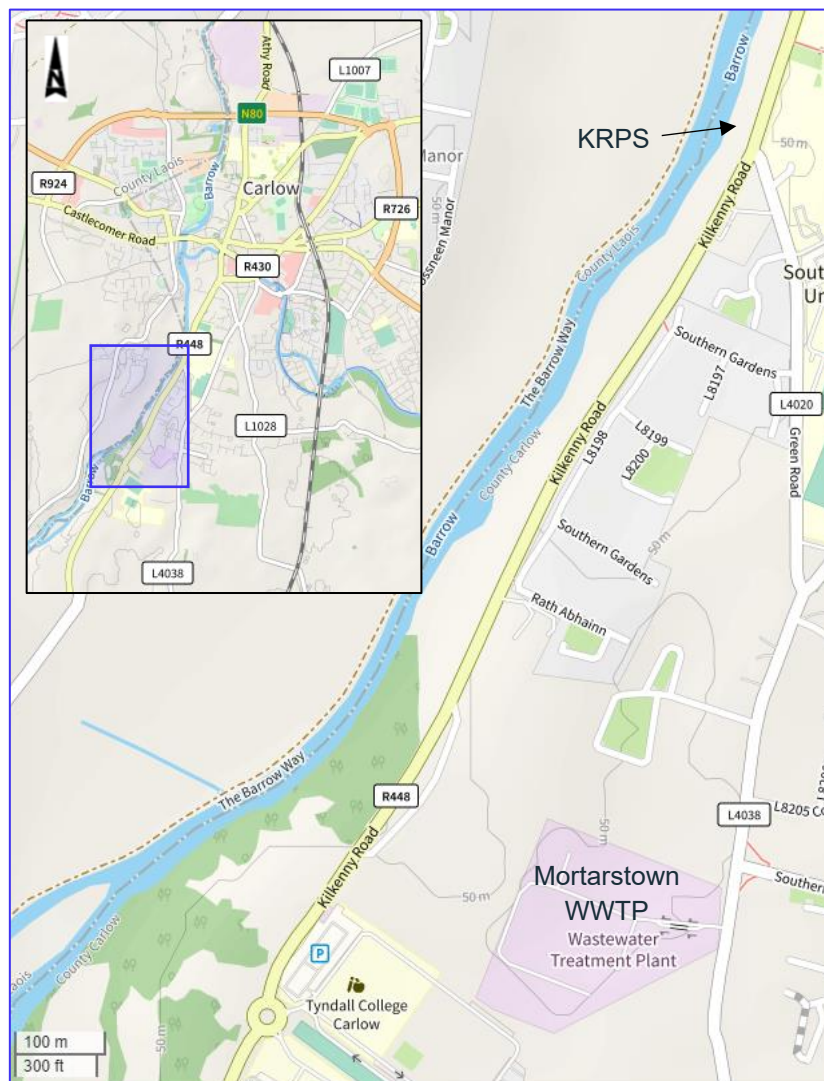


Figure 1 - Location plan of KRPS and Mortarstown WWTP

AtkinsRéalis has been instructed to propose a reference design for construction of the new reinforced concrete gravity sewer pipeline.

TECHNICAL NOTE

2. Scope

AtkinsRéalis undertook an initial assessment to assess the feasibility of WWTP tunnel construction options against industry requirements and standards. The high-level feasibility study concluded that:

- Wet segmental caisson construction is the preferred method of shaft construction based on the site geology and dimension requirements.
- Micro tunnel boring machine (MTBM) construction is the preferred method of tunnel construction based on the site geology consisting of gravel and clayey sand at tunnel level (see Section 3).
- The location of the intermediate shafts and manholes forms a key alignment and space-proofing constraint, so their number and size should be minimised.

The AtkinsRéalis Tunnel Option Review [1] provided the following recommendations for the next stage of the design:

- The construction risks should be reviewed and updated.
- Information on the location of utilities should be reviewed to confirm the vertical alignment of the pipeline.

The following aspects are included within the scope of this reference design:

- Review of Uisce Éireann's design standards
- Geotechnical desk study
- Outline design of the gravity main horizontal alignment
- Tunnel construction outline methodology
- Temporary works outline design
- Arrangement and sizing of permanent access structures
- Connection to the existing KRPS
- Examination of construction feasibility and risk

TECHNICAL NOTE

2.1 Uisce Éireann Standards

2.1.1 Gravity sewers

Requirements for the design of gravity sewers are set out in the Uisce Éireann Technical Standard for Wastewater Gravity Sewer (IW-TEC-800-01) [2]. The specific requirements for tunnelled sewers are summarised as follows:

- Sewer shall be located outside the zone of influence of any building.
- Curved sewers shall not be permitted, except in exceptional circumstances. The pipe joints shall not be pulled more than half the deviation specified by the manufacturers. ***This project has been assumed to constitute exceptional circumstances and is therefore exempted.***
- The roughness coefficient Ks for new wastewater pipes shall be 1.5 mm.
- Sewers shall not be laid through gardens unless no reasonable alternative exists.

2.1.2 Tunnel shafts

Requirements for vertical shafts constructed for tunnel construction and operation according to IW-TEC-800-01 [2] are as follows:

- The positions of shafts shall be determined by practical consideration such as minimising traffic disruption, avoidance of existing public utility services, etc.
- The minimum diameter of shafts shall be 2440 mm; this is necessary for operation and maintenance of the sewer system [2].
- Where a shaft is used for pumping machinery, the minimum shaft diameter is determined by the size and arrangement of equipment that is to be accommodated. A stepped shaft may be considered within a wider diameter shaft housing mechanical pumping plant.
- The preferred maximum spacing between manhole on tunnels should be limited to 200 m, but this may be increased with agreement from Uisce Éireann and subject to carrying out a risk analysis.
- Shafts should have full height clear of lift access for removal of stretchers, safety equipment and general maintenance.

2.1.3 Manholes

Requirements for the design and specification of manhole access shafts are outlined in the Code of Practice for Wastewater Infrastructure (IW-CDS-5030-03) [3]. These can be summarised as follows:

- Cast in situ concrete manholes should be employed at the following locations:
 - At every change of alignment or gradient.
 - In areas with a perched water table.
 - Adjacent to bodies of water like rivers or lakes.
 - Within zones identified by the Office of Public Works Catchment Flood Risk Assessment and Management (CFRAM) with a flood risk occurring once every ten years.

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- Manholes exceeding a depth of 6 m necessitate a detailed design submission for approval by Uisce Éireann prior to construction. These manholes should incorporate intermediate landing platform(s) as part of an engineered access solution.
- When located within a road, sewers should be at least 1 m from the kerb and the outside of manholes at least 0.5 m from the kerb line.
- For man-entry sewers, consideration shall be given to the size of the access openings required by confined space entry teams.
- Manholes shall be located to avoid dangerous traffic locations where possible.

Air-sealed covers have not been specified as a requirement along the proposed gravity main.

2.2 Design assumptions

The design presented herein has been established to comply with the design requirements presented below.

- The sewer will:
 - Connect from KRPS to the proposed new inlet PS at Mortarstown WWTP.
 - Operate according to a gravity fed design.
 - Have internal diameter 1.65 m.
- Intermediate access manholes will:
 - Have an internal diameter of at least 5 m to provide safe access.
 - Ideally be spaced not more than 200 m apart, with any specific exemption to be sought for any exceedance (under grant of Uisce Éireann).
 - Be located off the Kilkenny Road carriageway wherever practicable, to avoid lane closure as much as possible. Full road closure has not been permitted.
- The location and level of the connection into KRPS are fixed due to the existing structure on this site and the hydraulic design requirements.
- The pipe invert level of the connection into the new inlet PS is fixed at 39.50 m AOD according to the hydraulic design requirements.
- The size of the new inlet PS shaft is fixed at 15 m internal diameter according to the space-proofed requirements of the pump station [4].
- Utmost consideration will be given to the River Barrow Special Area of Conservation (SAC) and the alluvial woodland near the KRPS site. No works to be implemented in the alluvial woodland area and tunnelling beneath this area should be avoided.
- Consideration will only be given to exercise compulsory purchasing powers if all alternative options have been considered and ruled out.
- Based on a review of Uisce Éireann requirements for gravity mains, it has been assumed that:
 - Flow shall either drain to the pumping station or be controlled upstream of the gravity main.
 - No specific provision for air ventilation is required for reference design consideration.

The reference design outlined in this note accords to these requirements and others specified in Uisce Éireann requirements, which are considered to supersede any previous conflicting requirements.

TECHNICAL NOTE

3. Geology

A detailed ground investigation (GI) at the Mortarstown WWTP site was carried out by Priority Geotechnical Limited as part of the wastewater network upgrade project. A second phase was completed in 2022 with intrusive investigations at Mortarstown WWTP and KRPS. Surveying along Kilkenny Road (R448) and Green Road / Carraig Abhainn, but no intrusive GI was undertaken along these roads.

The following activities were undertaken across both phases:

- Eight trial pits
- 11 cable percussion boreholes
- 10 rotary core holes
- 16 slit trenches
- GPR of treatment plants, Kilkenny Road and Green Road / Carraig Abhainn

A Geotechnical Interpretative Report (document no: 5161805DG0361 rev 0 - CIP5 Mortarstown Prelim GIR & GDR_Rev A) was provided following the Phase 2 GI [5].

For the proposed pipeline route from KRPS to Mortarstown WWTP, topsoil down to 0.50 m bgl was noted at the roadside verge. This overlies made ground described as loose silty sand down to 1.52 m bgl at its greatest extent. Slightly silty/clayey gravelly sand was encountered beneath the made ground and recorded to 2.40 m bgl, before loose slightly silty very gravelly sand was encountered. This sand layer is described as fine to coarse. Groundwater was encountered as a trickle at 2.60 m bgl within the loose sand.

The slit trenches did not reach the proposed invert level or founding level of the pipeline and therefore the in-situ ground conditions could not be confirmed at formation level of the pipeline. Tunnel axis level is expected to range from approx. 43 m AOD (3 m bgl) at the KRPS end to approx. 42 m AOD (8 m bgl) at the WWTP end. The interpreted ground conditions at these locations is described in Table 1 and Table 2, but additional GI should be required to confirm the ground conditions at tunnel depth alongside Kilkenny Road.

Table 1 - Geological information from rotary core RC11 drilled at the KRPS [5]

Top of strata level (m AOD)	Top of strata depth (m bgl)	Material	Compaction
46.4	0.0	Gravel (made ground)	<i>Anticipated geology at tunnel crown level</i>
43.3	3.1	Sandy gravel	Dense. <i>Anticipated geology at tunnel invert level.</i>
35.9	10.5	Gravel with boulders	Dense
33.9	12.5	Limestone	Solid

TECHNICAL NOTE

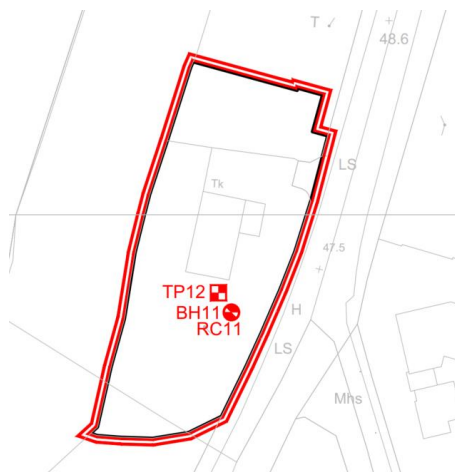


Figure 2 - Kilkenny Road Pumping Station GI locations

Table 2 – Geological information from rotary core RC06 drilled at Mortarstown WWTP [5]

Top of strata level (m AOD)	Top of strata depth (m bgl)	Material	Compaction
49.56	0.0	Sand	
48.06	1.5	Sand and boulders	
46.56	3.0	Boulders	Medium dense
45.06	4.5	Gravel and boulders	Dense
43.56	6.0	Clayey sand	Medium dense to loose. <i>Anticipated geology at tunnel level.</i>
40.56	9.0	Silty gravel	Loose to dense
33.06	16.5	Gravel with boulders to boulders	Dense

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Figure 3 - Mortarstown WWTP GI locations

Based on the rotary core records included within the GIR [5], there is a medium to low likelihood of the tunnel alignment encountering limestone boulders up to 400 mm in diameter. However, the likelihood of encountering boulders may be higher elsewhere along the proposed alignment, so further ground investigation is required to confirm the overall risk level to be expected. Chiselling records from the cable percussion boreholes [5] indicate likely obstructions (e.g., cobbles) below 3 m bgl at the WWTP site. At the KRPS site, these obstructions are likely below 6 m bgl, presenting a potential risk to any deep piling works at this location.

The high groundwater level and proximity to the River Barrow means that water ingress into excavations presents another significant risk, although options to mitigate this are outlined in Section 5.

The existing investigations show that there are consistent strata along the tunnel alignment. However, additional GI is recommended before confirmation of the tunnel vertical alignment, clarify the risks, and mitigation of mixed-face ground including boulders. In accordance with the UK draft NA to EN 1997-2:2024, it is recommended as a minimum that at least one ground investigation is conducted per shaft location. This will reduce the uncertainty from interpolation of the ground conditions and provide information to enable shaft design and construction planning. This would also be minimally compliant with the current BS EN 1997-2:1997 which recommends ground investigation spacing of 20 to 200 m for pipeline and tunnels.

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4. Alignment

4.1 Horizontal alignment

The factors constraining the horizontal alignment of the tunnel are described below and summarised in Figure 4.

- **Kilkenny Road (R448)** – the permissible site extent envelope (Figure 5) has been set to constrain the allowable extent of pipeline construction works to closely follow the alignment of this busy single-carriageway road for along most of its length, minimising the need to gain right-of-way on private property. In lieu of a temporary full road closure derogation provisioned by Carlow County Council Roads Department, the location and sizing of construction compounds has been designed to require only temporary partial (single lane) closure of the road during construction of the shafts and tunnel. These shaft sites have been positioned to ensure that access to the three properties along this stretch of Kilkenny Road can be maintained. Manhole access points are not permitted within the main carriageway but may be located within the adjacent cycle lane or footpath.
- **Permanent manhole access points** should be located away from the road when practicable to avoid future road closures when accessing and to reduce the extent of cyclic traffic loading on the manhole cover.
- **River Barrow Special Area of Conservation (SAC)** – the woodland between the river and the main road has a designated protected status. The permissible site extent envelope (Figure 5) has been set to delimit the greatest allowable extent of construction activity to ensure that the tunnel alignment avoids passing beneath the woodland, as stipulated in the project scope. Further, no construction compounds shall encroach upon this area.
- **Southern Gardens / Rath Abhainn** – the houses along this cul-de-sac may be at greatest risk of settlement if the proper controls and monitoring are not in place. For this reason, the horizontal tunnel alignment has been set to ensure that the horizontal distance between the tunnel and the houses is at least twice the tunnel depth below ground level.
- **Private property boundaries** – construction beneath the private greenfield sites between the WWTP and Rath Abhainn has been avoided, to minimise compulsory purchase requirements. This includes the private plot identified in Figure 4 for which an objection to any construction or tunnelling works was registered during the public consultation on 9 October 2025. The objection extends to a strip of land alongside Kilkenny Road which is owned by Carlow County Council but currently occupied by a private landowner.
- **Existing KRPS** – the connection point to the existing pump station is fixed.
- **Carlow southern relief road** – construction of an extension to the ring road is planned to commence after completion of the sewer pipeline. Therefore, tunnel construction sites need to avoid the area designated for road construction.
- The horizontal alignment as proposed will require the diversion of some **existing underground utilities**. These include Uisce Éireann clean water and wastewater pipes, cable, broadband, and Gas Network Ireland utilities that run alongside Kilkenny Road. The existing utilities as identified by GPR surveys are shown on the plans in drawings 5161805_EWE_DR_MOR_5520 to 5524.
- There are **trees and hedgerows** along the east side of Kilkenny Road. **Overhead wires** also pass close to KRPS. These may present an obstruction to crane operation, or roots may obstruct the construction of the intermediate shafts.

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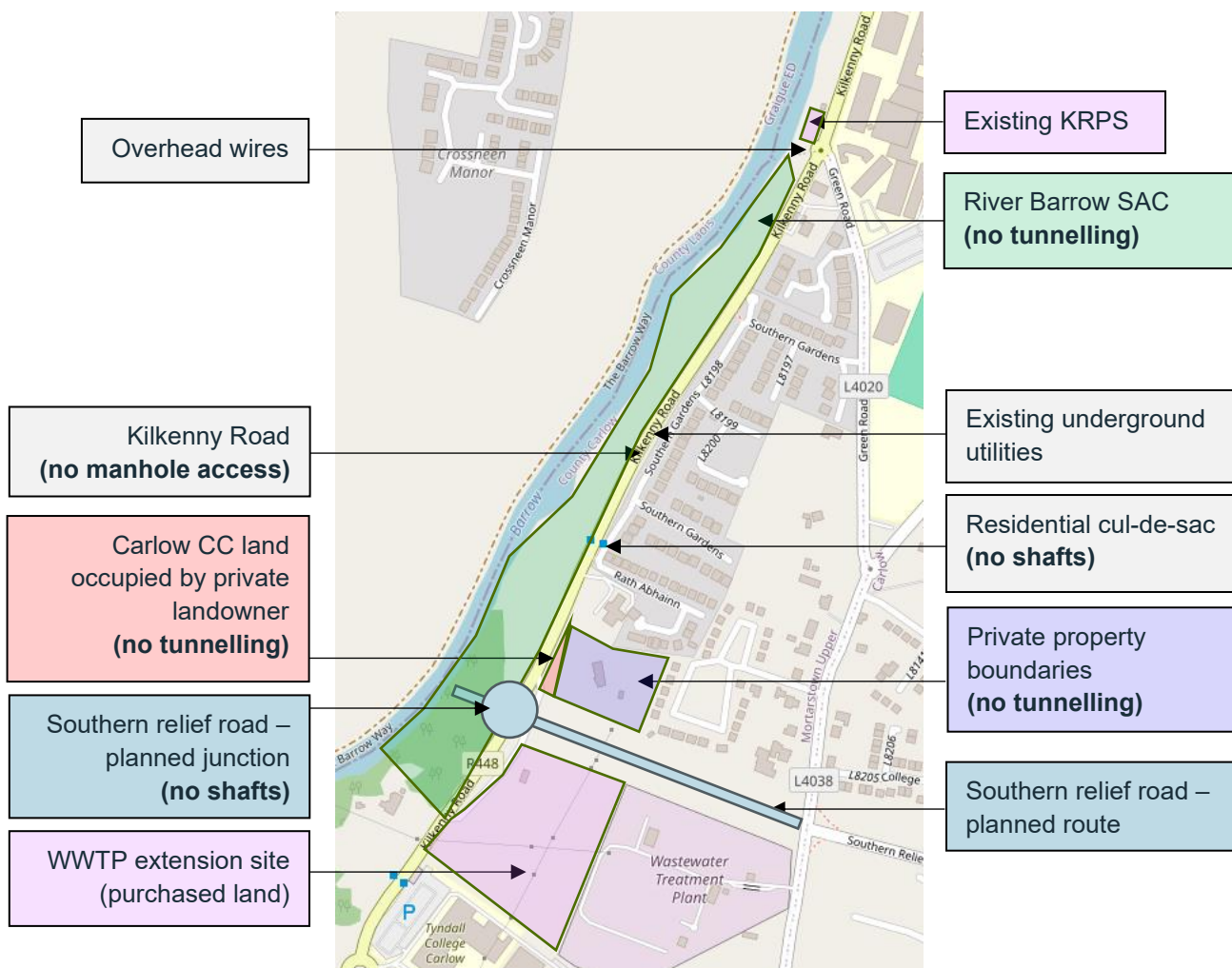


Figure 4 - Constraints for the horizontal alignment. Sketch not to scale

Based on the identified constraints, a red line envelope has been set to define the allowable extent of tunnelling. This is shown in drawings no. 5161805_EWE_DR_MOR_5120 to 5122 along with the subsequent horizontal alignment of the gravity main. Additional constraints remain within this envelope, including property boundaries and the planned relief road. These mean that the use of a single straight drive between KRPS and the new inlet PS is not feasible.

Construction with linear drives avoids the issue of additional forces within the pipeline prevalent in arc trajectories. There is also no requirement for an onboard machine operator, bringing a safety benefit. Re-alignment of the MTBM will be required at each intermediate manhole. However, use of a curved trajectory could enable tunnelling to progress from Shaft C to Shaft E without requiring an additional jacking installation at Shaft D, via the arrangement of tunnelling drives shown in Figure 5. The minimum jacking radius for a tunnel at this diameter has been conservatively considered to be 1000 m, with the actual required radius comfortably above this at 5600 m. This could facilitate construction of the full tunnel length with three pipe jack drives.

Due to greater space constraints at Shaft E, it is proposed that this shaft should be used for MTBM reception after each adjacent drive. Shaft C and Shaft F are proposed as the MTBM launch and jacking sites. The use of these shafts for both upstream and downstream bores can be achieved via rotation of the jacking rig within the shaft, thus minimising the extent of temporary works otherwise required to lift out and move the rig between shafts. The proposed configuration is shown in Figure 5 and summarised in Table 3.

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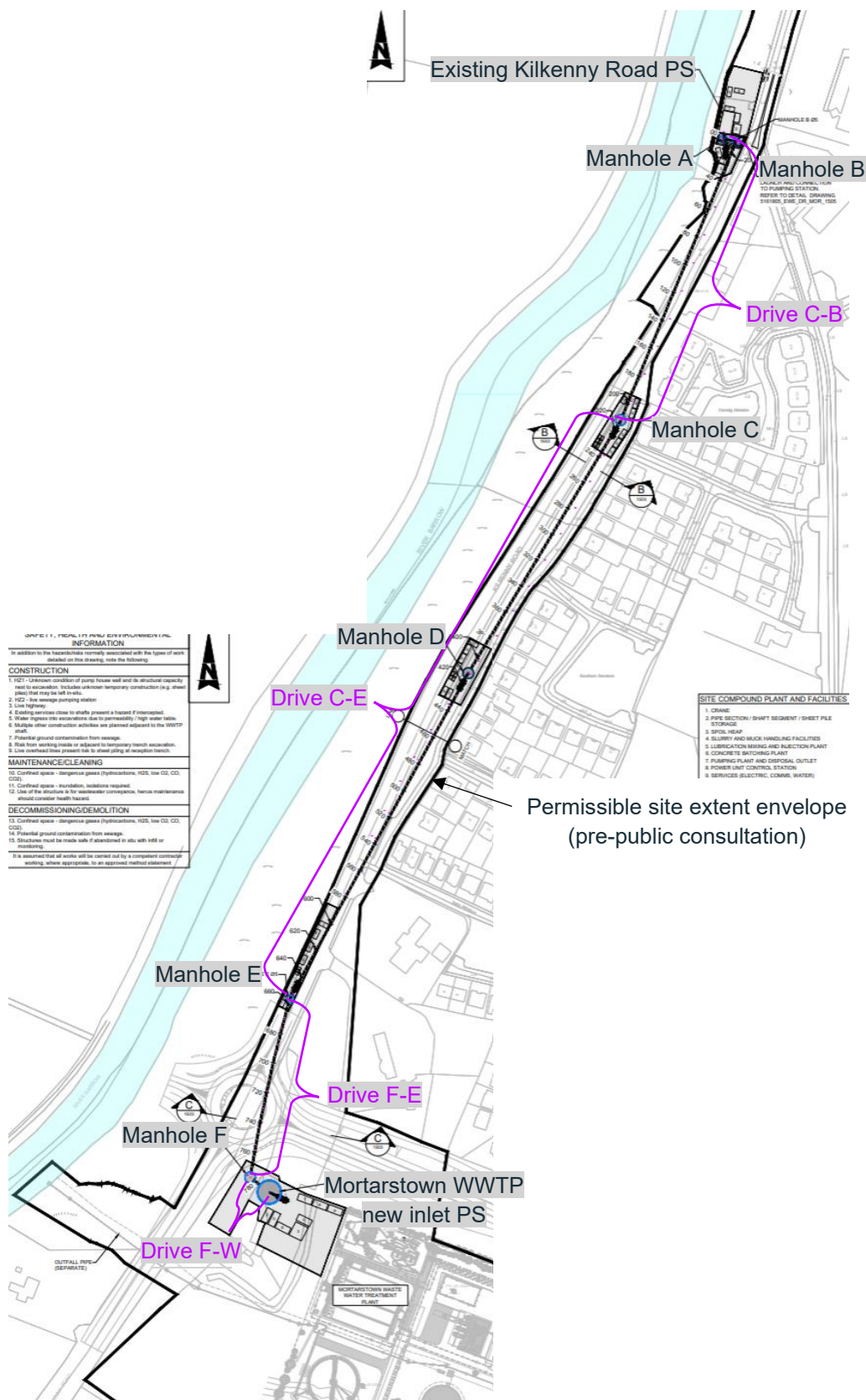


Figure 5 – Proposed tunnel and shaft alignment in plan, based on 5161805_EWE_DR_MOR_5120 to 5122

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Table 3 – Proposed pipe jack tunnel construction drives

Drive ref.	Launch site	Reception site	Drive length (m)	Jacking radius (m)
F-W	Shaft at manhole F	New inlet PS	5	n/a (linear)
F-E	Shaft at manhole F	Shaft at manhole E	115	n/a (linear)
C-E	Shaft at manhole C	Shaft at manhole E	432	5600
C-B	Shaft at manhole C	KRPS trench	200	n/a (linear)

4.2 Vertical alignment

Proposed tunnel dimensions are summarised in Table 4. These indicative dimensions have been used to develop the reference design drawings, but the final dimension requirements should be determined by the Contractor following detailed design. Unless a separate internal protective lining is provided, the thickness of the concrete lining should be increased to account for additional cover to resist H₂S induced biochemical attack and abrasion over the design life of the sewer. The protective and/or sacrificial layer is shown indicatively pending calculation at the detailed design stage.

The hydraulic performance of the sewer has been determined separately by AtkinsRéalis Ireland and set out in the hydraulic design. Each drive has been aligned to maintain a constant vertical gradient of 1:800, to provide a safety margin above the self-cleansing flow requirement (min 1:1000).

Table 4 – Indicative sewer tunnel dimensions.

Jacking pipe internal diameter*	1.80 m
Jacking pipe structural thickness	175 mm
Additional lining thickness (for corrosion/abrasion resistance)	75 mm
Excavated diameter	2.15 m
Total sewer length from KRPS connection box to Mortarstown WWTP inlet shaft	785 m
Minimum gradient*	1:1000

Note: *Confirmed fixed values

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5. Outline construction methodology

5.1 Sewer tunnel

The sewer product pipes have a hydraulic design requirement of 1.65 m internal diameter, which has been assumed to require 1.8 m I.D. pipes to account for the corrosion resistant interior lining as specified in the hydraulic design requirements. At this diameter, accounting for the fixed gradient requirements, AtkinsRéalis proposes the use of micro-tunnel construction by pipe jacking as the best suited approach for boring the pipeline.

Pipe jacking uses hydraulic jacks to drive purpose designed pipe sections through the ground concurrent with excavation at the face. Depending on the type of boring machine used, construction through a range of soil types can be possible, including cohesive soils, non-cohesive soils and mixed-faced conditions. The associated limitations on drive length and manoeuvrability have been accounted for in the design of the overall tunnel alignment.



Figure 6 - Example of a compact MTBM jacking operation from a shaft

The total drive length from KRPS to the new inlet PS will be 785 m. Guidance from the Pipe Jacking Association (PJA) [6] (reproduced in Table 5) indicates that pipe jack construction of a tunnel longer than 750 m carries at least a 'medium' risk, and that a maximum jacking drive of 500 m is preferable for the risk to remain 'low'. This reference design therefore proposes to sub-divide the construction into three drives to reduce the maximum individual drive length to below 500 m. In line with the requirement for regularly spaced maintenance access shafts along the tunnel alignment, these shafts have been sized to serve the temporary purpose of jacking rig installation and TBM launch/reception.

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Table 5 - PJA guidance on maximum drive lengths between shafts depending on tunnel diameter [6].

Excavation technique	Indicative risk	1.5 m tunnel I.D.	1.8 m tunnel I.D.
Pipe jack with remote operation machine	Low	<500 m	<750 m
	Medium	To 750 m	>750 m
Pipe jack with onboard machine operator	Low	300 m	750 m
Pipe jack with onboard machine operator & mechanical erector	Medium	250 m	500 m

Other tunnel construction methods have been ruled out due to unsuitability:

- Open cut trench excavation along the entire route is not suitable as this would require closure of Kilkenny Road for the full duration of the construction works.
- Segmental lining construction with a MTBM is not feasible at this small (1.65 m) diameter of tunnel. This option could typically only be considered if the tunnel diameter were to be increased to at least 2.4 m I.D.

5.1.1 Construction drives

Based on the above, for a 'low' risk pipe jack operation, two potential options for the micro-tunnelling configuration of a continuous drive from Shaft C to Shaft E have been considered:

1. **Single jacking station.** To construct the curved tunnel drive by jacking from a single launch site will require the inclusion of several inter jacks with an automatic lubrication system would need to be considered. It is recommended to install the intermediate access Shaft D before tunnelling to facilitate machine retooling, although this is not a requirement for this method of construction.
2. **Multiple jacking stations.** Requires construction of the intermediate Shaft D before tunnelling commences. An intermediate jacking station can be installed at the intermediate shaft to provide additional thrust for overcoming friction. This is recommended for the non-linear horizontal alignment and the maximum drive length near the upper limit of a typical 'low risk' drive. The space available at the Shaft D site is sufficient to facilitate this option, if selected.

The likelihood of encountering large boulders (greater than approx. 400 mm diameter) along the alignment should be determined, as these have the potential to jeopardise the viability of tunnel construction. Boulders of all sizes can also present a risk of significant cutter wear and blockage. The presence of intermediate shafts, which are required for maintenance access regardless of the construction configuration, presents the possibility of retooling machinery in response to cutter wear.

An alternative alignment with an increase in the maximum shaft spacing to 250 m was considered in the route optioneering and could be feasible. This option could avoid full closure of Kilkenny Road by relocating Shaft E onto a verge. However, the design of this alignment would be subject to further design, construction development, contractor involvement, and approval of derogations from Uisce Éireann of previously agreed spacing requirements.

With approval from Uisce Éireann to increase the permissible manhole access spacing beyond 200 m, this has facilitated the arrangement shown in Figure 5 whereby Shaft E is offset from the main carriageway of Kilkenny

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Road. This avoids full closure of the road during construction, while also ensuring that future road closure will not be required in order to access the manhole for routine inspection and maintenance.

5.1.2 Micro-TBM selection

The chosen type of MTBM must be suitable for the ground conditions at tunnel level along the tunnel alignment.

AtkinsRéalis proposes use of a slurry MTBM for excavation and construction of the tunnel, based on a combination of tunnelling technology, dimension requirements (Section 2.2), spatial constraints (Section 4) and geology (including gravel, sand and clay as described in Section 3).

The geotechnical interpretative report issued by Priority Geotechnical Limited [5] identified ground conditions along the pipeline route ranging from loose silt to loose gravelly sand, beneath sandy gravelly clay. These conditions indicate that a slurry shield MTBM equipped with internal crushers could be a suitable tunnelling method for this range of ground conditions and the high groundwater table [7].

To operate a slurry MTBM, the main WWTP compound site should include space for installation of a slurry treatment plant. However, further information about the ground conditions combined with the application of appropriate soil conditioning agents could allow construction using an earth pressure balance MTBM to be considered. This would provide an opportunity to avoid the need for a slurry treatment plant.

Construction via MTBM requires excavation of an annular overbreak, which should be filled with grout to prevent settlement once pipe installation for each individual tunnel is complete. The allowable tolerance for joint levels between pipe sections must meet the hydraulic design requirements during detailed design specification of the pipe connections.

5.2 Access structures

For inspection and maintenance access, the design includes four intermediate manholes in addition to the launch and reception connection shafts. The maximum distance between manholes has been set at 200 m wherever practicable, to comply with the Uisce Éireann maintenance requirements. However, there is a deviation from this requirement applied between Manholes D and E due to the confluence of constraints governing the location of Manhole E. A maximum spacing of 240 m has resulted.

The layout of shafts is shown in drawings no. 5161805_EWE_DR_MOR_5120 to 5122. The indicative dimensions for launch, reception and intermediate shafts are outlined Table 6. Note that:

- It is recommended that the MTBM auxiliary power, control and utilities remain stationed at the launch sites for the duration of the tunnel construction to minimise land take and grid connection requirements at the intermediary manhole sites.
- The internal dimensions proposed for MTBM launch sites have been sized according to the space required for a typical jacking rig sized to accommodate 1.65 m I.D. pipes [8].
- Shaft excavation base levels have been indicatively set at 1 m below the sewer tunnel invert level to accommodate the assumed jacking space requirement. Sloped benching will be required to make up the required invert level. Final elevations of the shafts base will be decided by the detailed design for construction.

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- The diameter of the new inlet PS shaft was determined by AtkinsRéalis Ireland within the separate Mortarstown WWTP SID Engineering Report (2026), according to the size and arrangement of the pumping equipment to be accommodated.
- The formation levels of shaft rings have been shown indicatively. Final toe levels remain subject to detailed design of the base slabs for resistance against uplift and support of the jacking rig.
- Structural support of the shaft lining is required at the tunnel breakthrough point. This involves sections of thickened concrete framing the tunnel eyes. The effect is a reduction in the shaft section area at breakthrough level.

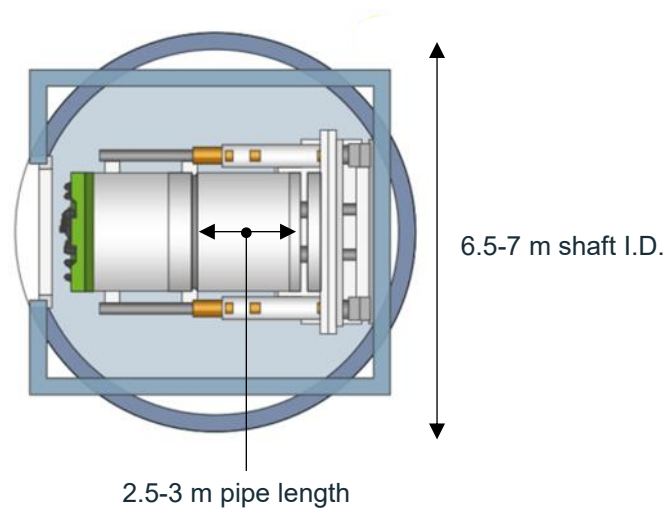


Figure 7 - Arrangement of a Herrenknecht compact jacking station

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Table 6 – Proposed shaft/excavation dimensions

	KRPS trench	Shaft C	Shaft D	Shaft E	Shaft F	Mortarstown WWTP
Tunnel construction purpose	MTBM reception	MTBM launch	N/A	MTBM reception	MTBM launch	N/A
Permanent use	Manholes A & B	Manhole C	Manhole D	Manhole E	Manhole F	New inlet pumping station
Proposed construction method	Sheet piles	Segmental wet caisson	Segmental wet caisson	Segmental wet caisson	Segmental wet caisson	Collar ring pile wet caisson
Internal plan dimensions (m)	14 x 7	Ø 7	Ø 7	Ø 5	Ø 7	Ø 15
Indicative structural support thickness (mm)	600	225	225	200	225	500
Total shaft depth (m)	8.90	8.012	11.855	11.214	9.465	11.483
Ground level (m AOD)	46.98	47.684	51.117	49.978	47.983	49.983
Sewer invert level (m AOD)	41.10	40.672	40.262	39.764	39.518	39.50
Base level (m AOD)	38.08	39.672	39.262	38.764	38.518	35.53
Indicative compound site dimensions at shaft location (m)	150 x 30	50 x 15	50 x 15	80 x 9		120 x 50

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There are two options for the method of intermediate shaft construction:

1. **Wet caisson segmental lined** shaft construction is proposed as the preferred option. This method involves sinking a pre-cast caisson whilst the shaft is excavated. A head of water is maintained within the excavation, to prevent groundwater inflow by applying a small excess pressure onto the shaft base. When the shaft has reached through full depth a tremie concrete plug is cast into the bottom of the excavated shaft to temporarily seal the base and enable dewatering. A permanent cast in-situ base slab is then cast to provide the permanent seal. The approach has been assumed suitable based on the following:
 - a. Pre-cast concrete segmental construction can be suitable for shafts greater than 2.4 m in diameter [7].
 - b. The KRPS and WWTP sites have highly permeable geology (sandy gravel) combined with an elevated water table [5]. It has been assumed by interpolation that the geology along the tunnel alignment is similar in composition. With wet caisson construction, groundwater inflow can be excluded up to a depth of 50 m [7].
2. Alternatively, use of **sheet piling** may be considered for construction of the intermediate shafts, based on a **cast in-situ** structure with maximum shaft depth not exceeding 10 m bgl. This method carries certain heightened risks which make it potentially less suitable:
 - a. With the current understanding of the ground conditions, this method will likely require ground treatment beneath the excavation level to enable a dry temporary excavation for construction of the permanent structure.
 - b. The potential existence of boulder sized underground obstacles will make the sheet piling less feasible, so any boulders encountered should be excavated out to facilitate full depth pile installation.

The final construction method determined during detailed design should minimise ground movement to safeguard surface assets within the vicinity of each shaft.

5.2.1 New inlet PS / Shaft F

Detailed structural and spatial design of the new Mortarstown WWTP wet well / pump well shaft is not included in the scope of this reference design. Based on the preliminary designs for a 15 m diameter shaft, it is expected that the shaft and compound area will be sufficiently sized to allow for MTBM reception at this location prior to the installation of permanent structures within this shaft.

A proposed arrangement for the sewer connection into the new inlet PS is shown in Figure 8. The Mortarstown WWTP Specimen Design defines the pipe inlet invert level at a height of 4 m above the permanent base fill of the shaft.

For the alternative construction sequence whereby the new inlet PS shaft is used for MTBM launch, a temporary base level of approx. 39 m AOD would be required to install the jacking rig. The exact extent of additional excavation required below the sewer invert to install a jacking rig depends on the dimensions and operating requirements of the selected machine. A typical MTBM for this application weighs a maximum of 13 T, so this will either need to be supported on a steel temporary support structure or the shaft back filled to provide a temporary base at this level. By contrast, MTBM reception could be achievable without installation of a fixed support structure. Hence, the latter option had been assumed to offer a constructability benefit as well as reduced works sequencing constraint to the new inlet PS construction.

A wet caisson construction method is assumed for the new inlet PS structure; hence, it is not possible to excavate the shaft partially to reach the MTBM level and complete the tunnel drive before the completion of the shaft to its permanent depth with waterproof system fully installed. However, if an alternative shaft construction

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method is chosen this may become an option. The exact construction sequence should be specified during detailed design.

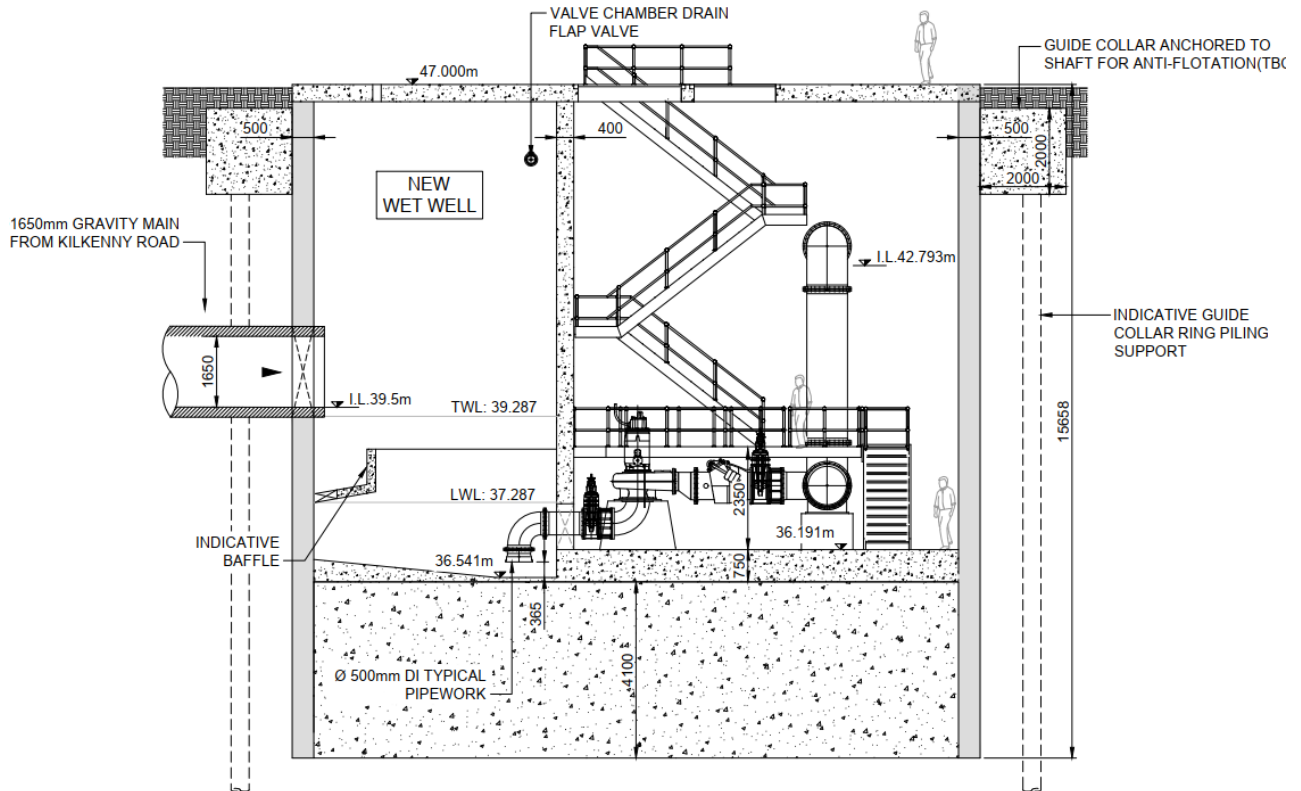


Figure 8 - New inlet works shaft at Mortarstown WWTP [4]

The use of Shaft F is required due to the constraints on the horizontal alignment resulting from the proposed bypass road junction and existing property boundaries to the east. Together, these inhibit a continuous linear tunnel alignment from Shaft E to the WWTP. Due to its proximity to the WWTP, Shaft F can be contained within the same compound site on land already owned by Uisce Éireann. Use of a full cut-and cover trenched connection into the new inlet PS has been considered unfavourable on account of the approx. 8 m depth of the tunnel at this location.

An indicative construction methodology relating only to construction of Shaft F and tunnel earth-retaining elements for the WWTP site is provided as below:

1. Construction of a jacking collar for hydraulic shaft sinking (or other preparatory work relevant to the chosen shaft construction).
2. Shaft excavation and segmental lining.
3. Installation of tremie concrete base seal.
4. Installation of jacking rig, thrust wall, MTBM and ancillary plant at Shaft F.
5. Lowering of pipe sections into the jacking rig during tunnel construction.

Indicative spatial requirements for the MTBM launch shaft site are outlined in Table 7 and shown in plan in Figure 9. These assumptions, based on the examples from other similar projects, have been used to determine the overall space requirements for the compound. Note that this is specific to the construction of the earth-

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retaining structures. It does not include any requirements for the construction of internal structures and space provision for mechanical/electrical/plumbing systems has been assumed.

There are existing buried utilities along this section of the pipeline route which will require either temporary or permanent diversion to facilitate construction.

Table 7 - Services contained within the new inlet PS and Shaft F launch site compound

Name	Approx. area (m ²)
Shafts and jacking collars	150
Crane movement area (1)	800
Pipe section and shaft segment storage (2)	500
Slurry and muck handling facilities (4)	500
Pumping plant and disposal outlet (7)	100
Power unit control station (8)	100
Lubrication mixing and injection plant (6)	200
General stores and workshop (5)	200
Services: electric, comms, water (9)	200
Spoil storage (3)	1000
Total site area incl. access routes and exclusion zones	5000

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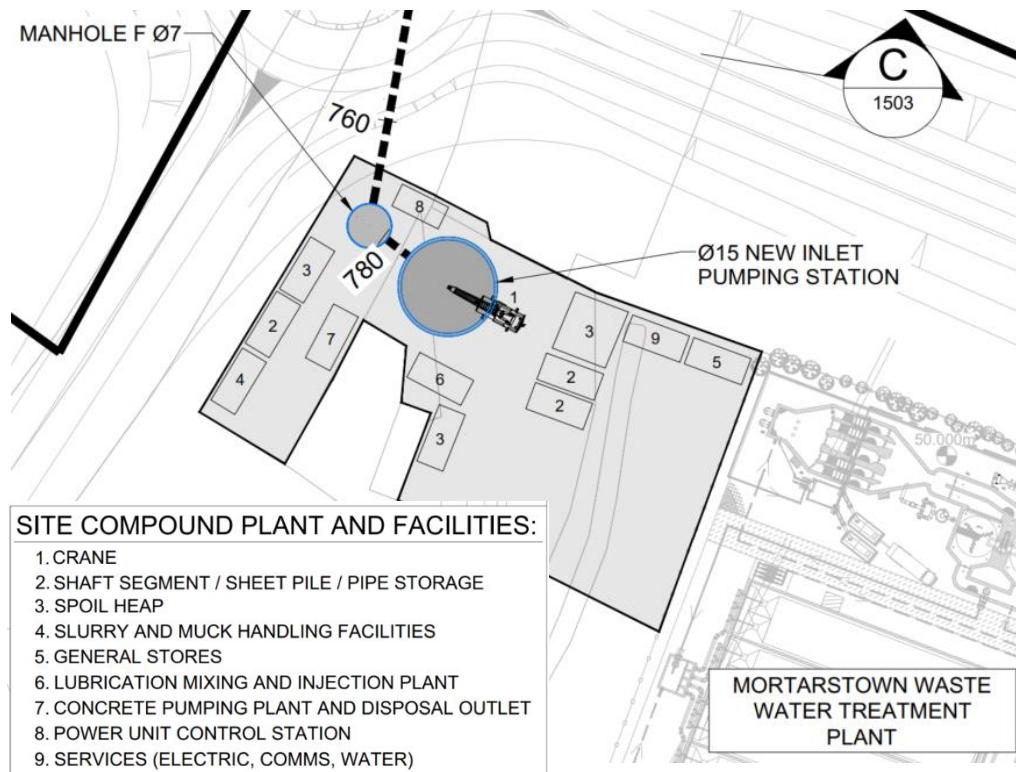


Figure 9 - Indicative plan arrangement at the new inlet PS / Shaft F site

5.2.2 Kilkenny Road Pumping Station

The following indicative activities are proposed at the existing KRPS site:

1. Driving of interlocking sheet piles on three sides. The fourth side will include support from the existing KRPS basement wall.*
2. Ground treatment below excavation depth to provide water cutoff
3. Pit excavation and soft eye installation.
4. Reception of the MTBM
5. Coring into existing wet well to form connection
6. Install pipe lengths and cast in-situ manhole shafts (x2).
7. Backfill trench and reinstate surface (leaving manhole cover access).

** Note: At this time, the nature of construction of the existing basement wall is unknown and will need to be determined to detail the connection between the temporary sheet piles as well as the breakthrough detail of the new pipe into the existing structure.*

Installation of soft-eye connection points is required to feed the pipeline into the existing wet well. A steel connecting pipe is proposed for this purpose.

Constraints on the horizontal alignment (in particular, the SAC) inhibit a continuous linear tunnel alignment from Shaft C to the KRPS connection point. Permanent manhole access needs to be maintained wherever a pipe bend is installed, meaning that two manholes are required for the proposed dog-leg alignment.

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A temporary trench excavation is proposed for reception of the 'C-B' MTBM drive and construction of the pipe connection into the existing KRPS wet well. The cut-and-cover method is proposed for the existing PS connection for the following reasons:

- Construction of this section of tunnel by manual tunnel digging beneath timber headings carries a greater safety risk than cut-and-cover construction.
- No existing utilities have been identified along this section of the pipeline route. This should be confirmed by the Contractor via a utility search.
- Sufficient space is required for extraction of the MTBM at this location. Use of an open trench allows for permanent manholes of only 5 m diameter to be installed, for inspection and maintenance access only.

The pipe invert is located approx. 6 m bgl at this location, meaning that a minimum excavation depth of 7 m has been assumed required. As shown in Figure 10, a short section of pipework requires installation within the trench to make the connection from the KRPS wet well chamber to the tunnelled gravity main. Construction of the manhole shafts is proposed as cast in-situ, as per Uisce Éireann requirements, and capped with precast slabs. Further detailing of the permanent access structures will be specified following agreement of the overall construction methodology. The outline arrangement currently proposed is shown in Figure 10, taken from 5161805_EWE_DR_MOR_5127.

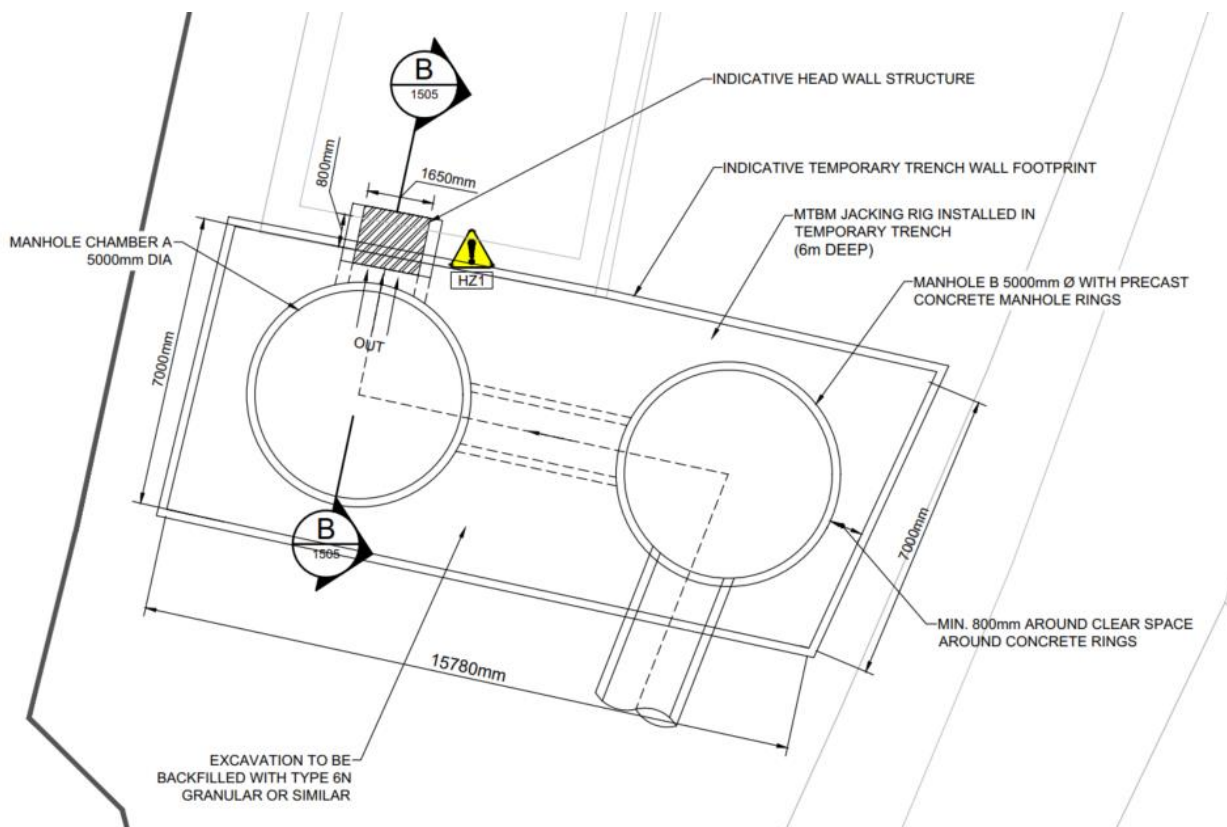


Figure 10 - KRPS proposed temporary trench arrangement plan

The low geological cohesion and a high groundwater table at this site are likely to require extensive prior ground treatment to mitigate the inherent construction risk.

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Typical space requirement for plant and services located at the KRPS trench site are indicated in Table 8. The proposed works site as shown in Figure 11 has been arranged to avoid the environmentally sensitive area to the south and west.

Table 8 - Services contained within the KRPS launch site compound

Name	Approx. area (m ²)
Excavated area and sheet piles	100
Crane movement area (1)	250
Pile storage (2)	200
Spoil heap (3)	500
General stores and workshop (5)	200
Lubrication mixing and injection plant (6)	100
Concrete pumping plant and disposal outlet	200
Services: electric, comms, water (9)	200
Total site area incl. access routes and exclusion zones	2500

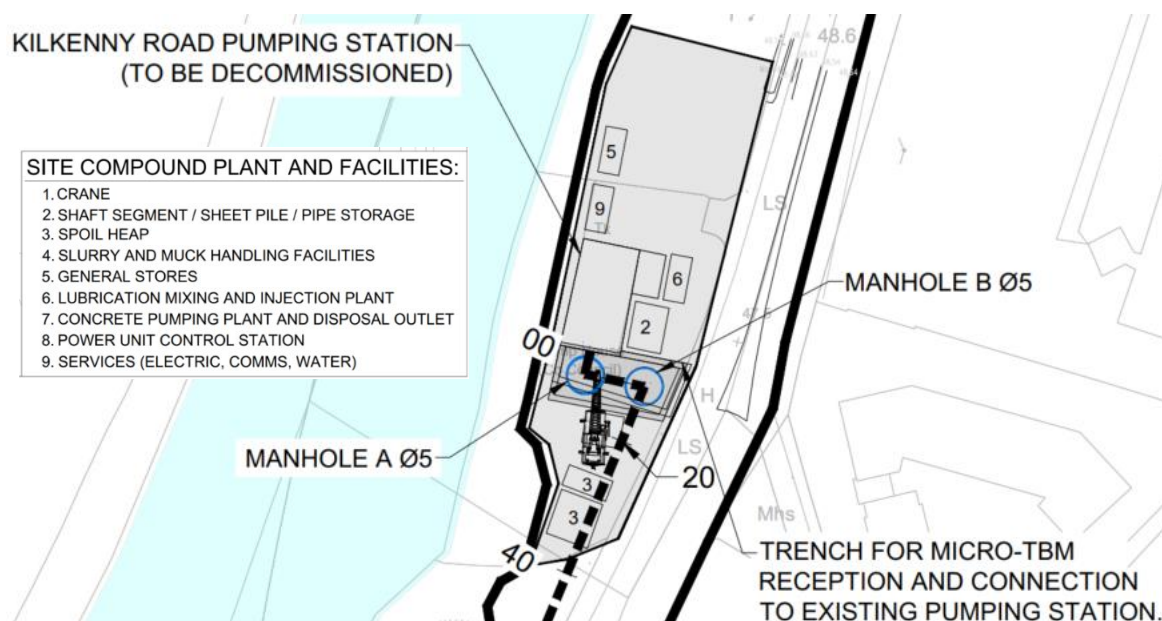


Figure 11 - Indicative plan arrangement at the KRPS trench excavation site.

To support the southwest wall of KRPS whilst the trench is open, temporary shoring is proposed in the form of waling beams. An example of this type of system is shown in Figure 12.

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Figure 12 – Sheet pile trench box with waling beams example

There is a potential for differential settlement between the new gravity sewer and the existing KRPS. Mitigation could be provided by installing a rocker pipe at the soft eye connection with relative pipe movements accounted for in the detailed design of waterproof joints.

5.2.3 Launch Shaft C

Shaft C, like Shaft F, is located at a proposed change in horizontal trajectory along the alignment. It is proposed to use both of these structures for launch of the MTBM to complete the tunnel drives in alternate directions.

To drive the tunnel between Shafts C and E, the former is proposed for installation of a jacking rig to launch the MTBM. This is the most suitable configuration due to the greater availability of space for an enlarged construction compound (for jacking pipe storage) around Shaft C.

The following activities have been assumed for wet caisson construction:

1. Construction of a jacking collar for hydraulic shaft sinking (or other preparatory work relevant to the chosen shaft construction).
2. Shaft excavation and segmental lining.
3. Installation of tremie concrete base seal.
4. Installation of MTBM jacking frame and thrust wall.
5. MTBM launch and first drive completion.
6. MTBM pipework disconnected and jacking frame rotated inside shaft.
7. Second MTBM drive completed.
8. Completion of permanent shaft base slab and any benching.

Figure 13 shows an indicative site layout for the MTBM launch site proposed at Shaft C. The arrangement of working and storage areas varies between each of the shaft sites due to the surface space constraints. It is proposed to site that all MTBM control and utility services to be arranged at the launch sites in order to

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minimise the space requirement at other intermediate shaft sites. Indicative space requirements for the reception shaft are listed in Table 9.

Table 9 - Services contained within the Shaft C site compound

Name	Approx. area (m ²)
Shaft and jacking collar	50
Gantry/crane movement area ¹ (1)	200
Pipe section storage (2)	150
Spoil heap (3)	200
General stores (5)	100
Services: electric, comms, water ² (9)	100
Slurry and muck handling facilities (4)	500
Lubrication mixing and injection plant (6)	200
Pumping plant and disposal outlet (7)	100
Power unit control station	100
Total site area incl. access routes and exclusion zones	2500

¹ Due to the constrained space onsite and the proximity to a live road lane, use of a gantry lifting system may be preferable to a standard swing-crane.

² A supply of water will be required at each site. If water mains supply is not available, water tankers access to the sites will be required.

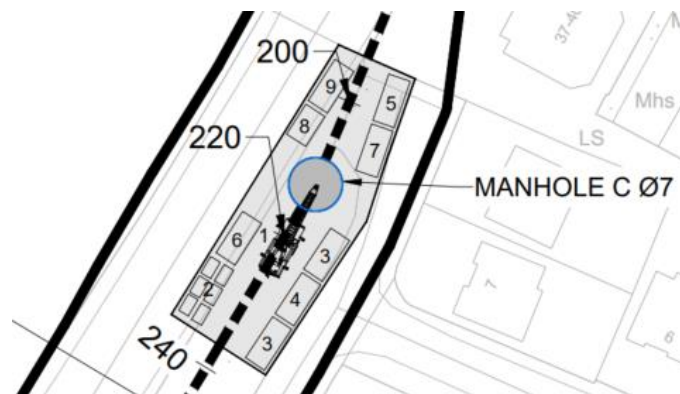


Figure 13 - Combined MTBM launch and reception site at Manhole C

5.2.4 Intermediate shafts

The space requirements for the compounds at Manholes D and E are less onerous than at the other sites, as there are fewer storage and service requirements for reception/intermediate shafts. The arrangement of working and storage areas varies between each of the shaft sites due to the surface space constraints. It is proposed to site all MTBM control and utility services at the launch sites in order to minimise the space requirement at the intermediate shaft sites.

TECHNICAL NOTE

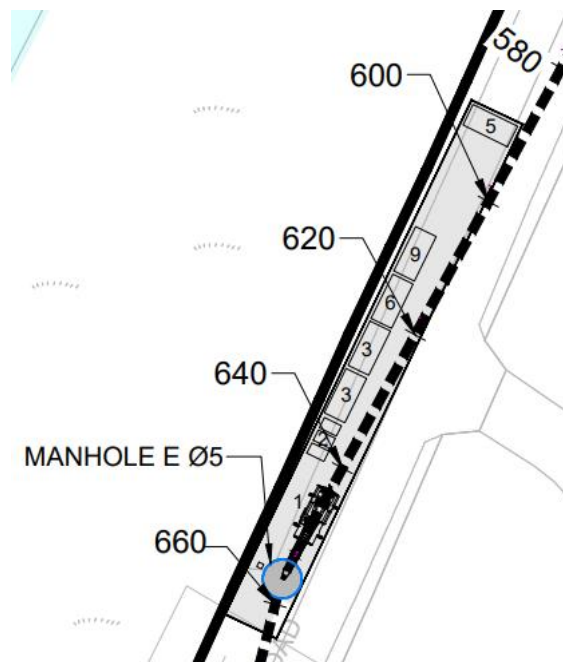


Figure 14 - Manhole E compound site indicative arrangement

Shaft D is not required for tunnel construction under this design but remains a requirement for inspection and maintenance access via a permanent manhole. Shaft construction prior to tunnelling is proposed as the preferred sequence, with the MTBM breaking through pre-installed soft-eyes to simplify the construction process and provide the opportunity to utilise these shafts for access during tunnelling for any maintenance and repairment. The site arrangement as shown in Figure 15 has been proposed according to a 7 m diameter manhole to facilitate the option to install intermediate jacking rigs, dependent on the jacking thrust requirements for the alignments as proposed. Alternatively, if the shaft is constructed after tunnelling has completed then there is an opportunity to reduce the manhole diameter to 5 m.

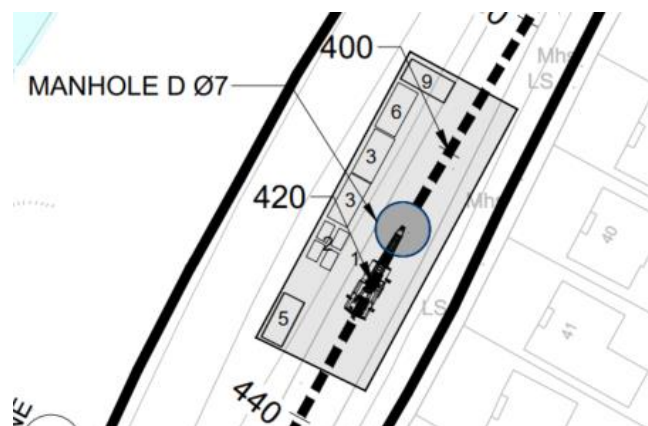


Figure 15 - Manhole D compound site indicative arrangement

5.2.5 Permanent manholes

The internal permanent structures to be installed within the KRPS trench are two manholes (A and B) with cut-and-cover pipe connection and an assumed steel connection into the existing pump station (see Figure 16 and

TECHNICAL NOTE

drawing no. 5161805_EWE_DR_MOR_5127). The proposed construction of the manhole shafts consisting of pre-cast caissons are required to be located at the alignment vertices in the trench. It is assumed that the trench will be backfilled upon completion of the tunnel and manholes to facilitate the removal of the sheet piles.

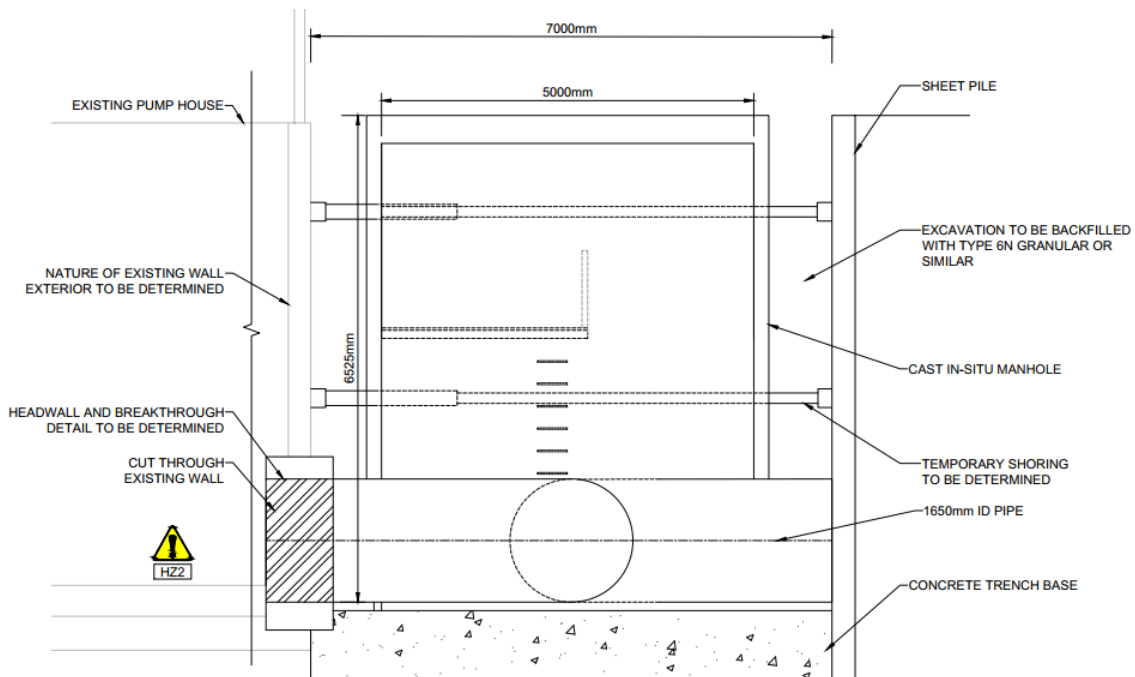


Figure 16 - Section showing proposed arrangement of Manhole A

Permanent manholes should also be installed inside Shafts C, D, E and F, with the proposed dimensions according to Table 6 and the Uisce Éireann standards. They should be capped and the original surface reinstated, leaving only the manhole access. Manholes are expected to be min. 675 x 675 mm to provide sufficient clear ladder access down to sewer invert level according to IW-CDS-5030-03. Where the sewer invert is greater than 6 m bgl, an intermediate landing platform should be installed between ladder runs.

Shaft bases should be benched to sewer invert level for maintenance of low flows and to aid inspections and maintenance. No allowance has been designed for installation of a sump or valve, as it is assumed that flow shall either drain to the pumping station or be controlled upstream of the gravity main. Based on a review of Uisce Éireann requirements for gravity mains, it has also been assumed that no specific provision for air ventilation is required for reference design considerations.

During detailed design, the cover of Manhole E should be specified to support regular vehicular loading as it is positioned within a cycle lane adjacent to the main carriageway. Similarly, Manhole F is located below an access road which is assumed to remain in regular use for traffic. This is expected to increase the thickness of the cover slab and access hatch. At Manholes A to D and F, regular vehicular loading is unlikely to be encountered. Covers should be designed to withstand potential explosions in case of ignition of methane from the wastewater system.

Space provision has been provided for installation of a second access point per manhole, if required for emergency access in accordance with Uisce Éireann's Access Strategy. Other operational emergency provisions that are recommended for installation at all shafts include a safety chain and stopboard.

TECHNICAL NOTE

6. Construction risks

The hazards identified within the risk assessment have been assigned a risk rating. Ratings have also been assigned for any control measures which are currently in place and any further control measures which will be required. A value for the likelihood of an incident occurring based on the hazard from 1 to 5 and a value for the severity / impact of the hazard from 1 to 5 have been assigned. The risk score for a hazard causing harm is calculated as likelihood x severity (or impact).

SEVERITY or IMPACT (S)	5 CATASTROPHIC	5	10	15	20	25
	4 MAJOR	4	8	12	16	20
	3 SERIOUS	3	6	9	12	15
	2 MODERATE	2	4	6	8	10
	1 MINOR	1	2	3	4	5
		1 RARE	2 UNLIKELY	3 POSSIBLE	4 LIKELY	5 ALMOST CERTAIN
		LIKELIHOOD (L)				

Risk score (R)

High – rating 15 or more

Further action is essential to control and/or lower the level of risk.
Exposure to the identified hazard is prohibited or severely restricted

Medium – rating 8 to 12

Requires review of the equipment, activities, system of work within the workplace with the aim of lowering the risk to the next level.

Low – rating 1 to 6

Usually, no further action will be required except for monitoring to ensure the risk does not change and controls remain in place.
However, if it is possible to reduce the risk levels still further, by using controls that are “reasonably practicable”, then this should be done.

TECHNICAL NOTE

Table 10 - Design risks

Ref	Construction Risk	L	S	R	Response/Control Measure	L	S	R
1	MTBM launch operations at KRPS may be restricted by medium voltage overhead lines.	5	4	20	While height restriction may be required, it is recommended to conduct a site survey before construction begins to confirm if the medium voltage overhead line may impose any potential risk to the construction process. If so then utility diversion may need consideration.	1	4	4
2	Reception shaft construction operations may be restricted by medium voltage overhead lines.	4	4	16	While height restriction may be required, it is recommended to conduct a site survey before construction begins to confirm if the medium voltage overhead line may impose any potential risk to the construction process. If so then utility diversion may need consideration.	1	4	4
3	Clashes with known underground utilities	5	2	10	Utilities to be diverted away from shaft construction locations. Predominantly a requirement at the location of Manholes E and F.	5	1	5
4	Clashes with underground utilities or service foundations of unknown elevation.	3	5	15	The exact location and depth of all Gas Network Ireland underground utilities and ESB underground cables should be confirmed before construction. If an unforeseen clash is encountered during construction, further utility diversion may be required.	1	3	3
5	Encountering larger boulders (>400 mm) during tunnel boring	4	4	16	Suitability of the vertical alignment to be confirmed against further GI. Choice of tunnelling method to consider the risk of larger (>400 mm) boulders.	3	3	9

TECHNICAL NOTE

Ref	Construction Risk	L	S	R	Response/Control Measure	L	S	R
6	Encountering boulders during shaft sinking	5	4	20	Shaft construction via the wet segmental caisson method should allow for any boulders encountered during the sinking process to be excavated.	5	2	10
7	Groundwater ingress through shaft base during construction.	5	4	20	Temporary sealing of excavation base should be implemented during construction. Proposed construction methodologies involve pre-installation of impermeable shaft walls (e.g., sheet piles) prior to excavation. The base of the excavation is to be sealed either prior to excavation (i.e. pre-installed ground treatment below the excavation level e.g., jet grouting, permeation grouting or neutrogel) or after underwater excavation using a tremie concrete placed plug. Dewatering pumping may also be considered, however based on current understanding of the ground conditions this is unlikely to be a sufficient measure to achieve a dry excavation on its own.	2	2	4
8	Uplift of shaft base	3	3	9	Shear connection to be provided between base slab and shaft walls. Uplift checks to be conducted during detailed design.	2	2	4
9	Ground movement and settlement impacting the road and/or nearby buildings	4	4	16	Ground settlement and its impact on assets to be assessed during detailed design. Monitoring and protection measures (inclinometers, extensometers, piezometers, monitoring targets) to be implemented if required. Horizontal alignment has been set to avoid property boundaries.	2	4	8
10	Unforeseen ground conditions	4	4	16	A more comprehensive ground investigation utilizing methods such as borehole or rotary core sampling is recommended along the tunnel alignment. This will provide a better understanding of the soil condition in this area and help mitigate the potential for unforeseen soil conditions.	3	2	6

TECHNICAL NOTE

Ref	Construction Risk	L	S	R	Response/Control Measure	L	S	R
11	Excavations encountering underground utilities of unknown depth.	4	4	16	Underground utilities should be confirmed on site using techniques such as ground penetrating radar and / or exploratory excavations prior to commencing shaft and tunnel construction. This includes confirmation of the utility type, size and horizontal and vertical alignment.	2	3	6
12	Vehicle collision	3	5	15	Lane closure with physical barriers to entry is proposed to prevent any form of road accident into the deep excavation along the road. Exclusion zone to extend 1 m from shafts in all directions. Reduced speed limit (ideally 30 km/h) to be enforced where works occupy part of the main road.	2	3	6
13	Sinkholes	3	4	12	Loose cohesionless ground at the tunnel face extending to the ground surface represents a risk for uncontrolled face collapse and a sink hole developing. This risk of this occurring can be reduced by vigilance during construction, maintaining slurry pressure and continuously monitoring excavation volumes passing through the machine. Surface watch when MTBM is passing critical locations (e.g. under roads) may also severity of impact by enable fast mitigative reaction (e.g. stop traffic). Risk assessment and emergency action plan to be developed during construction planning.	2	3	6
14	Damage to the Special Area of Conservation (SAC)	4	3	12	The red line envelope has been set to exclude tunnelling underneath this area. Contractor to ensure measures such as fixed hoardings and impermeable barriers are installed to prevent impingement on the SAC.	2	3	6
15	Unknown construction of the KRPS basement structure	3	4	12	A comprehensive records source check and/or additional trial pits investigations required to confirm the nature of the construction of the original KRPS basement structure and the nature and likelihood of any temporary support	2	3	6

TECHNICAL NOTE

Ref	Construction Risk	L	S	R	Response/Control Measure	L	S	R
					measures left in the ground on the outside face. Such detail will be important for ensuring an adequate seal between the temporary excavation support for the new construction and the existing structure as well as appropriately planning the adjacent excavation and breakthrough works into the existing wet well.			
16	Vibration and progressive load imposition from MTBM on granular soil causing vertical tilting of the MTBM trajectory.	3	3	9	Ground treatment should be considered behind the launch/reception shaft eyes to reinforce the soil against vibrational or differential loading deformation.	2	2	4
17	Pipe jack construction program at risk of delay due to non-continuous working schedule and/or noise limit hours	3	2	6	To be confirmed or agreed with local and environmental authorities.	2	2	4
18	Visual/reputational impact of slurry leakage impacting the SAC/river	3	2	6	Option for use of and EPB MTBM outlined. Alignment set to avoid tunnelling beneath the SAC.	2	1	2
19	Damage to tunnel caused by subsequent construction of intermediate shaft for Manhole D.	4	2	8	Contractor agreement on the preferred approach to be sought. Reference design considers pre-installation of all intermediate shafts as beneficial in facilitating tunnel access during construction and potential use for intermediate jacking stations.	2	2	4

7. Conclusion

A horizontal tunnel alignment has been proposed based on a review of constraints between the KRPS and Mortarstown WWTP sites and an assessment of construction method compatibility. The main constraints were identified as Kilkenny Rd, the SAC adjacent to the River Barrow, and the properties along Southern Gardens. Avoidance of the jacking rig installation beneath the road has been prioritised. However, installation of a construction shaft within the road has been determined to be unavoidable based on the currently imposed constraints. The vertical tunnel alignment is set by the constraints of the hydraulic design.

The proposed design utilises a trench adjacent to KRPS with two intermediate shafts for MTBM launch, for tunnel construction via three main pipe jacking drives plus a short drive into the WWTP wet well. An additional intermediate shaft is required for housing of a permanent access manhole. Contractor involvement is required to assure the compatibility of these shafts' connections with the tunnel, dependent on the construction sequence selected. Detailed design should be undertaken to confirm that the required jacking forces are achievable with the proposed alignment and working spaces.

The key outcomes for further engagement are:

- Single lane closure of Kilkenny Road is required for the construction of Manholes C, D and E. This will require liaison with the road authority to arrange and understand any limitations on the allowable duration or extent of closure.
- Manholes E and F, which have been located to avoid tunnelling beneath private property, are situated adjacent to the site earmarked for construction of the southern relief road junction. Any modification to the currently planned arrangement of this road construction should be communicated to ensure that this does not result in a clash with the proposed manhole construction.
- The suitability of maintenance access shaft spacing of up to 240 m should be confirmed and agreed upon by Uisce Éireann.
- Diversion of utilities will be required where these clash with the shaft locations alignment as shown in 5161805_EWE_DR_MOR_5520 to 5524. The detailed tunnel design should consider the wayleave and allowable settlement requirements of each utility owner.

In order to improve the understanding of geological risks associated with the tunnel and shaft construction, it is recommended that further ground investigation shall be carried out along the proposed sewer alignment. This should aim to increase the extent of borehole data available across the site, improve the ground risks management strategy and reduce the likelihood of encountering unexpected underground obstacles. The GI should:

- Improve the understanding of the groundwater conditions at the site to inform the development of a safe ground treatment or shaft dewatering strategy, as well as to aid the choice of MTBM.
- Confirm the expected depths, distribution and size of the boulders/cobbles along the tunnel alignment, to fully understand the potential risks to construction arising from the large boulders (greater than one third of the tunnel outer diameter).
- Be scoped appropriately and consider the potentials of using geophysical techniques to support the intrusive ground investigation where there is a risk of encountering obstructions may lead to boreholes refusal.

The full tunnel specimen design drawings set is included in Appendix E of the SID Engineering Report.

8. References

- [1] AtkinsRealis, "Kilkenny Road Pumping Station to Mortarstown Wastewater Treatment Works: Tunnel Option Review," 2023.
- [2] Uisce Éireann, "IW-TEC-800-01 Technical Standard: Wastewater Gravity Sewers," 2018.
- [3] Uisce Éireann, "IW-CDS-5030-03 Code of Practice for Wastewater Infrastructure," 2020.
- [4] AtkinsRéalais, *5161805_EWE_DR_MOR_1150_I_Rev01 Mortarstown WWTP Upgrade Proposed Inlet Pumping Station*, Dublin, 2024.
- [5] Priority Geotechnical, "CIP Lot 5 - Mortarstown, Site Investigation - Factual Report," Dublin, 2022.
- [6] Pipe Jacking Association, "Pipejacking design guidance for CDM duty holders," 2024.
- [7] Pipe Jacking Association, "An introduction to pipe jacking and microtunnelling," 2017.
- [8] Herrenknecht, "AVN1200TB - AVN1800TB Pipe Jacking," Schwanau, 2022.
- [9] Atkins, "Mortarstown Waste Water Treatment Plant & Kilkenny Road Pumping Station: Utility Services Report," Galway, 2019.

Appendix E. Drawings



Appendix F. Asbestos Report



ASBESTOS REFURBISHMENT SURVEY REPORT

Of

Carlow WWTP

Mortarstown

Carlow

Co. Carlow

On behalf of

Irish Water

Unit 2BeaT Centre,
Stephenstown Industrial Estate,
Balbriggan, Co. Dublin
Tel: (01) 6905907
Fax: (01) 8020439
Email: info@ohss.ie
Website: www.ohss.ie

Directors: Deirdre Corry, Keith Foran **Company Reg no:** 354843

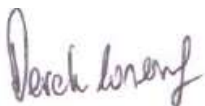


Project Number

24535

DOCUMENT CONTROL

Client	Irish Water
Project Title	24535 Carlow WWTP Asbestos Survey
Document Title	Asbestos Refurbishment Report
Report No.	24535

Rev	Status	Author(s)	Revision History	Approved By	Issue Date
D01	Final	 Derek Conerney	Initial Release to Client	 Paul Foran	11 th July 2018

Contents

1. Executive summary
2. Scope of the project
3. General site and survey information
4. Conclusions and actions
5. Survey results

1 EXECUTIVE SUMMARY

OHSS carried out an asbestos survey to HSG264 requirements for the purposes of identifying asbestos containing materials in the premises(s) prior to the refurbishment of the area. It should be noted that this survey only includes areas within the scope of the survey and should not be read as an extensive assessment of all possible asbestos containing materials (ACMs) in the premises.

The findings of this survey are contained within the summary tables and risk assessment in the results section of this report.

Summary of Findings

Following the site survey and analysis of collected samples the following asbestos containing materials were identified in **Carlow (Mortarstown) Waste Water Treatment Plant**;

- Asbestos containing floor tiles and bitumen located within the administration office and laboratory in the control building
- Asbestos containing bitumen pads to underside of canteen sink unit in control building
- Asbestos containing lining to penstock gates throughout the inlet works
- Asbestos containing lining to penstock gates throughout the FDC Chambers #1 to #4
- Presumed asbestos containing lining to penstock gates throughout the outlet chamber area
- Asbestos containing mastic to expansion joints in Aeration Tanks #1 to #4
- Presumed asbestos containing mastic to all older concrete tanks, chambers, vessels throughout the site
- Presumed asbestos containing pipe work to the storm tank and outlet chamber area
- Presumed asbestos cement pipes throughout underground areas of the site

Recommendations

The identified asbestos containing materials are intact and in use. This report recommends that the asbestos containing materials are removed in advance of any refurbishment or demolition works. Asbestos containing materials should only be removed by a competent contractor.

Areas Not Accessible

Any area found to be inaccessible during the site survey is listed within the incomplete access section of this report. Areas not accessed are presumed asbestos containing.

Areas of particular concern where asbestos containing materials are likely to be encountered include;

- Chambers where penstock gates are in use
- Buried or hidden asbestos cement pipes
- Live services and equipment

The survey undertaken complies with the legal duty to identify the presence of asbestos containing materials and carryout a risk assessment in respect of these materials at the premises.

The risk assessment will form part of the overall safety management system for the contractor carrying out any asbestos works. The results of the risk assessment must be communicated to the employees and made available to them. This report may be used by the Project Supervisor for Design Process and the designers to highlight the presence of asbestos containing materials found in the buildings.

Where following the refurbishment work, asbestos containing materials remain in situ it may be necessary to undertake a management survey of the areas.

While every effort has been taken to ensure the accuracy of this report OHSS do not accept responsibility for any omissions or areas of the building not addressed in the report. This report is intended to assist in reducing the possibility of accidents and ill health by bringing to the client's attention identified asbestos containing materials. Within the constraints of time and resources every effort has been made to identify ACM's. It is not implied that all other hazards are under control at the time of inspections.

THIS REPORT SHOULD BE READ IN ITS ENTIRETY AND SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF OHSS AND THE CLIENT.

Questions arising from the survey report should be directed, in the first instance, to the author of this report, who will clarify any technical issues raised.

Further information on previous surveys should be sought from the client.

1.1.1 ABBREVIATIONS

Throughout the report the following terms and abbreviations may be used:

ACM	Asbestos containing material.
AND	Asbestos not detected.
MMMF	This describes any machine made mineral fibre, fibreglass, Rockwool, ceramic fibres and other such material.
MA	Material Assessment Score as defined in HSG264 relates to the friability of the product. It is used to indicate the level of risk posed by the product
AIB	Asbestos Insulating Board.
AC	Asbestos Cement
Chrysotile	Commonly known as white asbestos.
Amosite	Commonly known as brown asbestos.
Crocidolite	Commonly known as blue asbestos.
Amphibole	Generic name for all asbestos types, excluding Chrysotile.
BOHS	British Occupational Hygiene Society
INAB	Irish National Accreditation Board

2 SCOPE OF WORK

2.1 GENERAL

The scope of the survey included;

Refurbishment asbestos survey of all safely accessible and visible areas. No access to confined spaces, tanks, vessels, underground areas or live electrical equipment.

The purpose of the survey is to identify and risk assess asbestos containing materials (ACM's) in the premises or area where planned refurbishment works are to take place. The survey aims to provide sufficient information for designers and the project supervisor for design process to take account of identified asbestos risks. The design team must take account of known locations where ACM's are identified and plan to eliminate the risk or prevent exposure to asbestos during the construction phase. Asbestos is a particular risk within the definitions of "particular risk" in the Safety Health and Welfare at Work (Construction) Regulations 2013 and should be highlighted in the design risk assessments accompanying the Preliminary Safety and Health Plan.

The surveyor undertook as far as reasonably practicable to, record the location, extent and product type of any presumed or known ACMs. All areas identified in the survey were inspected and the information recorded on the accessibility, condition and surface treatment of any presumed or known ACMs. The asbestos type was identified either by collecting representative samples of suspect materials for laboratory identification, or by making a presumption based on the product type and its appearance or previous sampling of similar products..

2.2 BUILDING DETAILS AND CONSTRUCTION TYPE

Carlow WWTP comprises four buildings (control room, press building, compressor building and ESB building). There are three large circular tanks (storm and 2 x clarifier) and a large rectangular tank (aeration). Overall construction is of concrete, block work and brick. The plant was constructed in the early 1980's however some refurbishment and new build works have been completed in recent times.

3 GENERAL SITE AND SURVEY INFORMATION

Client Details: Irish Water

Client Address: Irish Water
24-26 Talbot St
Dublin 1

Site Address: Carlow Waste Water Treatment Plant
Mortarstown
Carlow
Co. Carlow

Commissioned By: Martin Ryan

Surveyor: Derek Conerney

Staff Consulted during the survey Site Caretaker

Date of Survey: 26th June 2018

Date of Report: 11th July 2018

Description of the Areas Surveyed: All safely accessible and visible areas

Excluded Areas: As per the clients requirements the following areas were not accessed;

Plant live and in operation, no access into live equipment, tanks, vessels, confined spaces or underground / hidden areas.

Survey Methodology:

Onsite inspection bulk sampling and risk assessment were conducted in accordance with OHSS documented in-house work instructions.

Analysis of asbestos fibres in bulk materials is carried out at the OHSS laboratory. OHSS is accredited by INAB and meet the requirements of International Standard BS EN ISO/IEC 17025 for the sampling and analysis of asbestos fibres in bulk materials.

The surveyor conducted a systematic inspection of the nominated areas. Where access for sampling purposes was not possible, a visual assessment has been made if possible. For similar/repetitive elements, a representative bulk sampling protocol has been adopted following visual examination and assessment.

Bulk Samples were obtained using fibre suppression techniques in order to minimise respirable fibre release. Each sample was double bagged, uniquely labelled on site and then returned to the laboratory for analysis using plane and polarised light microscopy and dispersion staining techniques as defined in UK HSE Guidelines HSG248 and the OHSS documented in-house work instructions.

The results of the survey together with the laboratory bulk sample analysis records are given in further sections to this report.

The Safety Health and Welfare at Work (Exposure to Asbestos) Regulations 2006-2010 allows materials to be 'presumed' to contain asbestos. Therefore in the asbestos survey, materials can be presumed to contain asbestos.

There are two levels of 'presumption':

1. **Strongly presumed:** in this case the material looks as if it is an ACM, or that it might contain asbestos. This conclusion can be reached through visual inspection alone by an experienced, well-trained surveyor, familiar with the range of asbestos products. Examples of 'strong

presumption' are:

- where laboratory analysis has confirmed the presence of asbestos in a similar construction material;
- materials in which asbestos is known to have been commonly used in the manufactured product at the time of installation (eg corrugated cement roof and wall sheeting, cement gutters and drainpipes, cement water tanks, ceiling tiles, insulating boards);
- materials which have the appearance of asbestos but no sample has been taken, eg thermal insulation on a pipe where fibres are clearly visible
- where the laboratory has sampled the same material in a different location and subsequent laboratory analysis has found that it does not contain asbestos.

2. **Presumed:** is the 'default' situation where a material is **presumed** to contain asbestos because there is insufficient evidence (eg no analysis) to confirm that it is asbestos free, or where a surveyor decides that it is easier under the planned management arrangements to presume certain materials contain asbestos. Many non-asbestos materials will also be presumed to contain asbestos using this system.

There is a further default situation where materials must be **presumed** to contain asbestos. **The default applies to areas which cannot be accessed or inspected. In this situation any area not accessed or inspected must be presumed to contain asbestos, unless there is strong evidence that it does not.**

The risk assessment process (also known as risk algorithms) designed by HSE, allow asbestos containing materials to be ranked according to a Material Assessment algorithm and the HSE have related the scores obtained in the Materials

Assessment algorithms in HSG 264 to a number of risk categories that may be used to guide the employers as to the best course of action to take to mitigate the risk. These are further explained in our risk assessment sheets contained within this report.

These scores can then be ranked and so decisions can be taken as to what actions are required to control the risks from asbestos containing materials during refurbishment.

4 CONCLUSIONS AND ACTIONS

Where asbestos containing materials were identified in the survey recommendations are provided in the asbestos register and risk assessments. A further explanation of the terms used in the management of asbestos containing materials risks are given below.

Asbestos is a known human carcinogen (cancer causing agent) that was used extensively in Ireland up to 2000 when it was finally banned from use. Asbestos fibres may cause fatal lung disease when inhaled. These diseases are not sudden and may take many years to develop from the first exposures. **Asbestos containing materials constitute a particular risk within the meaning of the Safety Health and Welfare at Work (Construction) Regulations 2013 and should be addressed in the Preliminary Health and Safety Plan by the designers and the Project Supervisor Design Process.**

Asbestos is a fibrous material and has excellent insulating and fire resistant properties. Asbestos was seldom used as pure asbestos fibres but rather combined with other products to add strength and stability or fire resistance to them. Asbestos may be found in products from a few percent up to 90% depending on the type of material.

Asbestos is a hazard to humans but the risks posed by asbestos containing materials (ACM) will depend on the type of ACM found. In simple terms where asbestos products are flaky and would crumble under hand pressure quite easily they are termed friable. The more friable the ACM the more risk there is to the individual handling the material. This is reflected in the material assessment scores in the risk assessments

No person is permitted to work with asbestos containing materials unless they have received training and have taken all reasonable steps to prevent exposure to asbestos. The requirement for training is detailed in Regulation 17 of the Safety Health and Welfare at Work (Exposure to Asbestos) Regulations, 2006-2010

4.1 REFURBISHMENT OPTIONS

ACM are found in many industrial buildings, hospitals, schools and homes. These materials were installed before 2000 with the peak period for installation occurring from the 1970's to the late 1980's. ACM's installed some 20-30 years ago will vary in condition depending on the type of product and the use of that product. The Safety health and Welfare at Work (Exposure to Asbestos) Regulations 2006-2010 requires a managed approach to asbestos containing materials in workplaces. These regulations require employers to identify the presence of asbestos containing materials and to assess the risk posed to workers by these

ACM's based on the likely work activities and the potential for these work activities to disturb ACM's.

The outcome of these risk assessments are as follows;

1. Manage in place & monitor periodically

Where ACM's are in good condition and pose minimal risk to building occupants or maintenance personnel and are not likely to be disturbed during refurbishment work it is recommended that they remain in situ and are monitored on a regular basis as to their condition. The frequency of monitoring is usually every 6 months but this should be determined by the asbestos management plan.

2. Encapsulate and manage in place

ACM's that are damaged but repairable can be repaired by a competent trained contractor and then managed in place. Where the repairs involve containing the ACM's behind a protective material (Encapsulation) it is important that the original ACM and the new surfaces are labelled as to the presence of ACM's. Following encapsulation of the asbestos containing materials a site clearance for re-occupation certificate must be obtained from a competent independent analyst prior to re-occupancy of the area in accordance with **Regulation 15 (10) of the Safety Health and Welfare at Work (Exposure to Asbestos) Regulations 2006-2010.**

3. Environmental clean

Where there is debris from the installed ACM's in the surrounding area it may be recommended that this material is removed by environmentally cleaning the area around the materials. Following removal of the asbestos containing materials a site clearance for re-occupation certificate must be obtained from a competent independent analyst prior to re-occupancy of the area in accordance with **Regulation 15 (10) of the Safety Health and Welfare at Work (Exposure to Asbestos) Regulations 2006-2010..** The materials can then be managed in place as above.

4. Remove

Where ACM's are found to have reached the end of their serviceable life and the presence of the material in the work area may lead to increased human exposure it may be necessary to remove the ACMs. ACM removal will form part of a construction project and will require careful coordination to be carried out safely. Following removal of the asbestos containing materials a site clearance for re-occupation certificate must be obtained from a competent independent analyst prior to re-occupancy of the area in

accordance with **Regulation 15 (10) of the Safety Health and Welfare at Work (Exposure to Asbestos) Regulations 2006-2010.**

5. Restrict access

Where ACM's are found to have reached the end of their serviceable life and the presence of the materials in the work area may lead to increased human exposure it may be necessary to restrict access to areas where the ACMs are located pending removal. Where access is restricted it is advisable to have a permit to work system in place to control all work activities in the area. Removal or encapsulation will be required prior to the area being returned to normal occupancy.

4.2 MATERIALS ASSESSMENT SCORING

4.2.1 ASBESTOS RISK ASSESSMENT

Employers are required under the Safety Health and Welfare at Work (Exposure to Asbestos) Regulations 2006-2010 to identify if asbestos containing materials are present in the workplace and to perform a risk assessment. The risk posed by asbestos is determined by the current and potential level of employee exposure to asbestos fibres. The following parameters are used in developing a risk assessment for asbestos containing materials;

4.2.2 ASBESTOS TYPE

There are six regulated types of asbestos. The common names associated with some of the asbestos types are shown in brackets below;

- Crocidolite (Blue Asbestos)
- Amosite (Brown Asbestos)
- Actinolite
- Anthophyllite
- Tremolite
- Chrysotile (White Asbestos)

International studies have identified that they have different potential to cause harm. Crocidolite is the most dangerous and Chrysotile the least.

4.2.3 SURFACE TREATMENT

Surface treatment is a term used to describe how the fibres in the material are protected from release. The safest materials are composites such as cement and plastic where the fibres are contained within a material within a strong matrix. At the other end of the scale are materials

that damage easily and have no protective coating such as sprayed asbestos and boiler lagging.

4.2.4 FRIABILITY

Products that damage easily such as sprayed asbestos are clearly more likely to release fibres than strong materials such as cement. This 'likelihood of fibre release' or crumbliness is commonly referred to as friability. Materials with high friability (such as insulation) are higher risk than those with low friability (such as vinyl floor tiles).

4.2.5 CONDITION

Products which are damaged are more likely to release fibres than those in good condition and are ranked according to the extent of damage observed.

4.3 CALCULATING RISK ASSESSMENTS

The HSE developed a risk assessment process within HSG264 which takes these four factors into account and attributes values to each of the factors allowing you to calculate a material risk assessment.

4.3.1 MATERIAL ASSESSMENT ALGORITHM

The material assessment algorithm is commonly used by most surveying organisations to give an indication of how dangerous a material is. Each of the four risk factors (friability, condition, surface treatment and asbestos type) are attributed a score of between 0 and 3 (see below). These scores are accumulated to give a risk score of between 0 and 12 (where 12 is the highest risk).

When using this algorithm it is commonly accepted that materials can be divided into the following risk groups;

Material Risk Rating	Description
10-12	High risk
7-9	Medium risk
5-6	Low risk
2-4	Very low risk

These are colour coded within our risk assessment as outlined above.

4.3.2 HSG264 MATERIAL ASSESSMENT TABLE

Sample Variable	Score	Example of Score
Product type (or debris from product)	1	Asbestos reinforced composites (Plastics, resins, mastics, roofing felts, vinyl floor tiles, semi-rigid paints or decorative finishes, asbestos cement etc)
	2	Asbestos insulation board, mill boards, other low density boards, asbestos textiles, gaskets, ropes and woven textiles, asbestos paper and felt
	3	Thermal insulation (pipe and boiler lagging), Sprayed Asbestos, loose asbestos, asbestos mattresses and packing
Extent of damage / deterioration	0	Good condition: no visible damage
	1	Low Damage: a few scratches or surface marks; broken edges on boards, tiles etc
	2	Medium damage; significant breakage of materials or several small areas where material has been damaged revealing loose asbestos fibres
	3	High damage or delamination of materials, sprays or insulation. Visible asbestos debris
Surface Treatment	0	Composite materials containing asbestos: reinforced plastics, resins, vinyl tiles
	1	Enclosed sprays and lagging, AIB (with exposed face painted or encapsulated), asbestos cement sheets
	2	Unsealed AIB, or encapsulated lagging and sprays
	3	Unsealed lagging and sprays
Asbestos Type	1	Chrysotile
	2	Amphibole asbestos excluding crocidolite
	3	Crocidolite

4.4 REFERENCES

Safety Health and Welfare at Work Act 2005

Safety Health and Welfare at Work (Exposure to Asbestos) Regulations 2006-2010

Safety Health and Welfare at Work (Construction) Regulations 2013

HSG264 The Survey Guide, HSE Books

HSG248 The Analysts Guide, HSE Books

HSG247 The Contractors Guide, HSE Books

5 SURVEY RESULTS



Survey Results

Unit 2BeaT Centre,
Stephenstown Industrial Estate,
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Tel: (01) 6905907
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Directors: Deirdre Corry, Paul Foran BA(Mod), MSc., MA, Dip Env. Eng., Dip Mgt., MIOSH, ROH **Company Reg no:** 354843



Customer Site
Survey Date
Valid Until
Commissioned by

Irish Water
 Carlow WWTP
 26/6/2018
 26/6/2019
 Martin Ryan

Type
Report Number
Surveyor
Review Date
Method

Refurbishment
 24535
 Derek Conerney
 26/6/2019
 WI-02 & WI-03



ACM REGISTER

The following areas were found to contain ACM's

Risk Assessment		297528	Location	RA:297528 Aeration Basins, Clarifiers, Tanks Construction Expansion Joints in Concrete						
Notes:		ALL expansion joints with mastic / putty should be presumed asbestos containing								
Type of Product	Quantity	Accessibility	Condition	Surface Treatment	Asbestos Type	Sample No.	Confirmation	MA	PA	Action
Putty	--N\A--	--N\A--	Low Damage	Composite materials containing asbestos	Chrysotile	as sample DKB20180626007	Strongly Presumed	3	3	Priority 1 : Remove ACM's Prior to Refurbishment or Demolition.

Risk Assessment	295177	Location	RA:295177 Outlet Chamber Area Construction Pipe Work							
Notes:	Cement pipe innputlet chamber, no access to sample									
Type of Product	Quantity	Accessibility	Condition	Surface Treatment	Asbestos Type	Sample No.	Confirmation	MA	PA	Action
Asbestos Cement	--N\A--	--N\A--	Low Damage	Composite materials containing asbestos	Chrysotile		Presumed	3	3	Priority 1 : Remove ACM's Prior to Refurbishment or Demolition.

Risk Assessment		295178	Location	RA:295178 Outlet Chamber Area Construction Penstock Gates						
Notes:		Cement lining to gates as sampled								
Type of Product	Quantity	Accessibility	Condition	Surface Treatment	Asbestos Type	Sample No.	Confirmation	MA	PA	Action
Asbestos Cement	--N\A--	--N\A--	Low Damage	Composite materials containing asbestos	Chrysotile	as samples	Strongly presumed	3	3	Priority 1 : Remove ACM's Prior to Refurbishment or Demolition.

Risk Assessment	295179	Location	RA:295179 Outlet Chamber Area Construction Pipe Work							
Notes:	Cement pipe in chamber									
Type of Product	Quantity	Accessibility	Condition	Surface Treatment	Asbestos Type	Sample No.	Confirmation	MA	PA	Action
Asbestos Cement	--N\A--	--N\A--	Low Damage	Composite materials containing asbestos	Chrysotile		Presumed	3	3	Priority 1 : Investigate prior to disturbing



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Martin Ryan

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Refurbishment
24535
Derek Conerney
26/6/2019
WI-02 & WI-03



ACM REGISTER

The following areas were found to contain ACM's

Risk Assessment	295180	Location	RA:295180 All Underground Areas Construction Pipe Work							
Notes:	Cement pipes should be presumed present throughout plant									
Type of Product	Quantity	Accessibility	Condition	Surface Treatment	Asbestos Type	Sample No.	Confirmation	MA	PA	Action
Asbestos Cement	--N\A--	--N\A--	Low Damage	Composite materials containing asbestos	Chrysotile		Presumed	3	3	Priority 1 : Remove ACM's Prior to Refurbishment or Demolition.

Risk Assessment	295144	Location	RA:295144 FDC No. 4 Construction Penstock Gates							
Type of Product	Quantity	Accessibility	Condition	Surface Treatment	Asbestos Type	Sample No.	Confirmation	MA	PA	Action
Asbestos Cement	--N\A--	--N\A--	Low Damage	Composite materials containing asbestos	Chrysotile	as samples	Strongly presumed	3	3	Priority 1 : Remove ACM's Prior to Refurbishment or Demolition.

Risk Assessment	295145	Location	RA:295145 FDC No. 4 Construction Stored Penstock Gates							
Type of Product	Quantity	Accessibility	Condition	Surface Treatment	Asbestos Type	Sample No.	Confirmation	MA	PA	Action
Asbestos Cement	--N\A--	--N\A--	Low Damage	Composite materials containing asbestos	Chrysotile	DKB20180626006	Sample Taken	3	3	Priority 1 : Remove ACM's Prior to Refurbishment or Demolition.

Risk Assessment	295146	Location	RA:295146 Aeration Basin No. 1, 2, 3 and 4 Construction Expansion Joints in Concrete							
Notes:	present throughout plant areas									
Type of Product	Quantity	Accessibility	Condition	Surface Treatment	Asbestos Type	Sample No.	Confirmation	MA	PA	Action
Putty	--N\A--	--N\A--	Low Damage	Composite materials containing asbestos	Chrysotile	DKB20180626007	Sample Taken	3	3	Priority 1 : Remove ACM's Prior to Refurbishment or Demolition.



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Martin Ryan

Type
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Method

Refurbishment
24535
Derek Conerney
26/6/2019
WI-02 & WI-03



ACM REGISTER

The following areas were found to contain ACM's

Risk Assessment	295147	Location	RA:295147 FDC No. 3 Construction Coplastix Panels							
Notes:	as sample dkb20180626006									
Type of Product	Quantity	Accessibility	Condition	Surface Treatment	Asbestos Type	Sample No.	Confirmation	MA	PA	Action
Asbestos Cement	--N\A--	--N\A--	Low Damage	Composite materials containing asbestos	Chrysotile	as samples	Strongly presumed	3	3	Priority 1 : Remove ACM's Prior to Refurbishment or Demolition.

Risk Assessment	295148	Location	RA:295148 FDC No. 3 Construction Coplastix Panels							
Notes:	as sample dkb20180626006 presumed in tank									
Type of Product	Quantity	Accessibility	Condition	Surface Treatment	Asbestos Type	Sample No.	Confirmation	MA	PA	Action
Asbestos Cement	--N\A--	--N\A--	Low Damage	Composite materials containing asbestos	Chrysotile	as samples	Strongly presumed	3	3	Priority 1 : Remove ACM's Prior to Refurbishment or Demolition.

Risk Assessment	295149	Location	RA:295149 FDC No. 1 Construction Coplastix Panels							
Notes:	as sample dkb20180626006									
Type of Product	Quantity	Accessibility	Condition	Surface Treatment	Asbestos Type	Sample No.	Confirmation	MA	PA	Action
Asbestos Cement	--N\A--	--N\A--	Low Damage	Composite materials containing asbestos	Chrysotile	as samples	Strongly presumed	3	3	Priority 1 : Remove ACM's Prior to Refurbishment or Demolition.

Risk Assessment	295107	Location	RA:295107 Administration Building Control Room Office and Laboratory Floor							
Notes:	some minor damage in laboratory									
Type of Product	Quantity	Accessibility	Condition	Surface Treatment	Asbestos Type	Sample No.	Confirmation	MA	PA	Action
Vinyl Floor Tiles & Bitumen	--N\A--	--N\A--	Low Damage	Composite Materials Containing Asbestos	Chrysotile	DKB20180626001	Sample Taken	3	3	Priority 1 : Remove ACM's Prior to Refurbishment or Demolition.



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 Martin Ryan

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Refurbishment
 24535
 Derek Conerney
 26/6/2019
 WI-02 & WI-03



ACM REGISTER

The following areas were found to contain ACM's

Risk Assessment		295133		Location		RA:295133 Inlet Works Area Construction Penstock Gates (approx 7 no)				
Notes:		Cement lining panels to Penstock gates								
Type of Product	Quantity	Accessibility	Condition	Surface Treatment	Asbestos Type	Sample No.	Confirmation	MA	PA	Action
Asbestos Cement	--N\A--	--N\A--	Low Damage	Composite materials containing asbestos	Chrysotile	DKB20180626005	Sample Taken	3	3	Priority 1 : Remove ACM's Prior to Refurbishment or Demolition.

Risk Assessment		295109		Location		RA:295109 Administration Building Canteen Sink				
Type of Product	Quantity	Accessibility	Condition	Surface Treatment	Asbestos Type	Sample No.	Confirmation	MA	PA	Action
Asbestos Bitumen Products	--N\A--	--N\A--	Low Damage	Composite Materials Containing Asbestos	Chrysotile	DKB20180626003	Sample Taken	3	3	Priority 1 : Remove ACM's Prior to Refurbishment or Demolition.

Risk Assessment		295160		Location		RA:295160 Storm Tank Construction Outlet Chamber				
Notes:		Large diameter cement pipe visible, no access to sample								
Type of Product	Quantity	Accessibility	Condition	Surface Treatment	Asbestos Type	Sample No.	Confirmation	MA	PA	Action
Asbestos Cement	--N\A--	--N\A--	Good condition	Composite materials containing asbestos	Chrysotile		Presumed	2	2	Priority 1 : Remove ACM's Prior to Refurbishment or Demolition.

Client and Survey Details

Client :Irish Water

Site :Carlow WWTP

Address :Mortarstown
Carlow

Date of Survey : 26 Jun 2018

Review Survey : 26 Jun 2019

Surveyor : Derek Conerney

Method : WI02 & WI03

Report No. : 24535

Location Details

Building/Area : Aeration Basins, Clarifiers, Tanks

Room/Section : Construction

Location : Expansion Joints in Concrete

Description : Mastic in Expansion Joints

Sample No. : as sample DKB20180626007

Confirmation : Strongly Presumed

Access : Full Access

Normal Use : External Plant Area

Material Risk Assessment 297528

	Score	Risk Rating
Asbestos Type : Chrysotile	1	High Risk
Type Of Product : Putty	1	Medium Risk
Condition : Low Damage	1	Low Risk
Surface Treatment : Composite materials containing asbestos	0	Very Low Risk
Material Assessment Score :	3	Very Low Risk

Removal/Encapsulation Estimate

To be completed by the estimating contractor

	Costs	Notes
Labour		
Equipment		
Disposal		
Analytical		
Totals		

Photograph



Recommendations and Notes

Priority 1 : Remove ACM's Prior to Refurbishment or Demolition. ALL expansion joints with mastic / putty should be presumed asbestos containing

Client and Survey Details

Client :Irish Water

Site :Carlow WWTP

Address :Mortarstown
Carlow

Date of Survey : 26 Jun 2018

Review Survey : 26 Jun 2019

Surveyor : Derek Conerney

Method : WI02 & WI03

Report No. : 24535

Location Details

Building/Area : Outlet Chamber Area

Room/Section : Construction

Location : Pipe Work

Description : Cement Pipes

Sample No. :

Confirmation : Presumed

Access : Partial Access (Notes)

Normal Use : External

Material Risk Assessment 295177

	Score	Risk Rating
Asbestos Type : Chrysotile	1	High Risk
Type Of Product : Asbestos Cement	1	Medium Risk
Condition : Low Damage	1	Low Risk
Surface Treatment : Composite materials containing asbestos	0	Very Low Risk
Material Assessment Score :	3	Very Low Risk

Removal/Encapsulation Estimate

To be completed by the estimating contractor

	Costs	Notes
Labour		
Equipment		
Disposal		
Analytical		
Totals		

Photograph



Recommendations and Notes

Priority 1 : Remove ACM's Prior to Refurbishment or Demolition. Cement pipe inputlet chamber, no access to sample

Client and Survey Details

Client :Irish Water
Site :Carlow WWTP
Address :Mortarstown
Carlow

Date of Survey : 26 Jun 2018
Review Survey : 26 Jun 2019
Surveyor : Derek Conerney
Method : WI02 & WI03
Report No. : 24535

Location Details

Building/Area : Outlet Chamber Area
Room/Section : Construction
Location : Penstock Gates
Description : Cement Lining

Sample No. : as samples DKB20180626005/006
Confirmation : Strongly presumed
Access : Full Access
Normal Use : External

Material Risk Assessment 295178

Asbestos Type : Chrysotile
Type Of Product : Asbestos Cement
Condition : Low Damage
Surface Treatment : Composite materials containing asbestos

Score

Risk Rating

1

High Risk

1

Medium Risk

1

Low Risk

0

Very Low Risk

Material Assessment Score :

3

Very Low Risk

Removal/Encapsulation Estimate

To be completed by the estimating contractor

	Costs	Notes
Labour		
Equipment		
Disposal		
Analytical		
Totals		

Photograph



Recommendations and Notes

Priority 1 : Remove ACM's Prior to Refurbishment or Demolition. Cement lining to gates as sampled

Client and Survey Details

Client :Irish Water

Site :Carlow WWTP

Address :Mortarstown

Carlow

Date of Survey : 26 Jun 2018

Review Survey : 26 Jun 2019

Surveyor : Derek Conerney

Method : WI02 & WI03

Report No. : 24535

Location Details

Building/Area : Outlet Chamber Area

Room/Section : Construction

Location : Pipe Work

Description : Cement Pipe

Sample No. :

Confirmation : Presumed

Access : Full Access

Normal Use : External

Material Risk Assessment 295179

	Score	Risk Rating
Asbestos Type : Chrysotile	1	High Risk
Type Of Product : Asbestos Cement	1	Medium Risk
Condition : Low Damage	1	Low Risk
Surface Treatment : Composite materials containing asbestos	0	Very Low Risk
Material Assessment Score :	3	Very Low Risk

Removal/Encapsulation Estimate

To be completed by the estimating contractor

	Costs	Notes
Labour		
Equipment		
Disposal		
Analytical		
Totals		

Photograph



Recommendations and Notes

Priority 1 : Investigate prior to disturbing Cement pipe in chamber

Client and Survey Details

Client :Irish Water
Site :Carlow WWTP
Address :Mortarstown
Carlow

Date of Survey : 26 Jun 2018
Review Survey : 26 Jun 2019
Surveyor : Derek Conerney
Method : WI02 & WI03
Report No. : 24535

Location Details

Building/Area : All Underground Areas
Room/Section : Construction
Location : Pipe Work
Description : Cement Pipes

Sample No. :
Confirmation : Presumed
Access : Partial Access (Notes)
Normal Use : External

Material Risk Assessment 295180

Asbestos Type : Chrysotile
Type Of Product : Asbestos Cement
Condition : Low Damage
Surface Treatment : Composite materials containing asbestos

Score	Risk Rating
1	High Risk
1	Medium Risk
1	Low Risk
0	Very Low Risk
Material Assessment Score : 3	Very Low Risk

Removal/Encapsulation Estimate

To be completed by the estimating contractor

	Costs	Notes
Labour		
Equipment		
Disposal		
Analytical		
Totals		

Photograph



Recommendations and Notes

Priority 1 : Remove ACM's Prior to Refurbishment or Demolition. Cement pipes should be presumed present throughout plant

Client and Survey Details

Client :Irish Water

Site :Carlow WWTP

Address :Mortarstown
Carlow

Date of Survey : 26 Jun 2018

Review Survey : 26 Jun 2019

Surveyor : Derek Conerney

Method : WI02 & WI03

Report No. : 24535

Location Details

Building/Area : FDC No. 4

Room/Section : Construction

Location : Penstock Gates

Description : Cement Lining to Gates

Sample No. : as samples DKB20180626005/006

Confirmation : Strongly presumed

Access : Full Access

Normal Use : External Plant Area

Material Risk Assessment 295144

	Score	Risk Rating
Asbestos Type : Chrysotile	1	High Risk
Type Of Product : Asbestos Cement	1	Medium Risk
Condition : Low Damage	1	Low Risk
Surface Treatment : Composite materials containing asbestos	0	Very Low Risk
Material Assessment Score :	3	Very Low Risk

Removal/Encapsulation Estimate

To be completed by the estimating contractor

	Costs	Notes
Labour		
Equipment		
Disposal		
Analytical		
Totals		

Photograph



Recommendations and Notes

Priority 1 : Remove ACM's Prior to Refurbishment or Demolition.

Client and Survey Details

Client :Irish Water

Site :Carlow WWTP

Address :Mortarstown

Carlow

Date of Survey : 26 Jun 2018

Review Survey : 26 Jun 2019

Surveyor : Derek Conerney

Method : WI02 & WI03

Report No. : 24535

Location Details

Building/Area : FDC No. 4

Room/Section : Construction

Location : Stored Penstock Gates

Description : Cement Lining to Gates

Sample No. : DKB20180626006

Confirmation : Sample Taken

Access : Full Access

Normal Use : External Plant Area

Material Risk Assessment 295145

	Score	Risk Rating
Asbestos Type : Chrysotile	1	High Risk
Type Of Product : Asbestos Cement	1	Medium Risk
Condition : Low Damage	1	Low Risk
Surface Treatment : Composite materials containing asbestos	0	Very Low Risk
Material Assessment Score :	3	Very Low Risk

Removal/Encapsulation Estimate

To be completed by the estimating contractor

	Costs	Notes
Labour		
Equipment		
Disposal		
Analytical		
Totals		

Photograph



Recommendations and Notes

Priority 1 : Remove ACM's Prior to Refurbishment or Demolition.

Client and Survey Details

Client :Irish Water

Site :Carlow WWTP

Address :Mortarstown
Carlow

Date of Survey : 26 Jun 2018

Review Survey : 26 Jun 2019

Surveyor : Derek Conerney

Method : WI02 & WI03

Report No. : 24535

Location Details

Building/Area : Aeration Basin No. 1, 2, 3 and 4

Room/Section : Construction

Location : Expansion Joints in Concrete

Description : Mastic

Sample No. : DKB20180626007

Confirmation : Sample Taken

Access : Full Access

Normal Use : External Plant Area

Material Risk Assessment 295146

	Score	Risk Rating
Asbestos Type : Chrysotile	1	High Risk
Type Of Product : Putty	1	Medium Risk
Condition : Low Damage	1	Low Risk
Surface Treatment : Composite materials containing asbestos	0	Very Low Risk
Material Assessment Score :	3	Very Low Risk

Removal/Encapsulation Estimate

To be completed by the estimating contractor

	Costs	Notes
Labour		
Equipment		
Disposal		
Analytical		
Totals		

Photograph



Recommendations and Notes

Priority 1 : Remove ACM's Prior to Refurbishment or Demolition. present throughout plant areas

Client and Survey Details

Client :Irish Water

Site :Carlow WWTP

Address :Mortarstown
Carlow

Date of Survey : 26 Jun 2018

Review Survey : 26 Jun 2019

Surveyor : Derek Conerney

Method : WI02 & WI03

Report No. : 24535

Location Details

Building/Area : FDC No. 3

Room/Section : Construction

Location : Coplastix Panels

Description : Cement

Sample No. : as samples DKB20180626005/006

Confirmation : Strongly presumed

Access : Full Access

Normal Use : External Plant Area

Material Risk Assessment 295147

Asbestos Type : Chrysotile
Type Of Product : Asbestos Cement
Condition : Low Damage
Surface Treatment : Composite materials containing asbestos

Score

Risk Rating

1

High Risk

1

Medium Risk

1

Low Risk

0

Very Low Risk

Material Assessment Score : 3

Very Low Risk

Removal/Encapsulation Estimate

To be completed by the estimating contractor

	Costs	Notes
Labour		
Equipment		
Disposal		
Analytical		
Totals		

Photograph



Recommendations and Notes

Priority 1 : Remove ACM's Prior to Refurbishment or Demolition. as sample dkb20180626006

Client and Survey Details

Client :Irish Water

Site :Carlow WWTP

Address :Mortarstown

Carlow

Date of Survey : 26 Jun 2018

Review Survey : 26 Jun 2019

Surveyor : Derek Conerney

Method : WI02 & WI03

Report No. : 24535

Location Details

Building/Area : FDC No. 3

Room/Section : Construction

Location : Coplastix Panels

Description : Cement

Sample No. : as samples DKB20180626005/006

Confirmation : Strongly presumed

Access : Full Access

Normal Use : External Plant Area

Material Risk Assessment 295148

	Score	Risk Rating
Asbestos Type : Chrysotile	1	High Risk
Type Of Product : Asbestos Cement	1	Medium Risk
Condition : Low Damage	1	Low Risk
Surface Treatment : Composite materials containing asbestos	0	Very Low Risk
Material Assessment Score :	3	Very Low Risk

Removal/Encapsulation Estimate

To be completed by the estimating contractor

	Costs	Notes
Labour		
Equipment		
Disposal		
Analytical		
Totals		

Photograph



Recommendations and Notes

Priority 1 : Remove ACM's Prior to Refurbishment or Demolition. as sample dkb20180626006 presumed in tank

Client and Survey Details

Client :Irish Water

Site :Carlow WWTP

Address :Mortarstown
Carlow

Date of Survey : 26 Jun 2018

Review Survey : 26 Jun 2019

Surveyor : Derek Conerney

Method : WI02 & WI03

Report No. : 24535

Location Details

Building/Area : FDC No. 1

Room/Section : Construction

Location : Coplastix Panels

Description : Cement

Sample No. : as samples DKB20180626005/006

Confirmation : Strongly presumed

Access : Full Access

Normal Use : External Plant Area

Material Risk Assessment 295149

	Score	Risk Rating
Asbestos Type : Chrysotile	1	High Risk
Type Of Product : Asbestos Cement	1	Medium Risk
Condition : Low Damage	1	Low Risk
Surface Treatment : Composite materials containing asbestos	0	Very Low Risk
Material Assessment Score :	3	Very Low Risk

Removal/Encapsulation Estimate

To be completed by the estimating contractor

	Costs	Notes
Labour		
Equipment		
Disposal		
Analytical		
Totals		

Photograph



Recommendations and Notes

Priority 1 : Remove ACM's Prior to Refurbishment or Demolition. as sample dkb20180626006

Client and Survey Details

Client :Irish Water

Site :Carlow WWTP

Address :Mortarstown
Carlow

Date of Survey : 26 Jun 2018

Review Survey : 26 Jun 2019

Surveyor : Derek Conerney

Method : WI02 & WI03

Report No. : 24535

Location Details

Building/Area : Administration Building

Room/Section : Control Room Office and Laborato

Location : Floor

Description : Tiles and Bitumen

Sample No. : DKB20180626001

Confirmation : Sample Taken

Access : Full Access

Normal Use : Office type use

Material Risk Assessment 295107

	Score	Risk Rating
Asbestos Type : Chrysotile	1	High Risk
Type Of Product : Vinyl Floor Tiles & Bitumen	1	Medium Risk
Condition : Low Damage	1	Low Risk
Surface Treatment : Composite Materials Containing Asbestos	0	Very Low Risk
Material Assessment Score :	3	Very Low Risk

Removal/Encapsulation Estimate

To be completed by the estimating contractor

	Costs	Notes
Labour		
Equipment		
Disposal		
Analytical		
Totals		

Photograph



Recommendations and Notes

Priority 1 : Remove ACM's Prior to Refurbishment or Demolition. some minor damage in laboratory

Client and Survey Details

Client :Irish Water

Site :Carlow WWTP

Address :Mortarstown
Carlow

Date of Survey : 26 Jun 2018

Review Survey : 26 Jun 2019

Surveyor : Derek Conerney

Method : WI02 & WI03

Report No. : 24535

Location Details

Building/Area : Inlet Works Area

Room/Section : Construction

Location : Penstock Gates (approx 7 no)

Description : Cement Lining Panels

Sample No. : DKB20180626005

Confirmation : Sample Taken

Access : Full Access

Normal Use : External Plant Area

Material Risk Assessment 295133

	Score	Risk Rating
Asbestos Type : Chrysotile	1	High Risk
Type Of Product : Asbestos Cement	1	Medium Risk
Condition : Low Damage	1	Low Risk
Surface Treatment : Composite materials containing asbestos	0	Very Low Risk
Material Assessment Score :	3	Very Low Risk

Removal/Encapsulation Estimate

To be completed by the estimating contractor

	Costs	Notes
Labour		
Equipment		
Disposal		
Analytical		
Totals		

Photograph



Recommendations and Notes

Priority 1 : Remove ACM's Prior to Refurbishment or Demolition. Cement lining panels to Penstock gates

Client and Survey Details

Client :Irish Water

Site :Carlow WWTP

Address :Mortarstown
Carlow

Date of Survey : 26 Jun 2018

Review Survey : 26 Jun 2019

Surveyor : Derek Conerney

Method : WI02 & WI03

Report No. : 24535

Location Details

Building/Area : Administration Building

Room/Section : Canteen

Location : Sink

Description : Bitumen Pad

Sample No. : DKB20180626003

Confirmation : Sample Taken

Access : Full Access

Normal Use : Office type use

Material Risk Assessment 295109

Asbestos Type : Chrysotile
Type Of Product : Asbestos Bitumen Products
Condition : Low Damage
Surface Treatment : Composite Materials Containing Asbestos

Score

Risk Rating

1

High Risk

1

Medium Risk

1

Low Risk

0

Very Low Risk

Material Assessment Score : 3

Very Low Risk

Removal/Encapsulation Estimate

To be completed by the estimating contractor

	Costs	Notes
Labour		
Equipment		
Disposal		
Analytical		
Totals		

Photograph



Recommendations and Notes

Priority 1 : Remove ACM's Prior to Refurbishment or Demolition.

Client and Survey Details

Client :Irish Water

Site :Carlow WWTP

Address :Mortarstown
Carlow

Date of Survey : 26 Jun 2018

Review Survey : 26 Jun 2019

Surveyor : Derek Conerney

Method : WI02 & WI03

Report No. : 24535

Location Details

Building/Area : Storm Tank

Room/Section : Construction

Location : Outlet Chamber

Description : Cement Pipe

Sample No. :

Confirmation : Presumed

Access : Partial Access (Notes)

Normal Use : External Plant Area

Material Risk Assessment 295160

	Score	Risk Rating
Asbestos Type : Chrysotile	1	High Risk
Type Of Product : Asbestos Cement	1	Medium Risk
Condition : Good condition	0	Low Risk
Surface Treatment : Composite materials containing asbestos	0	Very Low Risk
Material Assessment Score :	2	Very Low Risk

Removal/Encapsulation Estimate

To be completed by the estimating contractor

	Costs	Notes
Labour		
Equipment		
Disposal		
Analytical		
Totals		

Photograph



Recommendations and Notes

Priority 1 : Remove ACM's Prior to Refurbishment or Demolition. Large diameter cement pipe visible, no access to sample



Customer Site
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 26/6/2018
 26/6/2019
 Martin Ryan

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 Derek Conerney
 26/6/2019
 WI-02 & WI-03



INCOMPLETE ACCESS REGISTER

The following areas could not be accessed and therefore in accordance with HSG264 should be presumed to contain ACM's.

Risk Assessment	295098	Location	RA:295098 Administration Building Workshop Old Style Electrical Storage Heater							
Notes:	old style									
Type of Product	Quantity	Accessibility	Condition	Surface Treatment	Asbestos Type	Sample No.	Confirmation	MA	PA	Action
--N\A--	--N\A--	--N\A--	--N\A--	--N\A--	Presumed ACM Present		--N\A--	6	6	Priority 1 : Investigate prior to disturbing

Risk Assessment	295106	Location	RA:295106 Administration Building Control Room Electrical Equipment and Storage Heater							
Notes:	live equipment									
Type of Product	Quantity	Accessibility	Condition	Surface Treatment	Asbestos Type	Sample No.	Confirmation	MA	PA	Action
--N\A--	--N\A--	--N\A--	--N\A--	--N\A--	Presumed ACM Present		--N\A--	6	6	Priority 1 : Investigate prior to disturbing

Risk Assessment	295121	Location	RA:295121 ESB Substation Internal Areas Construction							
Notes:	ESB controlled									
Type of Product	Quantity	Accessibility	Condition	Surface Treatment	Asbestos Type	Sample No.	Confirmation	MA	PA	Action
--N\A--	--N\A--	--N\A--	--N\A--	--N\A--	Presumed ACM Present		--N\A--	6	6	Priority 1 : Investigate prior to disturbing

Risk Assessment	295143	Location	RA:295143 Aeration Basin No. 1, 2 and 3 Construction Outlet Weir Gates							
Notes:	Possibly acm lined as similar to others identified.									
Type of Product	Quantity	Accessibility	Condition	Surface Treatment	Asbestos Type	Sample No.	Confirmation	MA	PA	Action
--N\A--	--N\A--	--N\A--	--N\A--	--N\A--	Presumed ACM Present		--N\A--	6	6	Priority 1 : Investigate prior to disturbing



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INCOMPLETE ACCESS REGISTER

The following areas could not be accessed and therefore in accordance with HSG264 should be presumed to contain ACM's.

Risk Assessment	295128	Location	RA:295128 Air Blower Building Internal Areas Attic							
Notes:	no access due to location of hatch over equipment									
Type of Product	Quantity	Accessibility	Condition	Surface Treatment	Asbestos Type	Sample No.	Confirmation	MA	PA	Action
--N\A--	--N\A--	--N\A--	--N\A--	--N\A--	Presumed ACM Present		--N\A--	6	6	Priority 1 : Investigate prior to disturbing

Risk Assessment	295153	Location	RA:295153 Claifier No. 1 Construction Outlet Area							
Notes:	possible acm to gates									
Type of Product	Quantity	Accessibility	Condition	Surface Treatment	Asbestos Type	Sample No.	Confirmation	MA	PA	Action
--N\A--	--N\A--	--N\A--	--N\A--	--N\A--	Presumed ACM Present		--N\A--	6	6	Priority 1 : Investigate prior to disturbing

Risk Assessment	295157	Location	RA:295157 Clarifier No. 2 Construction Inlet and Outlet							
Type of Product	Quantity	Accessibility	Condition	Surface Treatment	Asbestos Type	Sample No.	Confirmation	MA	PA	Action
--N\A--	--N\A--	--N\A--	--N\A--	--N\A--	Presumed ACM Present		--N\A--	6	6	Priority 1 : Investigate prior to disturbing

Risk Assessment	295166	Location	RA:295166 Sludge Dewatering Internal Areas Electrical Equipment							
Type of Product	Quantity	Accessibility	Condition	Surface Treatment	Asbestos Type	Sample No.	Confirmation	MA	PA	Action
--N\A--	--N\A--	--N\A--	--N\A--	--N\A--	Presumed ACM Present		--N\A--	6	6	Priority 1 : Investigate prior to disturbing



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26/6/2018
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Martin Ryan

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INCOMPLETE ACCESS REGISTER

The following areas could not be accessed and therefore in accordance with HSG264 should be presumed to contain ACM's.

Risk Assessment		295167		Location		RA:295167 Sludge Dewatering Internal Areas - Office and Toilet Electrical Heater				
Type of Product	Quantity	Accessibility	Condition	Surface Treatment	Asbestos Type	Sample No.	Confirmation	MA	PA	Action
--N\A--	--N\A--	--N\A--	--N\A--	--N\A--	Presumed ACM Present		--N\A--	6	6	Priority 1 : Investigate prior to disturbing

Risk Assessment		295173	Location	RA:295173 Sludge Dewatering External Areas Roof						
Notes:		no access onto roof								
Type of Product	Quantity	Accessibility	Condition	Surface Treatment	Asbestos Type	Sample No.	Confirmation	MA	PA	Action
--N\A--	--N\A--	--N\A--	--N\A--	--N\A--	Presumed ACM Present		--N\A--	6	6	Priority 1 : Investigate prior to disturbing

Risk Assessment		295181	Location		RA:295181 All Underground Areas Construction Hidden and Underground Areas					
Notes:		No access into underground areas, vessels, tanks, chambers or live equipmen								
Type of Product	Quantity	Accessibility	Condition	Surface Treatment	Asbestos Type	Sample No.	Confirmation	MA	PA	Action
--N\A--	--N\A--	--N\A--	--N\A--	--N\A--	Presumed ACM Present		--N\A--	6	6	Priority 1 : Investigate prior to disturbing

Risk Assessment		295105	Location		RA:295105 Administration Building Control Room Electrical Equipment and Storage Heater					
Notes:		live equipment								
Type of Product	Quantity	Accessibility	Condition	Surface Treatment	Asbestos Type	Sample No.	Confirmation	MA	PA	Action
--N\A--	--N\A--	--N\A--	--N\A--	--N\A--	No Asbestos Found		--N\A--	0	0	--N\A--

Client and Survey Details

Client :Irish Water

Site :Carlow WWTP

Address :Mortarstown
Carlow

Date of Survey : 26 Jun 2018

Review Survey : 26 Jun 2019

Surveyor : Derek Conerney

Method : WI02 & WI03

Report No. : 24535

Location Details

Building/Area : Administration Building

Room/Section : Workshop

Location : Old Style Electrical Storage Heate

Description :

Sample No. :

Confirmation : --N\A--

Access : No Access

Normal Use : Office type use

Material Risk Assessment 295098

Asbestos Type : Presumed ACM Present

Type Of Product : --N\A--

Condition : --N\A--

Surface Treatment : --N\A--

Score

Risk Rating

6

High Risk

0

Medium Risk

0

Low Risk

0

Very Low Risk

Material Assessment Score :

6

Low Risk

Removal/Encapsulation Estimate

To be completed by the estimating contractor

	Costs	Notes
Labour		
Equipment		
Disposal		
Analytical		
Totals		

Photograph



Recommendations and Notes

Priority 1 : Investigate prior to disturbing old style

Client and Survey Details

Client :Irish Water

Site :Carlow WWTP

Address :Mortarstown
Carlow

Date of Survey : 26 Jun 2018

Review Survey : 26 Jun 2019

Surveyor : Derek Conerney

Method : WI02 & WI03

Report No. : 24535

Location Details

Building/Area : Administration Building

Room/Section : Control Room

Location : Electrical Equipment and Storage

Description :

Sample No. :

Confirmation : --N\A--

Access : No Access

Normal Use : Office type use

Material Risk Assessment 295106

Asbestos Type : Presumed ACM Present

Type Of Product : --N\A--

Condition : --N\A--

Surface Treatment : --N\A--

Score

Risk Rating

6

High Risk

0

Medium Risk

0

Low Risk

0

Very Low Risk

Material Assessment Score :

6

Low Risk

Removal/Encapsulation Estimate

To be completed by the estimating contractor

	Costs	Notes
Labour		
Equipment		
Disposal		
Analytical		
Totals		

Photograph



Recommendations and Notes

Priority 1 : Investigate prior to disturbing live equipment

Client and Survey Details

Client :Irish Water

Site :Carlow WWTP

Address :Mortarstown
Carlow

Date of Survey : 26 Jun 2018

Review Survey : 26 Jun 2019

Surveyor : Derek Conerney

Method : WI02 & WI03

Report No. : 24535

Location Details

Building/Area : ESB Substation

Room/Section : Internal Areas

Location : Construction

Description :

Sample No. :

Confirmation : --N\A--

Access : No Access

Normal Use : External

Material Risk Assessment 295121

Asbestos Type : Presumed ACM Present

Type Of Product : --N\A--

Condition : --N\A--

Surface Treatment : --N\A--

Score

Risk Rating

6

High Risk

0

Medium Risk

0

Low Risk

0

Very Low Risk

Material Assessment Score :

6

Low Risk

Removal/Encapsulation Estimate

To be completed by the estimating contractor

	Costs	Notes
Labour		
Equipment		
Disposal		
Analytical		
Totals		

Photograph



Recommendations and Notes

Priority 1 : Investigate prior to disturbing ESB controlled

Client and Survey Details

Client :Irish Water

Site :Carlow WWTP

Address :Mortarstown
Carlow

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Review Survey : 26 Jun 2019

Surveyor : Derek Conerney

Method : WI02 & WI03

Report No. : 24535

Location Details

Building/Area : Aeration Basin No. 1, 2 and 3

Room/Section : Construction

Location : Outlet Weir Gates

Description :

Sample No. :

Confirmation : --N\A--

Access : No Access

Normal Use : External Plant Area

Material Risk Assessment 295143

Asbestos Type : Presumed ACM Present

Type Of Product : --N\A--

Condition : --N\A--

Surface Treatment : --N\A--

Score

Risk Rating

6

High Risk

0

Medium Risk

0

Low Risk

0

Very Low Risk

Material Assessment Score :

6

Low Risk

Removal/Encapsulation Estimate

To be completed by the estimating contractor

	Costs	Notes
Labour		
Equipment		
Disposal		
Analytical		
Totals		

Photograph



Recommendations and Notes

Priority 1 : Investigate prior to disturbing Possibly acm lined as similar to others identified.

Client and Survey Details

Client :Irish Water

Site :Carlow WWTP

Address :Mortarstown
Carlow

Date of Survey : 26 Jun 2018

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Surveyor : Derek Conerney

Method : WI02 & WI03

Report No. : 24535

Location Details

Building/Area : Air Blower Building

Room/Section : Internal Areas

Location : Attic

Description :

Sample No. :

Confirmation : --N\A--

Access : No Access

Normal Use : Plantroom Area

Material Risk Assessment 295128

Asbestos Type : Presumed ACM Present

Type Of Product : --N\A--

Condition : --N\A--

Surface Treatment : --N\A--

Score

Risk Rating

6

High Risk

0

Medium Risk

0

Low Risk

0

Very Low Risk

Material Assessment Score :

6

Low Risk

Removal/Encapsulation Estimate

To be completed by the estimating contractor

	Costs	Notes
Labour		
Equipment		
Disposal		
Analytical		
Totals		

Photograph



Recommendations and Notes

Priority 1 : Investigate prior to disturbing no access due to location of hatch over equipment

Client and Survey Details

Client :Irish Water

Site :Carlow WWTP

Address :Mortarstown
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Date of Survey : 26 Jun 2018

Review Survey : 26 Jun 2019

Surveyor : Derek Conerney

Method : WI02 & WI03

Report No. : 24535

Location Details

Building/Area : Claifier No. 1

Room/Section : Construction

Location : Outlet Area

Description :

Sample No. :

Confirmation : --N\A--

Access : No Access

Normal Use : External Plant Area

Material Risk Assessment 295153

Asbestos Type : Presumed ACM Present

Type Of Product : --N\A--

Condition : --N\A--

Surface Treatment : --N\A--

Score

Risk Rating

6

High Risk

0

Medium Risk

0

Low Risk

0

Very Low Risk

Material Assessment Score :

6

Low Risk

Removal/Encapsulation Estimate

To be completed by the estimating contractor

	Costs	Notes
Labour		
Equipment		
Disposal		
Analytical		
Totals		

Photograph



Recommendations and Notes

Priority 1 : Investigate prior to disturbing possible acm to gates

Client and Survey Details

Client :Irish Water

Site :Carlow WWTP

Address :Mortarstown
Carlow

Date of Survey : 26 Jun 2018

Review Survey : 26 Jun 2019

Surveyor : Derek Conerney

Method : WI02 & WI03

Report No. : 24535

Location Details

Building/Area : Clarifier No. 2

Room/Section : Construction

Location : Inlet and Outlet

Description :

Sample No. :

Confirmation : --N\A--

Access : No Access

Normal Use : External Plant Area

Material Risk Assessment 295157

Asbestos Type : Presumed ACM Present

Type Of Product : --N\A--

Condition : --N\A--

Surface Treatment : --N\A--

Score

Risk Rating

6

High Risk

0

Medium Risk

0

Low Risk

0

Very Low Risk

Material Assessment Score :

6

Low Risk

Removal/Encapsulation Estimate

To be completed by the estimating contractor

	Costs	Notes
Labour		
Equipment		
Disposal		
Analytical		
Totals		

Photograph



Recommendations and Notes

Priority 1 : Investigate prior to disturbing

Client and Survey Details

Client :Irish Water
Site :Carlow WWTP
Address :Mortarstown
Carlow

Date of Survey : 26 Jun 2018
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Surveyor : Derek Conerney
Method : WI02 & WI03
Report No. : 24535

Location Details

Building/Area : Sludge Dewatering
Room/Section : Internal Areas
Location : Electrical Equipment
Description :

Sample No. :
Confirmation : --N\A--
Access : No Access
Normal Use : Plant Area

Material Risk Assessment 295166

Asbestos Type : Presumed ACM Present
Type Of Product : --N\A--
Condition : --N\A--
Surface Treatment : --N\A--

Score

Risk Rating

6

High Risk

0

Medium Risk

0

Low Risk

0

Very Low Risk

Material Assessment Score :

6

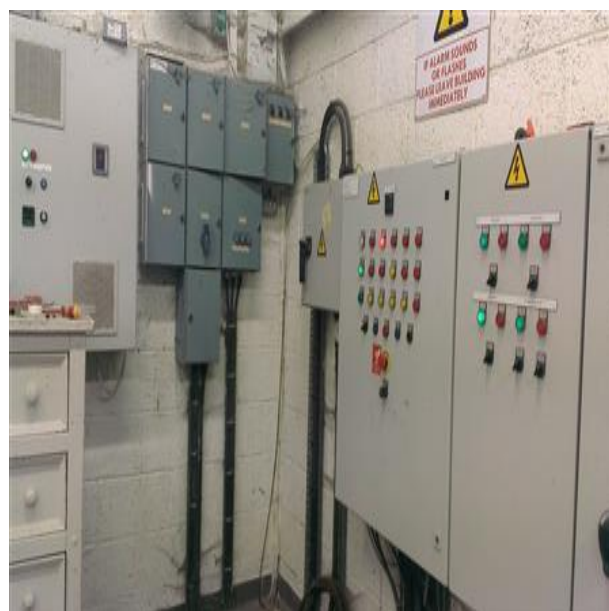
Low Risk

Removal/Encapsulation Estimate

To be completed by the estimating contractor

	Costs	Notes
Labour		
Equipment		
Disposal		
Analytical		
Totals		

Photograph



Recommendations and Notes

Priority 1 : Investigate prior to disturbing

Client and Survey Details

Client :Irish Water

Site :Carlow WWTP

Address :Mortarstown
Carlow

Date of Survey : 26 Jun 2018

Review Survey : 26 Jun 2019

Surveyor : Derek Conerney

Method : WI02 & WI03

Report No. : 24535

Location Details

Building/Area : Sludge Dewatering

Room/Section : Internal Areas - Office and Toilet

Location : Electrical Heater

Description :

Sample No. :

Confirmation : --N\A--

Access : No Access

Normal Use : Plant Area

Material Risk Assessment 295167

Asbestos Type : Presumed ACM Present

Type Of Product : --N\A--

Condition : --N\A--

Surface Treatment : --N\A--

Score

Risk Rating

6

High Risk

0

Medium Risk

0

Low Risk

0

Very Low Risk

Material Assessment Score :

6

Low Risk

Removal/Encapsulation Estimate

To be completed by the estimating contractor

	Costs	Notes
Labour		
Equipment		
Disposal		
Analytical		
Totals		

Photograph



Recommendations and Notes

Priority 1 : Investigate prior to disturbing

Client and Survey Details

Client :Irish Water

Site :Carlow WWTP

Address :Mortarstown
Carlow

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Surveyor : Derek Conerney

Method : WI02 & WI03

Report No. : 24535

Location Details

Building/Area : Sludge Dewatering

Room/Section : External Areas

Location : Roof

Description : No access

Sample No. :

Confirmation : --N\A--

Access : No Access

Normal Use : External

Material Risk Assessment 295173

Asbestos Type : Presumed ACM Present

Type Of Product : --N\A--

Condition : --N\A--

Surface Treatment : --N\A--

Score

Risk Rating

6

High Risk

0

Medium Risk

0

Low Risk

0

Very Low Risk

Material Assessment Score :

6

Low Risk

Removal/Encapsulation Estimate

To be completed by the estimating contractor

	Costs	Notes
Labour		
Equipment		
Disposal		
Analytical		
Totals		

Photograph



Recommendations and Notes

Priority 1 : Investigate prior to disturbing no access onto roof

Client and Survey Details

Client :Irish Water

Site :Carlow WWTP

Address :Mortarstown
Carlow

Date of Survey : 26 Jun 2018

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Surveyor : Derek Conerney

Method : WI02 & WI03

Report No. : 24535

Location Details

Building/Area : All Underground Areas

Room/Section : Construction

Location : Hidden and Underground Areas

Description :

Sample No. :

Confirmation : --N\A--

Access : No Access

Normal Use : External

Material Risk Assessment 295181

Asbestos Type : Presumed ACM Present

Type Of Product : --N\A--

Condition : --N\A--

Surface Treatment : --N\A--

Score

Risk Rating

6

High Risk

0

Medium Risk

0

Low Risk

0

Very Low Risk

Material Assessment Score :

6

Low Risk

Removal/Encapsulation Estimate

To be completed by the estimating contractor

	Costs	Notes
Labour		
Equipment		
Disposal		
Analytical		
Totals		

Photograph



Recommendations and Notes

Priority 1 : Investigate prior to disturbing No access into underground areas, vessels, tanks, chambers or live equipment

Client and Survey Details

Client :Irish Water

Site :Carlow WWTP

Address :Mortarstown
Carlow

Date of Survey : 26 Jun 2018

Review Survey : 26 Jun 2019

Surveyor : Derek Conerney

Method : WI02 & WI03

Report No. : 24535

Location Details

Building/Area : Administration Building

Room/Section : Control Room

Location : Electrical Equipment and Storage

Description :

Sample No. :

Confirmation : --N\A--

Access : No Access

Normal Use : Office type use

Material Risk Assessment 295105

Asbestos Type : No Asbestos Found

Type Of Product : --N\A--

Condition : --N\A--

Surface Treatment : --N\A--

Score

Risk Rating

0

High Risk

0

Medium Risk

0

Low Risk

0

Very Low Risk

Material Assessment Score : 0

Removal/Encapsulation Estimate

To be completed by the estimating contractor

	Costs	Notes
Labour		
Equipment		
Disposal		
Analytical		
Totals		

Photograph



Recommendations and Notes

--N\A-- live equipment



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AREAS INSPECTED

Area(s) inspected during the survey where no ACM's were identified.

Risk Assessment	295161	Location	RA:295161 Sludge Dewatering Internal Areas Roof
Risk Assessment	295162	Location	RA:295162 Sludge Dewatering Internal Areas Floor and Walls
Notes:	Ceramic tiles, blockwork walls, metal and timber doors,		
Risk Assessment	295163	Location	RA:295163 Sludge Dewatering Internal Areas Floor and Walls
Notes:	Ceramic tiles, blockwork walls, metal and timber doors,		
Risk Assessment	295164	Location	RA:295164 Sludge Dewatering Internal Areas Plant and Machinery
Notes:	Rubber gaskets visible to flanges		
Risk Assessment	295165	Location	RA:295165 Sludge Dewatering Internal Areas Plant and Machinery
Notes:	Rubber gaskets visible to flanges		
Risk Assessment	295168	Location	RA:295168 Sludge Dewatering Internal Areas - Office and Toilet Floor, walls, ceiling
Notes:	ceramic tiles, solid walls, plastered ceiling		
Risk Assessment	295169	Location	RA:295169 Sludge Dewatering Internal Areas - Office and Toilet Floor, walls, ceiling
Notes:	ceramic tiles, solid walls, plastered ceiling		
Risk Assessment	295170	Location	RA:295170 Sludge Dewatering External Areas Walls and Roof
Notes:	Brick walls, aluminum windows		
Risk Assessment	295171	Location	RA:295171 Sludge Dewatering External Areas Walls and Roof
Risk Assessment	295172	Location	RA:295172 Sludge Dewatering External Areas Walls and Roof
Risk Assessment	295174	Location	RA:295174 PFT 1 and 2 External Areas Construction
Notes:	Concrete tanks, metal pipes, rubber gaskets		
Risk Assessment	295175	Location	RA:295175 PFT 1 and 2 External Areas Construction
Notes:	Concrete tanks, metal pipes, rubber gaskets		



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AREAS INSPECTED

Area(s) inspected during the survey where no ACM's were identified.

Risk Assessment	295176	Location	RA:295176 PFT 1 and 2 External Areas Expansion Joints
Risk Assessment	295150	Location	RA:295150 FDC No. 1 Construction
Notes:	metal pipe, rubber gaskets		
Risk Assessment	295151	Location	RA:295151 Calarifier No. 1 Construction
Notes:	Concrete, metal weir, ceramic tiles		
Risk Assessment	295152	Location	RA:295152 Calarifier No. 1 Construction
Notes:	Concrete, metal weir, ceramic tiles		
Risk Assessment	295158	Location	RA:295158 Storm Tank Construction
Notes:	Ceramic floor tiles, solid walls, plastered ceiling, electrical storage heater		
Risk Assessment	295159	Location	RA:295159 Storm Tank Construction
Notes:	Ceramic floor tiles, solid walls, plastered ceiling, electrical storage heater		
Risk Assessment	295155	Location	RA:295155 Clarifier No. 2 Construction
Risk Assessment	295156	Location	RA:295156 Clarifier No. 2 Construction
Notes:	Ceramic floor tiles, solid walls, plastered ceiling, electrical storage heater		
Risk Assessment	295129	Location	RA:295129 Air Blower Building Internal Areas Doors
Notes:	timber doors and frame		
Risk Assessment	295130	Location	RA:295130 Inlet Works Area Construction
Notes:	Concrete base, machinery and tanks		
Risk Assessment	295131	Location	RA:295131 Inlet Works Area Construction
Notes:	Concrete base, machinery and tanks		
Risk Assessment	295132	Location	RA:295132 Inlet Works Area Construction
Notes:	Concrete base, machinery and tanks		



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AREAS INSPECTED

Area(s) inspected during the survey where no ACM's were identified.

Risk Assessment	295110	Location	RA:295110 Administration Building Workshop Ceiling
Risk Assessment	295111	Location	RA:295111 Administration Building Workshop Attic
Notes:	plastic water tanks, felt and timber roof, mmmf insulation		
Risk Assessment	295112	Location	RA:295112 Administration Building Workshop Attic
Notes:	plastic water tanks, felt and timber roof, mmmf insulation		
Risk Assessment	295113	Location	RA:295113 Administration Building Workshop Attic
Notes:	plastic water tanks, felt and timber roof, mmmf insulation		
Risk Assessment	295114	Location	RA:295114 Administration Building Attic Construction
Notes:	plastic water tanks, felt and timber roof, mmmf insulation		
Risk Assessment	295115	Location	RA:295115 Administration Building Attic Construction
Notes:	plastic water tanks, felt and timber roof, mmmf insulation		
Risk Assessment	295116	Location	RA:295116 Administration Building Attic Construction
Notes:	plastic water tanks, felt and timber roof, mmmf insulation		
Risk Assessment	295117	Location	RA:295117 Administration Building External Areas Construction
Notes:	Brick walls, aluminum windows, aluminum fascia, soffit and guttering, concrete tiles		
Risk Assessment	295118	Location	RA:295118 Administration Building External Areas Construction
Notes:	Brick walls, aluminum windows, aluminum fascia, soffit and guttering, concrete tiles		
Risk Assessment	295119	Location	RA:295119 Administration Building External Areas Construction
Notes:	Brick walls, aluminum windows, aluminum fascia, soffit and guttering, concrete tiles		
Risk Assessment	295120	Location	RA:295120 ESB Substation External Areas Construction
Risk Assessment	295099	Location	RA:295099 Administration Building Changing Room Floor, walls, ceiling
Notes:	Ceramic tiles, solid walls, plastered ceiling, modern electrical heater		



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AREAS INSPECTED

Area(s) inspected during the survey where no ACM's were identified.

Risk Assessment	295100	Location	RA:295100 Administration Building Toilet Floor, walls, ceiling
Notes:	Ceramic tiles, solid walls, plastered ceiling, modern electrical heater		
Risk Assessment	295101	Location	RA:295101 Administration Building Control Room. Walls, ceiling
Notes:	Solid walls, plastered ceiling		
Risk Assessment	295102	Location	RA:295102 Administration Building Control Room. Walls, ceiling
Notes:	Solid walls, plastered ceiling		
Risk Assessment	295103	Location	RA:295103 Administration Building Control Room Office Walls, ceiling
Notes:	Solid walls, plastered ceiling		
Risk Assessment	295104	Location	RA:295104 Administration Building Control Room Laboratory Walls, ceiling
Notes:	Solid walls, plastered ceiling		
Risk Assessment	295134	Location	RA:295134 Inlet Works Area Construction Gaskets
Notes:	Rubber gaskets where visible		
Risk Assessment	295135	Location	RA:295135 Ferric Dosing Area Construction
Notes:	modern units, concrete base		
Risk Assessment	295136	Location	RA:295136 Ferric Dosing Area Construction
Notes:	modern units, concrete base		
Risk Assessment	295137	Location	RA:295137 Ferric Dosing Area Construction
Notes:	modern units, concrete base		
Risk Assessment	295138	Location	RA:295138 Sludge Return Tank Construction
Notes:	Concrete base, metal covers		
Risk Assessment	295139	Location	RA:295139 Sludge Return Tank Construction
Notes:	Concrete base, metal covers		



Customer
Site
Survey Date
Valid Until
Commissioned by

Irish Water
Carlow WWTP
26/6/2018
26/6/2019
Martin Ryan

Type
Report Number
Surveyor
Review Date
Method

Refurbishment
24535
Derek Conerney
26/6/2019
WI-02 & WI-03



AREAS INSPECTED

Area(s) inspected during the survey where no ACM's were identified.

Risk Assessment	295140	Location	RA:295140 Aeration Basin No. 1, 2 and 3 Construction
Notes:	Concrete tanks, metal pipe work for compressed air		
Risk Assessment	295141	Location	RA:295141 Aeration Basin No. 1, 2 and 3 Construction
Notes:	Concrete tanks, metal pipe work for compressed air		
Risk Assessment	295142	Location	RA:295142 Aeration Basin No. 1, 2 and 3 Construction
Notes:	Concrete tanks, metal pipe work for compressed air		
Risk Assessment	295108	Location	RA:295108 Administration Building Control Room Floor
Risk Assessment	295095	Location	RA:295095 Administration Building Canteen Floor, Walls, Ceiling
Notes:	Ceramic floor tiles, solid walls, plastered ceiling, electrical storage heater		
Risk Assessment	295096	Location	RA:295096 Administration Building Canteen Floor, Walls, Ceiling
Notes:	Ceramic floor tiles, solid walls, plastered ceiling, electrical storage heater		
Risk Assessment	295097	Location	RA:295097 Administration Building Workshop Floor, Walls
Notes:	Solid floor, solid walls, light door		
Risk Assessment	295122	Location	RA:295122 Air Blower Building External Areas Construction
Notes:	Brick walls, concrete roof tiles, aluminum guttering and fascia / soffit		
Risk Assessment	295123	Location	RA:295123 Air Blower Building External Areas Construction
Notes:	Brick walls, concrete roof tiles, aluminum guttering and fascia / soffit		
Risk Assessment	295124	Location	RA:295124 Air Blower Building Internal Areas Floor, walls, ceiling
Notes:	ceramic floor tiles, solid walls, plastered ceiling		
Risk Assessment	295125	Location	RA:295125 Air Blower Building Internal Areas Floor, walls, ceiling
Notes:	ceramic floor tiles, solid walls, plastered ceiling		



Customer
Site
Survey Date
Valid Until
Commissioned by

Irish Water
Carlow WWTP
26/6/2018
26/6/2019
Martin Ryan

Type
Report Number
Surveyor
Review Date
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Refurbishment
24535
Derek Conerney
26/6/2019
WI-02 & WI-03



AREAS INSPECTED

Area(s) inspected during the survey where no ACM's were identified.

Risk Assessment	295126	Location	RA:295126 Air Blower Building Internal Areas Floor, walls, ceiling
Notes:	ceramic floor tiles, solid walls, plastered ceiling		
Risk Assessment	295127	Location	RA:295127 Air Blower Building Internal Areas Equipment
Notes:	modern compressor equipment		
Risk Assessment	295182	Location	RA:295182 Air Blower Building Store Room Floor, walls, ceiling
Risk Assessment	295183	Location	RA:295183 Storm Screen Building Screen Room Floor, walls, ceiling
Notes:	constructed in 2003		
Risk Assessment	295184	Location	RA:295184 Storm Screen Building Electrical Room Floor, walls, ceiling
Notes:	constructed in 2003		
Risk Assessment	295185	Location	RA:295185 Storm Screen Building External Areas Construction
Notes:	constructed in 2003		
Risk Assessment	295186	Location	RA:295186 Raw Sludge Tank External Areas Construction
Risk Assessment	295187	Location	RA:295187 Raw Sludge Tank External Areas Construction
Risk Assessment	295188	Location	RA:295188 Raw Sludge Tank External Areas Construction

Materials Risk Assessment REFURBISHMENT Survey in accordance with HSG264

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Location Details 295161 No Asbestos Found

Building/Area : Sludge Dewatering
Room/Section : Internal Areas
Location : Roof
Description : Lining and Insulation
Sample No. : DKB20180626008
Confirmation : Sample Taken
Access : Full Access
Normal Use : Plant Area
Recommendations :



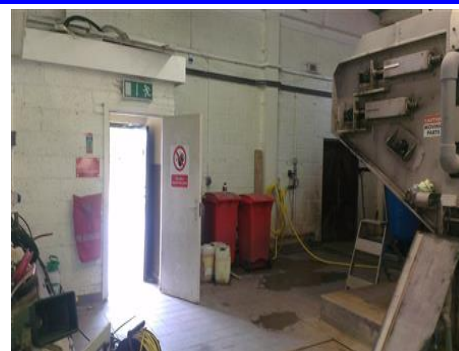
Location Details 295162 No Asbestos Found

Building/Area : Sludge Dewatering
Room/Section : Internal Areas
Location : Floor and Walls
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : Plant Area
Recommendations :
Ceramic tiles, blockwork walls, metal and timber doors,;



Location Details 295163 No Asbestos Found

Building/Area : Sludge Dewatering
Room/Section : Internal Areas
Location : Floor and Walls
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : Plant Area
Recommendations :
Ceramic tiles, blockwork walls, metal and timber doors,;



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Location Details 295164 No Asbestos Found

Building/Area : Sludge Dewatering
Room/Section : Internal Areas
Location : Plant and Machinery
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : Plant Area
Recommendations :
Rubber gaskets visible to flanges;



Location Details 295165 No Asbestos Found

Building/Area : Sludge Dewatering
Room/Section : Internal Areas
Location : Plant and Machinery
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : Plant Area
Recommendations :
Rubber gaskets visible to flanges;



Location Details 295168 No Asbestos Found

Building/Area : Sludge Dewatering
Room/Section : Internal Areas - Office and Toilet
Location : Floor, walls, ceiling
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : Plant Area
Recommendations :
ceramic tiles, solid walls, plastered ceiling;



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Location Details 295169 No Asbestos Found

Building/Area : Sludge Dewatering
Room/Section : Internal Areas - Office and Toilet
Location : Floor, walls, ceiling
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : Plant Area
Recommendations :
ceramic tiles, solid walls, plastered ceiling;



Location Details 295170 No Asbestos Found

Building/Area : Sludge Dewatering
Room/Section : External Areas
Location : Walls and Roof
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External
Recommendations :
Brick walls, aluminum windows;



Location Details 295171 No Asbestos Found

Building/Area : Sludge Dewatering
Room/Section : External Areas
Location : Walls and Roof
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External
Recommendations :
;



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Location Details 295172 No Asbestos Found

Building/Area : Sludge Dewatering
Room/Section : External Areas
Location : Walls and Roof
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External
Recommendations :
;



Location Details 295174 No Asbestos Found

Building/Area : PFT 1 and 2
Room/Section : External Areas
Location : Construction
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External
Recommendations :
Concrete tanks, metal pipes, rubber gaskets;



Location Details 295175 No Asbestos Found

Building/Area : PFT 1 and 2
Room/Section : External Areas
Location : Construction
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External
Recommendations :
Concrete tanks, metal pipes, rubber gaskets;



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Location Details 295176 No Asbestos Found

Building/Area : PFT 1 and 2
Room/Section : External Areas
Location : Expansion Joints
Description : Mastic
Sample No. : DKB20180626009
Confirmation : Sample Taken
Access : Full Access
Normal Use : External
Recommendations :
;



Location Details 295150 No Asbestos Found

Building/Area : FDC No. 1
Room/Section : Construction
Location :
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External Plant Area
Recommendations :
metal pipe, rubber gaskets;



Location Details 295151 No Asbestos Found

Building/Area : Calarifier No. 1
Room/Section : Construction
Location :
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External Plant Area
Recommendations :
Concrete, metal weir, ceramic tiles;



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Location Details 295152 No Asbestos Found

Building/Area : Calarifier No. 1
Room/Section : Construction
Location :
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External Plant Area
Recommendations :
Concrete, metal weir, ceramic tiles;



Location Details 295158 No Asbestos Found

Building/Area : Storm Tank
Room/Section : Construction
Location :
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External Plant Area
Recommendations :
Ceramic floor tiles, solid walls, plastered ceiling, electrical storage heater;



Location Details 295159 No Asbestos Found

Building/Area : Storm Tank
Room/Section : Construction
Location :
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External Plant Area
Recommendations :
Ceramic floor tiles, solid walls, plastered ceiling, electrical storage heater;



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Location Details 295155 No Asbestos Found

Building/Area : Clarifier No. 2
Room/Section : Construction
Location :
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External Plant Area
Recommendations :
;



Location Details 295156 No Asbestos Found

Building/Area : Clarifier No. 2
Room/Section : Construction
Location :
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External Plant Area
Recommendations :
Ceramic floor tiles, solid walls, plastered ceiling, electrical storage heater;



Location Details 295129 No Asbestos Found

Building/Area : Air Blower Building
Room/Section : Internal Areas
Location : Doors
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : Plantroom Area
Recommendations :
timber doors and frame;



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Location Details 295130 No Asbestos Found

Building/Area : Inlet Works Area
Room/Section : Construction
Location :
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External Plant Area
Recommendations :
Concrete base, machinery and tanks;



Location Details 295131 No Asbestos Found

Building/Area : Inlet Works Area
Room/Section : Construction
Location :
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External Plant Area
Recommendations :
Concrete base, machinery and tanks;



Location Details 295132 No Asbestos Found

Building/Area : Inlet Works Area
Room/Section : Construction
Location :
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External Plant Area
Recommendations :
Concrete base, machinery and tanks;



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Carlow	Method : WI02 & WI03
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Location Details 295110 No Asbestos Found

Building/Area : Administration Building
Room/Section : Workshop
Location : Ceiling
Description : Ceiling Panels
Sample No. : DKB20180626004
Confirmation : Sample Taken
Access : Full Access
Normal Use : Office type use
Recommendations :



Location Details 295111 No Asbestos Found

Building/Area : Administration Building
Room/Section : Workshop
Location : Attic
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : Office type use
Recommendations :
plastic water tanks, felt and timber roof, mmmf insulation;



Location Details 295112 No Asbestos Found

Building/Area : Administration Building
Room/Section : Workshop
Location : Attic
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : Office type use
Recommendations :
plastic water tanks, felt and timber roof, mmmf insulation;



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Location Details 295113 No Asbestos Found

Building/Area : Administration Building
Room/Section : Workshop
Location : Attic
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : Office type use
Recommendations :
plastic water tanks, felt and timber roof, mmmf insulation;



Location Details 295114 No Asbestos Found

Building/Area : Administration Building
Room/Section : Attic
Location : Construction
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : Office type use
Recommendations :
plastic water tanks, felt and timber roof, mmmf insulation;



Location Details 295115 No Asbestos Found

Building/Area : Administration Building
Room/Section : Attic
Location : Construction
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : Office type use
Recommendations :
plastic water tanks, felt and timber roof, mmmf insulation;



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Location Details 295116 No Asbestos Found

Building/Area : Administration Building
Room/Section : Attic
Location : Construction
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : Office type use
Recommendations :
plastic water tanks, felt and timber roof, mmmf insulation;



Location Details 295117 No Asbestos Found

Building/Area : Administration Building
Room/Section : External Areas
Location : Construction
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External
Recommendations :
Brick walls, aluminum windows, aluminum fascia, soffit and guttering, concrete tiles;



Location Details 295118 No Asbestos Found

Building/Area : Administration Building
Room/Section : External Areas
Location : Construction
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External
Recommendations :
Brick walls, aluminum windows, aluminum fascia, soffit and guttering, concrete tiles;



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Location Details 295119 No Asbestos Found

Building/Area : Administration Building
Room/Section : External Areas
Location : Construction
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External

Recommendations :

Brick walls, aluminum windows, aluminum fascia, soffit and guttering, concrete tiles;



Location Details 295120 No Asbestos Found

Building/Area : ESB Substation
Room/Section : External Areas
Location : Construction
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External

Recommendations :

;



Location Details 295099 No Asbestos Found

Building/Area : Administration Building
Room/Section : Changing Room
Location : Floor, walls, ceiling
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : Office type use

Recommendations :

Ceramic tiles, solid walls, plastered ceiling, modern electrical heater;



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Location Details 295100 No Asbestos Found

Building/Area : Administration Building
Room/Section : Toilet
Location : Floor, walls, ceiling

Description :

Sample No. :

Confirmation : --N\A--

Access : Full Access

Normal Use : Office type use

Recommendations :

Ceramic tiles, solid walls, plastered ceiling, modern electrical heater;



Location Details 295101 No Asbestos Found

Building/Area : Administration Building
Room/Section : Control Room.
Location : Walls, ceiling

Description :

Sample No. :

Confirmation : --N\A--

Access : Full Access

Normal Use : Office type use

Recommendations :

Solid walls, plastered ceiling;



Location Details 295102 No Asbestos Found

Building/Area : Administration Building
Room/Section : Control Room.
Location : Walls, ceiling

Description :

Sample No. :

Confirmation : --N\A--

Access : Full Access

Normal Use : Office type use

Recommendations :

Solid walls, plastered ceiling;



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Location Details 295103 No Asbestos Found

Building/Area : Administration Building
Room/Section : Control Room Office
Location : Walls, ceiling
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : Office type use
Recommendations :
Solid walls, plastered ceiling;



Location Details 295104 No Asbestos Found

Building/Area : Administration Building
Room/Section : Control Room Laboratory
Location : Walls, ceiling
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : Office type use
Recommendations :
Solid walls, plastered ceiling;



Location Details 295134 No Asbestos Found

Building/Area : Inlet Works Area
Room/Section : Construction
Location : Gaskets
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External Plant Area
Recommendations :
Rubber gaskets where visible;



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Location Details 295135 No Asbestos Found

Building/Area : Ferric Dosing Area
Room/Section : Construction
Location :
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External Plant Area
Recommendations :
modern units, concrete base;



Location Details 295136 No Asbestos Found

Building/Area : Ferric Dosing Area
Room/Section : Construction
Location :
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External Plant Area
Recommendations :
modern units, concrete base;



Location Details 295137 No Asbestos Found

Building/Area : Ferric Dosing Area
Room/Section : Construction
Location :
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External Plant Area
Recommendations :
modern units, concrete base;



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Location Details 295138 No Asbestos Found

Building/Area : Sludge Return Tank
Room/Section : Construction
Location :
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External Plant Area
Recommendations :
Concrete base, metal covers;



Location Details 295139 No Asbestos Found

Building/Area : Sludge Return Tank
Room/Section : Construction
Location :
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External Plant Area
Recommendations :
Concrete base, metal covers;



Location Details 295140 No Asbestos Found

Building/Area : Aeration Basin No. 1, 2 and 3
Room/Section : Construction
Location :
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External Plant Area
Recommendations :
Concrete tanks, metal pipe work for compressed air;



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Location Details 295141 No Asbestos Found

Building/Area : Aeration Basin No. 1, 2 and 3
Room/Section : Construction
Location :
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External Plant Area
Recommendations :
Concrete tanks, metal pipe work for compressed air;



Location Details 295142 No Asbestos Found

Building/Area : Aeration Basin No. 1, 2 and 3
Room/Section : Construction
Location :
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External Plant Area
Recommendations :
Concrete tanks, metal pipe work for compressed air;



Location Details 295108 No Asbestos Found

Building/Area : Administration Building
Room/Section : Control Room
Location : Floor
Description : Tiles
Sample No. : DKB20180626002
Confirmation : Sample Taken
Access : Full Access
Normal Use : Office type use
Recommendations :
;



Materials Risk Assessment REFURBISHMENT Survey in accordance with HSG264

Unit 2BEaT Centre, Stephenstown Industrial Estate, Balbriggan, Co. Dublin Tel: (01) 6905907 Fax: (01) 8020439 Email: info@ohss.ie Website: www.ohss.ie

Client and Survey Details

Client : Irish Water
Site : Carlow WWTP
Address : Mortarstown
Carlow

Date of Survey : 26 Jun 2018
Review Survey : 26 Jun 2019
Surveyor : Derek Conerney
Method : WI02 & WI03
Report No. : 24535

Location Details 295095 No Asbestos Found

Building/Area : Administration Building
Room/Section : Canteen
Location : Floor, Walls, Ceiling

Description :
Sample No. :

Confirmation : --N\A--

Access : Full Access

Normal Use : Office type use

Recommendations :

Ceramic floor tiles, solid walls, plastered ceiling, electrical storage heater;



Location Details 295096 No Asbestos Found

Building/Area : Administration Building
Room/Section : Canteen
Location : Floor, Walls, Ceiling

Description :
Sample No. :

Confirmation : --N\A--

Access : Full Access

Normal Use : Office type use

Recommendations :

Ceramic floor tiles, solid walls, plastered ceiling, electrical storage heater;



Location Details 295097 No Asbestos Found

Building/Area : Administration Building
Room/Section : Workshop
Location : Floor, Walls

Description :
Sample No. :

Confirmation : --N\A--

Access : Full Access

Normal Use : Office type use

Recommendations :

Solid floor, solid walls, light door;



Materials Risk Assessment REFURBISHMENT Survey in accordance with HSG264

Unit 2BEaT Centre, Stephenstown Industrial Estate, Balbriggan, Co. Dublin Tel: (01) 6905907 Fax: (01) 8020439 Email: info@ohss.ie Website: www.ohss.ie

Client and Survey Details

Client : Irish Water
Site : Carlow WWTP
Address : Mortarstown
Carlow

Date of Survey : 26 Jun 2018
Review Survey : 26 Jun 2019
Surveyor : Derek Conerney
Method : WI02 & WI03
Report No. : 24535

Location Details 295122 No Asbestos Found

Building/Area : Air Blower Building
Room/Section : External Areas
Location : Construction
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External

Recommendations :

Brick walls, concrete roof tiles, aluminum guttering and fascia / soffit;



Location Details 295123 No Asbestos Found

Building/Area : Air Blower Building
Room/Section : External Areas
Location : Construction
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External

Recommendations :

Brick walls, concrete roof tiles, aluminum guttering and fascia / soffit;



Location Details 295124 No Asbestos Found

Building/Area : Air Blower Building
Room/Section : Internal Areas
Location : Floor, walls, ceiling
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : Plantroom Area

Recommendations :

ceramic floor tiles, solid walls, plastered ceiling;



Materials Risk Assessment REFURBISHMENT Survey in accordance with HSG264

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Client and Survey Details

Client : Irish Water
Site : Carlow WWTP
Address : Mortarstown
Carlow

Date of Survey : 26 Jun 2018
Review Survey : 26 Jun 2019
Surveyor : Derek Conerney
Method : WI02 & WI03
Report No. : 24535

Location Details 295125 No Asbestos Found

Building/Area : Air Blower Building
Room/Section : Internal Areas
Location : Floor, walls, ceiling
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : Plantroom Area
Recommendations :
ceramic floor tiles, solid walls, plastered ceiling;



Location Details 295126 No Asbestos Found

Building/Area : Air Blower Building
Room/Section : Internal Areas
Location : Floor, walls, ceiling
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : Plantroom Area
Recommendations :
ceramic floor tiles, solid walls, plastered ceiling;



Location Details 295127 No Asbestos Found

Building/Area : Air Blower Building
Room/Section : Internal Areas
Location : Equipment
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : Plantroom Area
Recommendations :
modern compressor equipment;



Materials Risk Assessment REFURBISHMENT Survey in accordance with HSG264

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Client and Survey Details

Client : Irish Water
Site : Carlow WWTP
Address : Mortarstown
Carlow

Date of Survey : 26 Jun 2018
Review Survey : 26 Jun 2019
Surveyor : Derek Conerney
Method : WI02 & WI03
Report No. : 24535

Location Details 295182 No Asbestos Found

Building/Area : Air Blower Building
Room/Section : Store Room
Location : Floor, walls, ceiling
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : Store
Recommendations :
;



Location Details 295183 No Asbestos Found

Building/Area : Storm Screen Building
Room/Section : Screen Room
Location : Floor, walls, ceiling
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : Store
Recommendations :
constructed in 2003;



Location Details 295184 No Asbestos Found

Building/Area : Storm Screen Building
Room/Section : Electrical Room
Location : Floor, walls, ceiling
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : Store
Recommendations :
constructed in 2003;



Materials Risk Assessment REFURBISHMENT Survey in accordance with HSG264

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Client and Survey Details

Client : Irish Water
Site : Carlow WWTP
Address : Mortarstown
Carlow

Date of Survey : 26 Jun 2018
Review Survey : 26 Jun 2019
Surveyor : Derek Conerney
Method : WI02 & WI03
Report No. : 24535

Location Details 295185 No Asbestos Found

Building/Area : Storm Screen Building
Room/Section : External Areas
Location : Construction
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External
Recommendations :
constructed in 2003;



Location Details 295186 No Asbestos Found

Building/Area : Raw Sludge Tank
Room/Section : External Areas
Location : Construction
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External
Recommendations :
;



Location Details 295187 No Asbestos Found

Building/Area : Raw Sludge Tank
Room/Section : External Areas
Location : Construction
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External
Recommendations :
;



Materials Risk Assessment REFURBISHMENT Survey in accordance with HSG264

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Client and Survey Details

Client : Irish Water
Site : Carlow WWTP
Address : Mortarstown
Carlow

Date of Survey : 26 Jun 2018
Review Survey : 26 Jun 2019
Surveyor : Derek Conerney
Method : WI02 & WI03
Report No. : 24535

Location Details 295188 No Asbestos Found

Building/Area : Raw Sludge Tank
Room/Section : External Areas
Location : Construction
Description :
Sample No. :
Confirmation : --N\A--
Access : Full Access
Normal Use : External

Recommendations :

;





Sample Analysis

Unit 2BeaT Centre,
Stephenstown Industrial Estate,
Balbriggan, Co. Dublin
Tel: (01) 6905907
Fax: (01) 8020439
Email: info@ohss.ie
Website: www.ohss.ie



Directors: Deirdre Corry, Paul Foran BA(Mod), MSc., MA, Dip Env. Eng., Dip Mgt., MIOSH, ROH **Company Reg no:** 354843



Test Certificate

Certificate Number: 24124 Issue No: 1

Client Details

Irish Water
John Joyce
24-26 Talbot St
Dublin 1

Site Details

Carlow WWTP
Mortarstown
Carlow
Co. Carlow

Job No: 24535

Date Received: 26-Jun-2018

Date Tested: 03-Jul-2018

Date Reported: 3-Jul-2018

Number of Samples: 9

Specification: WI 05

Samples Taken By: OHSS

Bulk Identification of Asbestos in Materials

Sample Reference	Description	Asbestos Detected	Asbestos Type
DKB20180626.001	Floor Tiles and Bitumen from control room laboratory	Present	Chrysotile
DKB20180626.002	Floor Tiles from control room	Asbestos not detected	
DKB20180626.003	Sink Pad from canteen	Present	Chrysotile
DKB20180626.004	Ceiling Panels from workshop	Asbestos not detected	
DKB20180626.005	Lining to Penstock Gate from inlet works	Present	Chrysotile
DKB20180626.006	Lining to Coplastix Panel from FDC4	Present	Chrysotile
DKB20180626.007	Mastic to Expansion Joint from aeration basin 1 to 4	Present	Chrysotile
DKB20180626.008	Roof Panels from sludge dewatering	Asbestos not detected	
DKB20180626.009	Mastic to Expansion Joint from PFT 1 and 2	Asbestos not detected	

Comments

- 1 The Bulk sample(s) referred to above were analysed for asbestos content using dispersion staining and polarised light microscopy in accordance with the requirements of HSG 248 and using OHSS Documented Work Instruction –WI 05 Bulk Sampling Analysis.
- 2 Any work (removal, repair etc.) involving asbestos containing materials must be carried out in accordance with the Safety Health and Welfare at Work (Exposure to Asbestos) Regulations 2006-2010 or the Control of Asbestos Regulations NI 2012 and all other relevant national legislation.
- 3 In the case of samples supplied by the client, Occupational Hygiene and Safety Services Ltd. (OHSS) cannot accept responsibility for the sampling strategies employed and the sampling information supplied to OHSS. OHSS cannot accept responsibility for the interpretation of the sampling information contained on this report by any parties.
- 4 OHSS is an INAB accredited laboratory for the sampling and identification of Asbestos containing materials
- 5 Comments, observations and opinions are outside the scope of INAB accreditation

Analyst: Deirdre Corry

Signed:

Deirdre Corry

For and on authority of OHSS

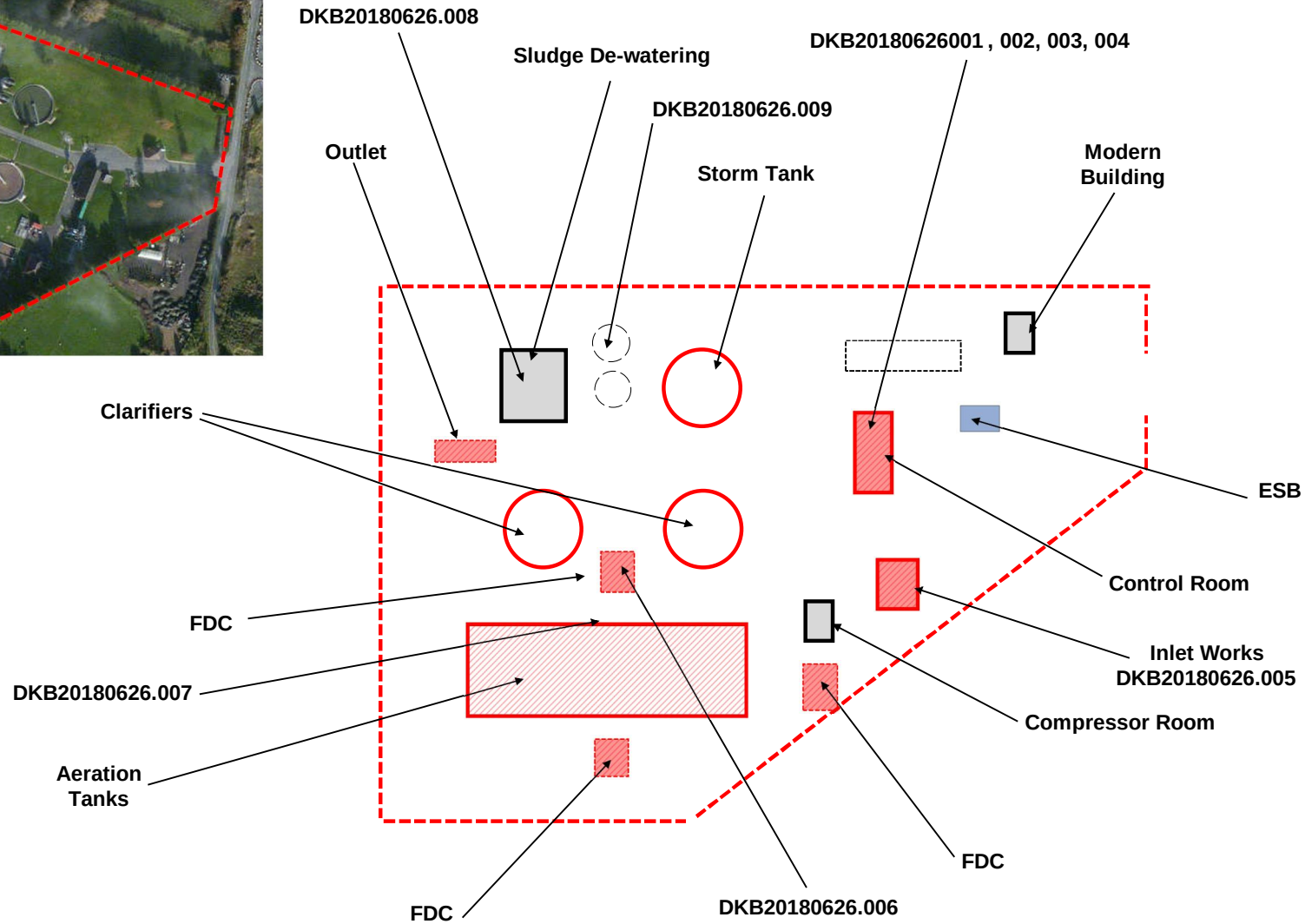


Drawings

Unit 2BeaT Centre,
Stephenstown Industrial Estate,
Balbriggan, Co. Dublin
Tel: (01) 6905907
Fax: (01) 8020439
Email: info@ohss.ie
Website: www.ohss.ie



Directors: Deirdre Corry, Paul Foran BA(Mod), MSc., MA, Dip Env. Eng., Dip Mgt., MIOSH, ROH **Company Reg no:** 354843



Drawing Legend		Drawing Revisions			Date	Scale	Project Number	Carlow (Mortarstown) WWTP Asbestos Survey	
Contains Asbestos		Not Accessed Presumed To Contain Asbestos		Rev #	Revision Description	Date	11/7/18		
Sample Point Location		No Access Under Fixed Floor Coverings Investigate Prior To Disturbance					Drawing No		
							1 of 1		
							This drawing is for illustration purposes only	24535	 SAFETY CONSULTANTS QMF 139 Rev 1
								Drawn By	
								DC	

Appendix G. WwTP Outdoor Lighting Report



DATE: 1 December 2025
DESIGNER: Sean Rafferty
PROJECT No: 5161805
PROJECT NAME: Mortarstown WWTP

**LIGHTING
REALITY**

FOR PLANNING

Design in Accordance with EN-13201 and WIMES 3.02E

Roads - 10 lux average 0.25 uniformity

Bat Roost Area: less than 1 lux, horizontal and vertical

Outdoor Lighting Report

Layout Report

General Data

Dimensions in Metres Angles in Degrees

Calculation Grids

ID	Grid Name	X	Y	X' Length	Y' Length	X' Spacing	Y' Spacing
1	Grid 1 Roads	671140.65	674658.10	433.83	286.86	1.74	1.49
2	Bat Roost	671234.23	674901.99	21.69	42.46	1.45	1.46
3	Bat Roost Vertical Grid	671248.83	674905.51	11.01	5.00	1.38	1.25

Luminaires



Luminaire A Data

Supplier	Urbis Schreder
Type	AXIA 3.1 5384 Integrated lenses 16 OSLO SQUARE GIANT@700mA
Lamp(s)	16 OSLO SQUARE GIANT@700mA WW 7 27 230V 00-53-397
LampFlux(klm)/Colour	4.16 WW 2700K/70
File Name	AXIA 3.1 5384 16 OSLO SQUARE GIANT 7 00mA WW 727 35.6W 487502 Integrated le...
Maintenance Factor	0.89
Imax70,80,90(cd/klm)	1031.6, 225.6, 0.0
No. in Project	33

Luminaire B Data

Supplier	
Type	AXIA 3.1 5384 Integrated lenses Back Light 1 6 OSLO SQUARE GI
Lamp(s)	16 OSLO SQUARE GIANT@700mA WW 7 27 230V 01-11-814
LampFlux(klm)/Colour	4.75 WW 2700K/70
File Name	36.3W 487532 Integrated lenses BL 230V EF Ultra-Narrow ProFlex .ldt
Maintenance Factor	0.89
Imax70,80,90(cd/klm)	849.7, 184.2, 0.0
No. in Project	3

Layout

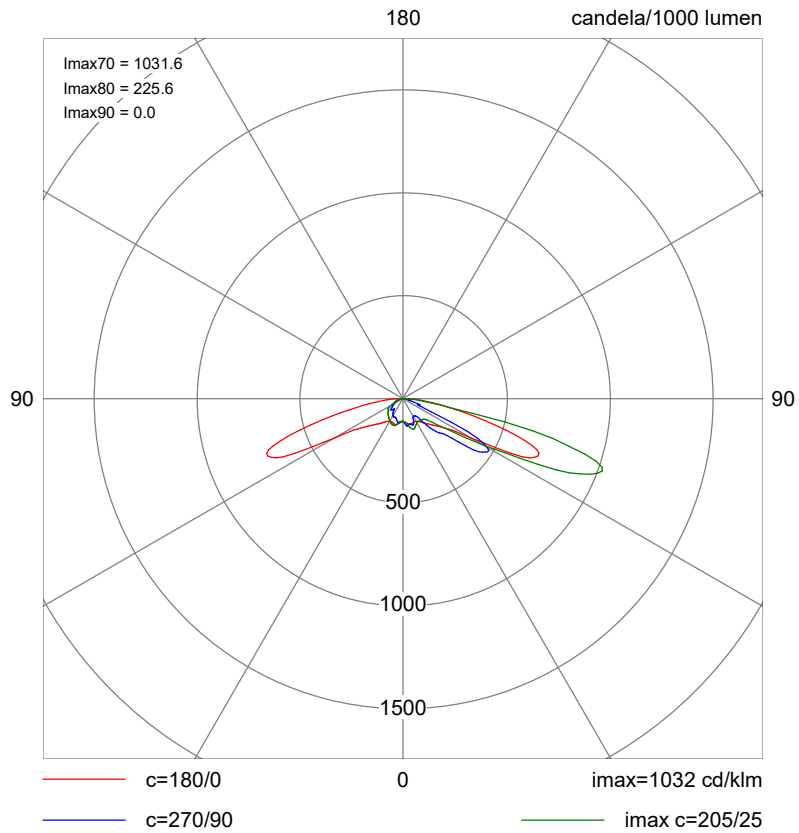
ID	Type	X	Y	Height	Angle	Tilt	Cant	Out- reach	Target X	Target Y	Target Z
1	A	671531.52	674782.22	6.00	260.00	0.00	0.00	0.50			
3	A	671481.88	674792.90	6.00	265.00	0.00	0.00	0.50			
4	A	671455.27	674790.76	6.00	247.00	0.00	0.00	0.50			
5	A	671462.43	674762.53	6.00	337.00	0.00	0.00	0.50			
6	A	671458.58	674738.72	6.00	155.00	0.00	0.00	0.50			
7	A	671452.45	674722.52	6.00	159.00	0.00	0.00	0.50			
8	A	671435.77	674800.36	6.00	224.00	0.00	0.00	0.50			
9	A	671440.26	674814.01	6.00	157.00	0.00	0.00	0.50			
10	A	671494.66	674771.27	6.00	90.00	0.00	0.00	0.50			
11	A	671447.26	674833.01	6.00	155.00	0.00	0.00	0.50			
12	A	671420.76	674839.17	6.00	67.00	0.00	0.00	0.50			
13	B	671449.82	674847.81	6.00	246.00	0.00	0.00	0.50			
14	A	671411.05	674807.48	6.00	242.00	0.00	0.00	0.50			
15	A	671372.30	674824.44	6.00	248.00	0.00	0.00	0.50			
16	A	671390.49	674809.95	6.00	72.00	0.00	0.00	0.50			
17	A	671347.76	674829.56	6.00	333.00	0.00	0.00	0.50			
18	A	671367.44	674863.37	6.00	160.00	0.00	0.00	0.50			
19	A	671355.59	674850.44	6.00	332.00	0.00	0.00	0.50			

Layout Continued

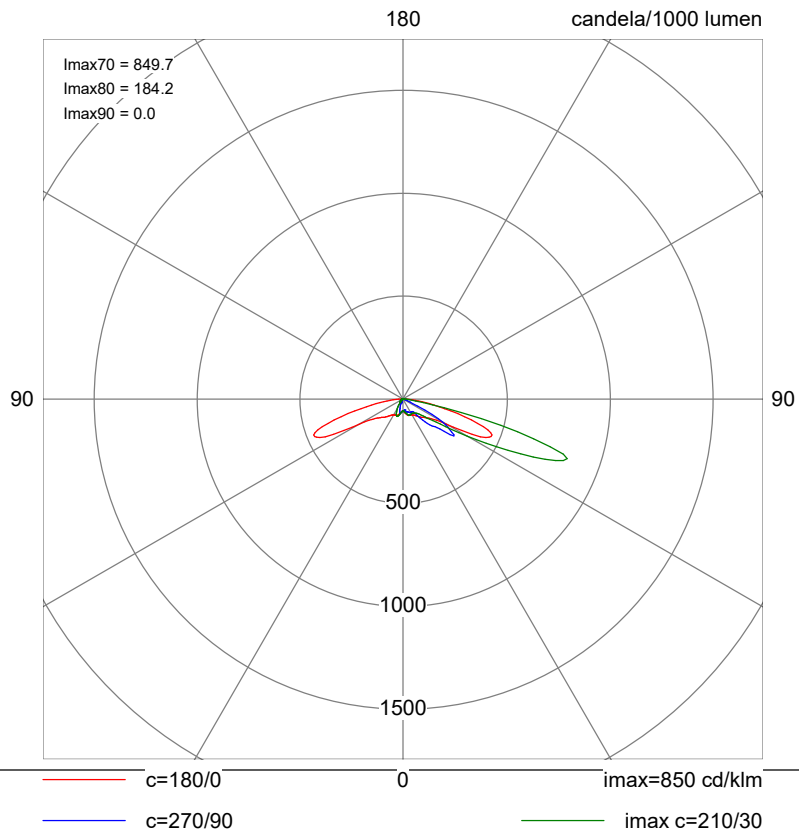
ID	Type	X	Y	Height	Angle	Tilt	Cant	Out- reach	Target X	Target Y	Target Z
20	A	671367.42	674882.04	6.00	334.00	0.00	0.00	0.50			
21	A	671344.30	674868.82	6.00	73.00	0.00	0.00	0.50			
23	B	671311.78	674881.08	6.00	69.00	0.00	0.00	0.50			
24	B	671285.16	674891.29	6.00	69.00	0.00	0.00	0.50			
26	A	671279.28	674908.42	5.00	249.00	0.00	0.00	0.50			
27	A	671347.01	674807.55	6.00	155.00	0.00	0.00	0.50			
28	A	671325.56	674811.76	6.00	69.00	0.00	0.00	0.50			
29	A	671299.93	674821.77	6.00	69.00	0.00	0.00	0.50			
30	A	671340.26	674789.42	6.00	162.00	0.00	0.00	0.50			
31	A	671332.48	674768.71	6.00	153.00	0.00	0.00	0.50			
32	A	671325.48	674750.54	6.00	160.00	0.00	0.00	0.50			
33	A	671319.74	674733.73	6.00	69.00	0.00	0.00	0.50			
35	A	671345.51	674723.97	6.00	69.00	0.00	0.00	0.50			
36	A	671371.30	674714.34	6.00	69.00	0.00	0.00	0.50			
37	A	671391.52	674706.85	6.00	69.00	0.00	0.00	0.50			
38	A	671411.52	674699.23	6.00	69.00	0.00	0.00	0.50			
39	A	671507.70	674783.95	6.00	261.00	0.00	0.00	0.50			
40	A	671550.34	674772.40	6.00	85.00	0.00	0.00	0.50			

Polar Diagrams

Luminaire A AXIA 3.1 5384 Integrated lenses 16 OSLON SQUARE GIANT@700mA

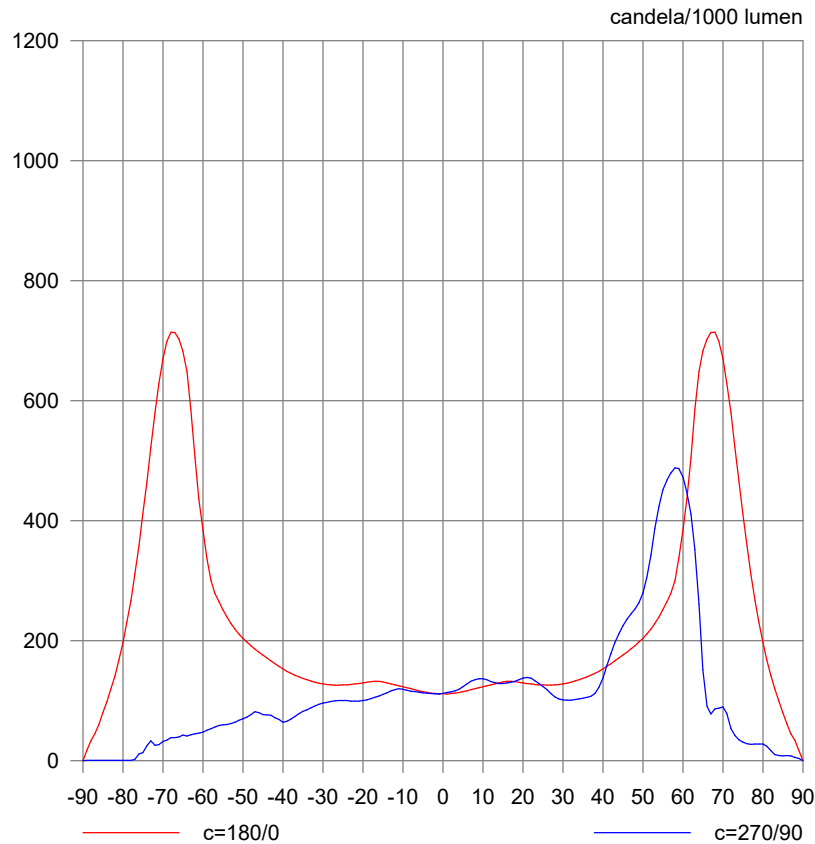


Luminaire B AXIA 3.1 5384 Integrated lenses Back Light 16 OSLON SQUARE GI

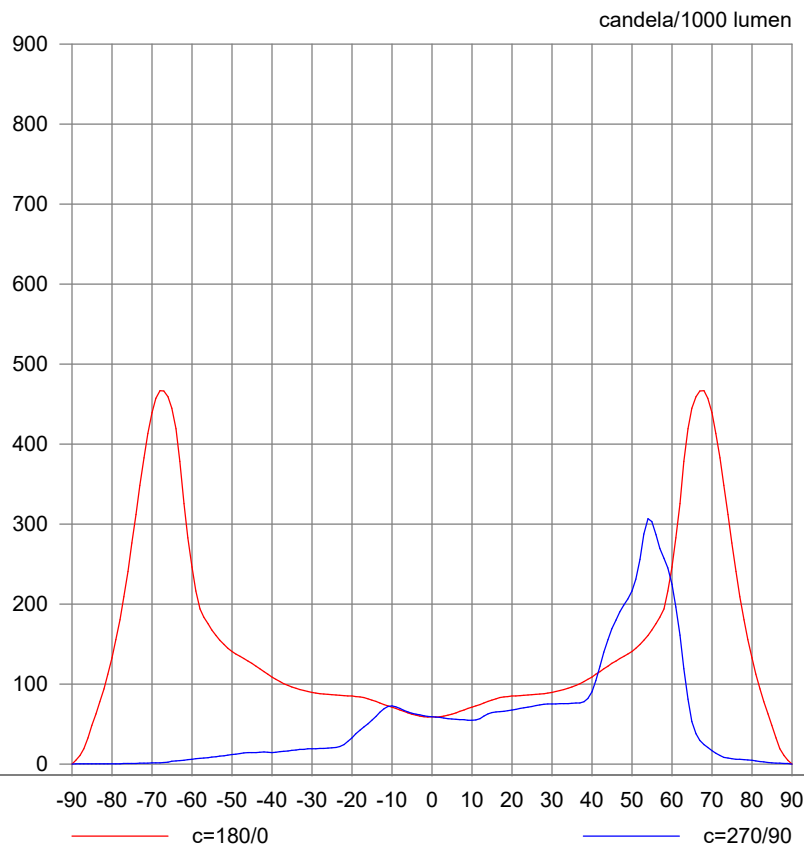


Cartesian Diagrams

Luminaire A AXIA 3.1 5384 Integrated lenses 16 OSLON SQUARE GIANT@700mA

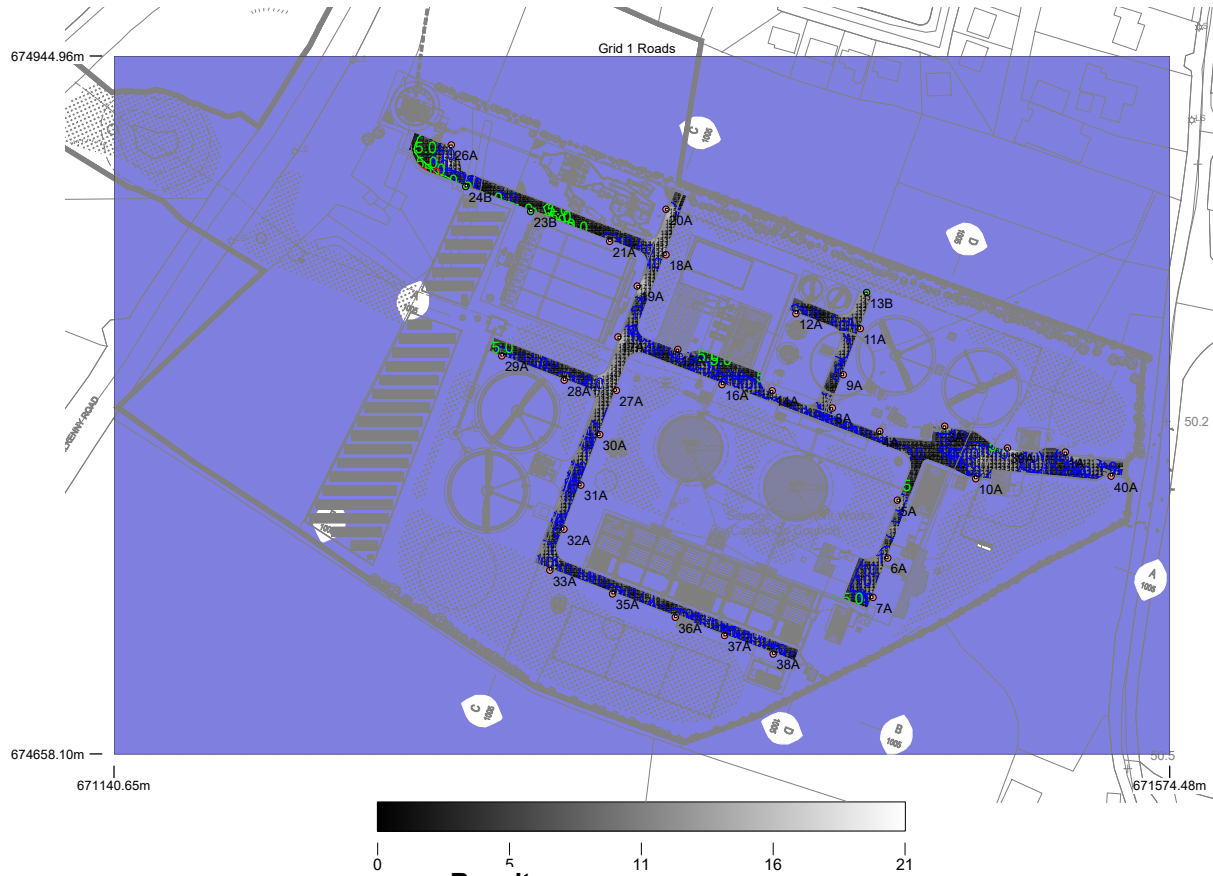


Luminaire B AXIA 3.1 5384 Integrated lenses Back Light 16 OSLON SQUARE GI



Horizontal Illuminance (lux)

Grid 1 Roads

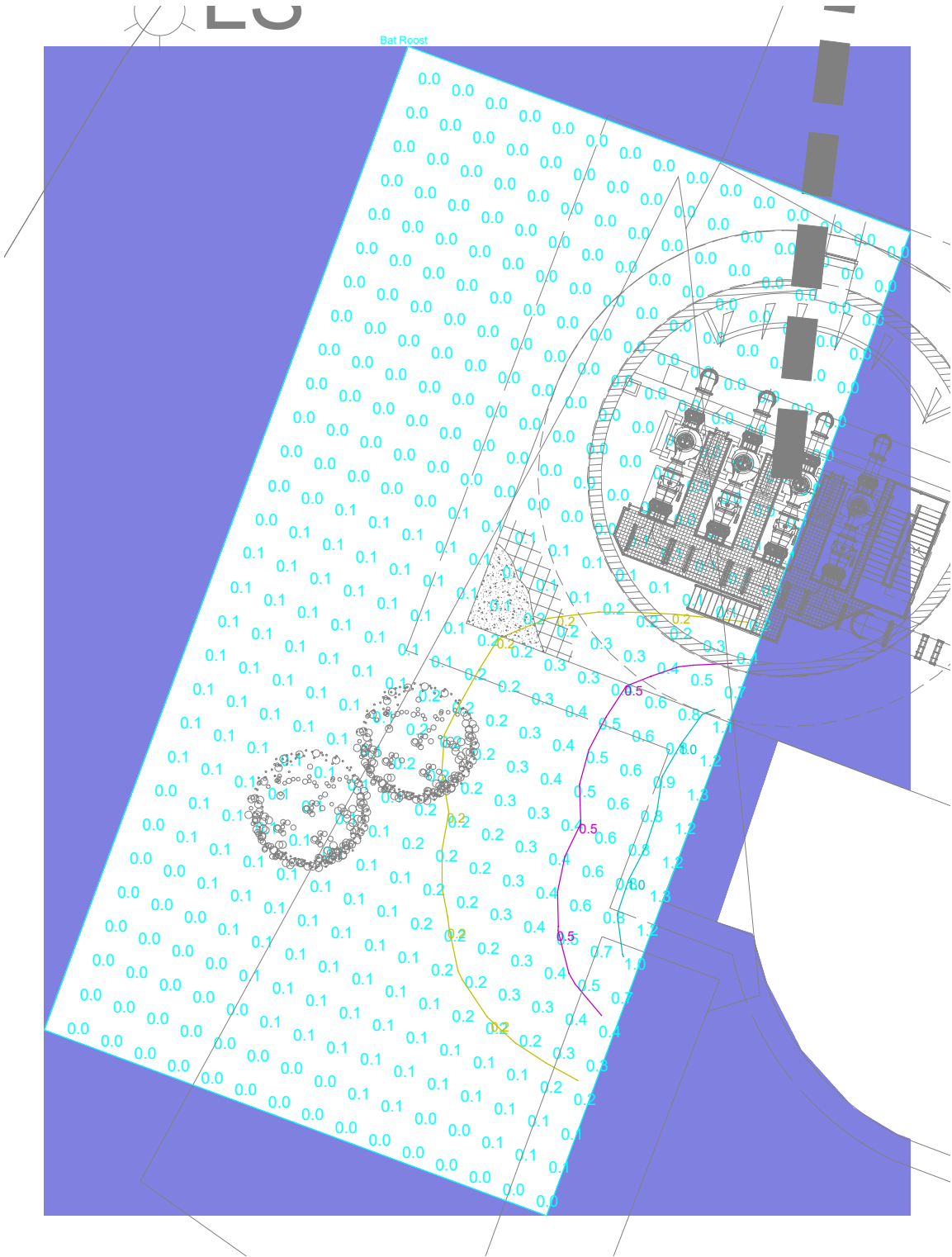


Results

Eav	10.08
Emin	2.60
Emax	21.12
Emin/Emax	0.12
Emin/Eav	0.26

Horizontal Illuminance (lux)

Bat Roost

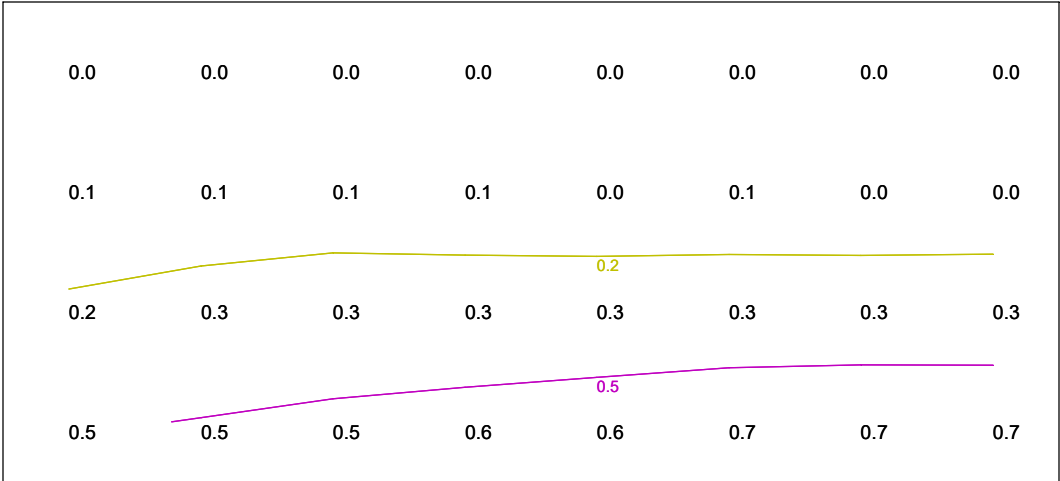


Results

Eav	0.13
Emin	0.01
Emax	1.29

Illuminance (lux)

Bat Roost Vertical Grid



Results

Eav	0.23
Emin	0.00
Emax	0.68
Emin/Emax	0.00
Emin/Eav	0.01

Appendix H. Renewable Energy Assessment



AtkinsRéalis



Renewable Energy Assessment Report

Uisce Éireann

22 July 2025

5161805DG0442 - Mortarstown WWTP
Renewable Energy Assessment

MORTARSTOWN WWTP UPGRADE

Notice

This document and its contents have been prepared and are intended solely as information for Uisce Éireann and use in relation to Draft

AtkinsRéalis Ireland Limited assumes no responsibility to any other party in respect of or arising out of or in connection with this document and/or its contents.

This document has 19 pages including the cover.

Document history

Document title: Renewable Energy Assessment Report

Document reference: 5161805DG0442 - Mortarstown WWTP Renewable Energy Assessment

Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
0.0	Renewable energy assessment	AJ	GK	KA	FQ	12/06/2025
1.0	Renewable energy assessment	AJ	GK	KA	FQ	22/07/2025

Client signoff

Client	Uisce Éireann
Project	MORTARSTOWN WWTP UPGRADE
Job number	5161805
Client signature/date	



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1. Introduction

AtkinsRéalis Ireland Ltd. have been commissioned as Engineering Service Providers (ESP) by Uisce Éireann (UÉ) to assist in the design delivery of the Mortarstown Wastewater Treatment Plant (WwTP) upgrade project including a renewable energy assessment. This report outlines the renewable energy assessment and conclusions drawn.

UÉ targets providing a minimum of 10% of energy demand from renewable sources and if possible maximise the energy generation based on the site potential and export back onto the grid where possible. The following renewable energy sources shall be considered in the order of preference:

- a) Solar Photo Voltaic (PV) & Solar Thermal
- b) Wind Energy (e.g. Wind Turbines)
- c) Hydro

The primary objective is to assess the site of the upgraded WwTP to determine the available quantity of renewables that can be installed to generate the maximum energy possible for consumption to be used by the upgraded Mortarstown Wastewater Treatment Plant as part of the renewable incentives of Uisce Éireann.

All solar PV systems are to be designed to comply with I.S. 10101 electrical standards and follow SEAI guidelines for Solar PV for Business.

1.1 Site description

Mortarstown Wastewater Treatment Plant is located 2.2km south of Carlow Town on the eastern bank of the River Barrow and serves the Carlow Town and its environs. The WwTP is predominantly fed from the Kilkenny Road Pumping Station but also accepts flows from other pumping stations in the area.

The plant was built and commissioned in 1986 for a capacity of 36,000 PE (Population Equivalent) with a planned upgrade to 52,500 PE (10 year horizon) and 58,500 PE (25 year horizon). Uisce Éireann propose to upgrade and expand the facility, extending into the agricultural grassland owned by Uisce Éireann the west of the WwTP including two clarifiers, a pumping station with settlement tanks and inlet works. The extended site includes available area for renewable energy resources.



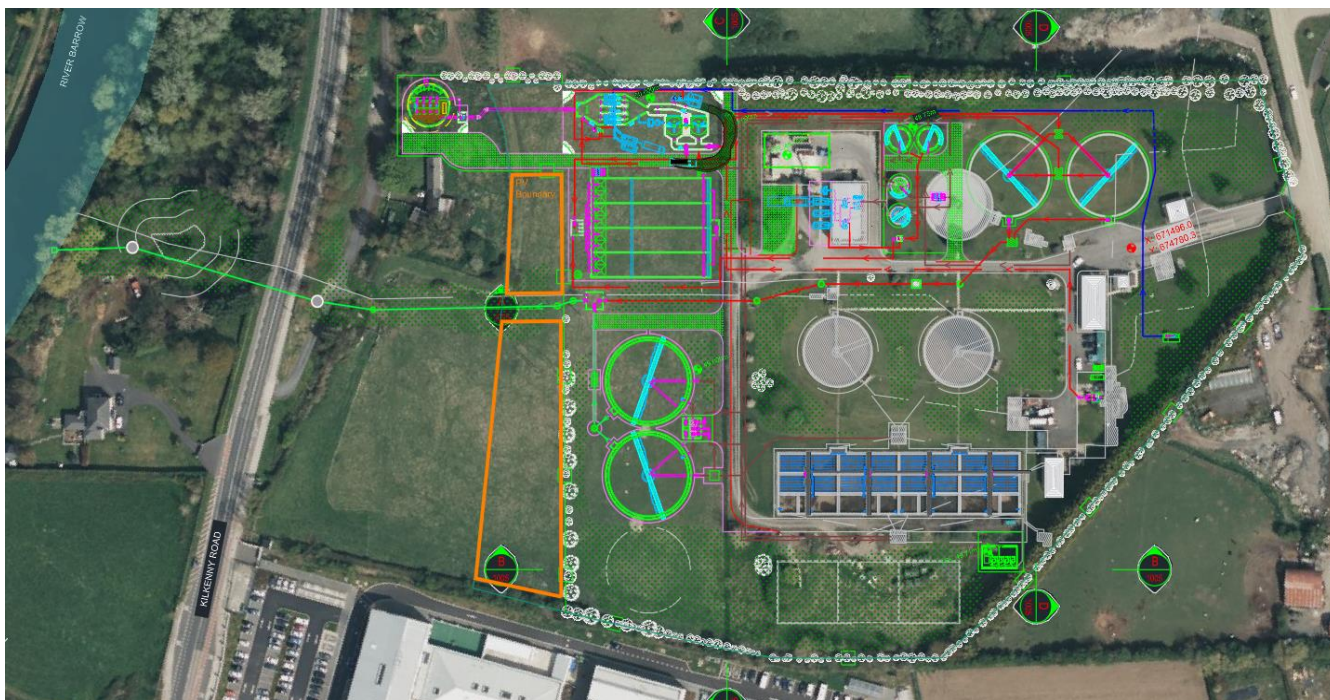


Figure 1-1 - Upgraded layout of Mortarstown Wastewater Treatment Plant

The available area for the renewable energy assessment is shown above in Figure 1-1 outlined by the orange boundary line, consisting of an area of approximately 3,610 m². The area to the west of the site PV area belongs to the county council and is not accessible to Uisce Éireann to use for energy generation. There is a 4-5 metre ditch to the south of our PV boundary that divides the site from the adjoining school which is excluded from the PV calculation as well as a 10m gap between the PV arrays for a wayleave of the outfall pipeline to the river Barrow.

The electrical supply to the WwTP enters from the east of the site across the Green Road via overhead cables and enters into an site ESB Substation. The main electrical switchgear is located at the Administration building on site.

There are existing 38KV high voltage overhead lines that enter the site from the west that go underground in cable ducting to traverse the site and exit the site on the east at Green Road. There is also ESB Networks infrastructure running north to south along the tree line and solar PV boundary that feeds power to the secondary school that is located south of the WwTP. This is reflected in the ESB Networks Infrastructure Map, Reference – 20250528-070_A3 included in the Appendix.

1.2 Scope of renewable energy assessment

The scope of the assessment is to study and survey the site to evaluate how much renewable energy is needed to compensate for 10% of the new overall demand of the Mortarstown WwTP. The assessment considers the terrain of the area available as well as the biodiversity present and any overhead lines with electricity poles impeding the area.

The study focusses on UÉ's preferred renewable energy source Solar Photo Voltaic (PV) and considers the maximum quantity of solar suitable to install, utilising the full area available and owned by UÉ.

The study assumes an evenly spaced ground mounted solar PV system with 3 phase inverter technology and with DC and AC isolators and cables running along the mains ESB cable network to the meter in the administration building.

1.3 Site Survey

A site survey was carried out on 22nd May 2025 by AtkinsRéalis to examine the landscape available for PV. Access to the WwTP was provided to AtkinsRéalis staff members. However, the area available for the installation of solar PV could not be accessed on the day of the survey due to restricted access to the field. All gates were locked with a barbed wire fence installed around the field.

The image below shows the existing 38KV high voltage overhead lines enter the site from the west and going underground through cable ducting to traverse the site and exit the site on the east at Green Road. This is reflected in the ESB Networks Infrastructure Map, Reference – 20250528-070_A3 that can be found in the appendix. The existing underground cable will need to be diverted through the site to allow for the upgrade works within the WwTP facility as it clashes with the new proposed pipework.



Figure 1-2 - HV 3-Phase Supply into Mortarstown WwTP Site

The grass area of the adjacent field available for the solar PV installation is not a simple flat land as seen in Figure 1.4, with sloping surfaces and vegetation that will need to be cleared and the soil levelled for ground mounting PV panels. There are several existing ESB Networks electricity poles that traverse the site from south to north that are located along the edge of the area available for the new solar PV and also at the location of the proposed Inlet Works and Primary Settlement Tanks. These ESB poles and electricity lines will have an impact on the setting out of the solar PV installation and the WwTP site infrastructure. AtkinsRéalis have engaged with ESB Networks at an earlier stage of the project and will resume discussions on finalisation of this assessment and any necessary updates to the specimen design, with a view to moving / diverting the ESB Networks infrastructure away from the development areas.



Figure 1-3 - Land Assigned for Renewable Energy

The open field area available is well suited to the sunshine for excellent solar gains as it is an open space. However, there is some overshading from the hedging to the south of the site along the adjoining school boundary. It is proposed to pullback the solar PV panels from the boundary line. New fencing is proposed to be constructed dividing the PV boundary area with the adjoining land owners property.

2. Energy Assessment

An energy balance assessment has been completed by AtkinsRéalis accounting for the power loads of the existing and new equipment power loads and their duration of use throughout the day. The maximum load accounted in the WwTP is approximately 612.5 kW with an estimated annual consumption of nearly 2.4 million kWh based on the energy balance calculation completed in 2024. Therefore to optimise the area available to maximise the supply of energy demand on site with renewables, a 382 kW PV system is required within a working area of 3,610 m².

2.1 Solar PV Potential for 10% Energy Demand

The Easy PV software was utilised to design the solar PV potential with the area mapped out through satellite image as shown in Figure 2.1 below.

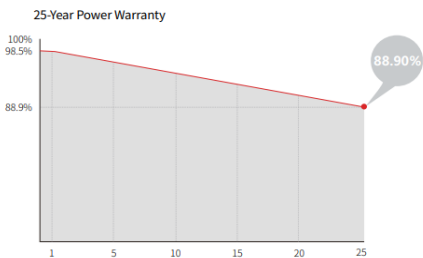


Figure 2-1 - Mapped Area Assigned to Renewable Energy Resource

A Longi Hi-Mo X6 LR5 66HTH 530W Black White Monocrystalline Panel was considered consisting of half-cell modules and PERC design for high output and over 21% module efficiency as can be seen in Figure 2.2 below. The panel arrangement is assumed to be south facing with an angle of inclination of 35 degrees and row spacing of 1.5 m is assumed for the ground mounted system to maximise the site boundary.

22.7% MAX MODULE EFFICIENCY	0~3% POWER TOLERANCE	<1.5% FIRST YEAR POWER DEGRADATION	0.40% YEAR 2-25 POWER DEGRADATION

Additional Value



Mechanical Parameters

Cell Orientation	132 (6×22)
Junction Box	IP68
Output Cable	4mm², +400, -200mm/±1400mm length can be customized
Glass	Single glass, 3.2mm coated tempered glass
Frame	Anodized aluminum alloy frame
Weight	26.0kg
Dimension	2094×1134×35mm
Packaging	31pcs per pallet / 155pcs per 20' GP / 682pcs per 40' HC

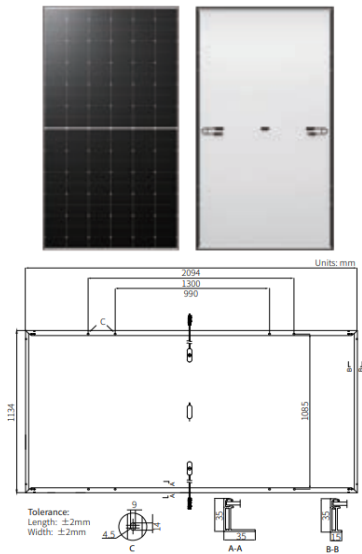


Figure 2-2 - Longi Hi-Mo X6 LR5 66HTH 530W Black White Monocrystalline Panel description

480 No. of the 530w PV panels are required to supply the 255 kW system covering a panel area of approximately 1,140m² required to house the PV installation. 2 No. of 100 kW Huawei SUN2000 M2 3-phase string inverter is considered on the panel array. The solar PV array is expected to generate an average of 222,242 kWh per year over the expected life expectancy of 25 years.

Assuming a tariff rate of 0.26 €/kWh daily tariff and 0.14 €/kWh nightly tariff, the total savings and earnings from the solar array in the first year are expected to be €61,690. The total cost of the PV system is expected to be €720,000 thereby giving a simple payback of 11.67 years. The total savings and earnings from the solar array over the course of 25 years are expected to be € 2,112,300.



Figure 2-3 - 255 KW Panel Layout

2.2 Solar PV Potential for the full site

If utilising the full available area of the site, 720 No. 530w panels can be accommodated, which results in a 382 kW solar PV system with the same 1.5m row spacing and south facing panels and covering a panel area of 1,710m². This arrangement will provide enough energy to cover 17% of the electrical energy demand for the WwTP during clear sunny hours. 3 No. Huawei SUN2000 M2 100kW 3ph string inverters and 1 Huawei SUN2000 M3 50kW 3ph string inverter are used to model a total 350 kW inverter inputs for the overall PV system.

The inverter sizes and locations shall be selected by the PV contractor on site. Due to some site restrictions such as the electricity poles located on site, PV panel placement needs to be adjusted to work around restrictions and could mean excluding some panels to make sufficient space.



Figure 2-4 - 382 kW Solar PV Panel Layout

This 382 kW solar PV array which can supply up to 15% of the energy demand of the Mortarstown WwTP as shown above, is expected to generate a maximum of 333,363 kWh over a typical year. This is around overall total annual energy demand is expected to be supplied directly by the solar array. The remaining 85% (2,061,512 kWh) is supplied from the ESB grid.

Over the course of the first year with the same tariff rate of 0.26 €/kWh daily tariff and 0.14 €/kWh nightly tariff, €92,535 is expected to be saved on electricity consumed by the facility and €280,988 spent on electricity imported from the grid. Without solar, an expected €373,523 would be spent on importing electricity from the grid. The total savings and earnings from the solar array over the course of 25 years is expected to be € 3,168,450. The total cost of the PV system is approximately €1,080,000 giving a simple payback of 11.67 years for the system assuming a 3% inflation rate. The net present value (NPV) of the PV system after 25 years is expected to be €6.2 million.

2.3 Wind and Hydro Energy Sources

Wind and hydro energy sources were not investigated further given the target 10% of the energy demand consumed by the Mortarstown WwTP can be achieved with UE's preferred renewable energy source, solar PV.

3. Renewable Energy Summary

In keeping with the Project EED objectives, the use of renewables in the form of solar PV has been investigated for the site. The following should be noted with regards to the sizing of the solar PV installations:

1. The maximum installation size cannot exceed the associated site's maximum anticipated power capacity.
2. The annual yearly hours of utilisable sunshine for Carlow County is taken as 1300 hours per year (Met Eireann, Peak Solar Incidence for Oak Park, Co. Carlow, data).

For the Mortarstown WWTP, two options were investigated namely

- a. Provide a PV installation at the WWTP with sufficient capacity to power 10% of the WWTP.
- b. Provide a PV installation, and associated electrical infrastructure to cover the full field available with sufficient capacity to power 70% of the WwTP.

Please note that for the purpose of this review, the consideration for the installation of battery storage was not reviewed as it was deemed too expensive for the solar PV installation. Note also that the PV layouts presented are subject to changes in accordance with ESB distribution line diversions.

Table 3-1 below shows the anticipated size, capital cost and pay-back period for each of the PV installations. The installation size and costs indicated assumes the solar panels for this site will be installed at the Mortarstown WwTP site with associated electrical infrastructure (invertors, underground ducting and cabling) required to relay the generated power down to the Administration Building housing the switchgear. The figures indicated for the WwTP serve as a cost reference associated with additional solar panel installation and power relaying infrastructure required for the WwTP.

Table 3-1 - Summary of Solar PV installation per site

Site	Approximate site Energy Demand (kWh)	Size of Solar PV Installation (kW)	Approximate Yearly Energy Generation (kWh / a)	CAPEX (€)	Payback Period (years)
Mortarstown WwTP at 10% Energy Demand	2.4m kWh / a	255	222,242	€720,000	11.67
Mortarstown WwTP at full site potential Energy Demand	2.4m kWh / a	382	333,363	€1,080,000	11.67



4. Conclusion

Both options of the 255 kW and 382 kW PV system yield the same payback period at just under 12 years. The smaller system costs less but only supplies 10% of the energy demand while the bigger system costs more and generates 15% of the WwTP's energy demand.

The SEAI has grant funding for the Non-Domestic Microgen Grant (NDMG) that provides financial assistance to help businesses and other sectors to install solar PV panels to generate electricity on site. It offers grants to a maximum of €162,600 and this is available for systems from 1kWp to a maximum of 1000kWp.

It can be concluded that 10% of the energy demand of Mortarstown WwTP plus more is achievable within the available area on site. UÉ shall confirm, if they wish to proceed with solar PV and to confirm the extent to be included following further commercial assessments based on budget constraints and other factors.



APPENDICES

Appendix A. ESB Network Map





DATE: 28-May-2025

** SCALE: 1:2200

*** SCALE WHEN PRINTED ON AN A3 PAGE
XY COORDINATES DISPLAYED IN IRISH GRID COORDINATE SYSTEM

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X.Y: 271020 174998

ESB NETWORKS HAS ISSUED THIS MAP AS A PDF DOCUMENT. IF VIEWING A PAPER VERSION OF THIS MAP, THE VIEWER MUST ENSURE THAT IT HAS BEEN PRINTED IN COLOUR TO FIT TO AN A3 (OR LARGER) PAGESIZE AND THAT EACH OF THE COLOURS INDICATED ON THE COLOUR CODE LEGEND ABOVE ARE CLEAR AND DISTINCT FROM EACH OTHER TO MAINTAIN A CORRECT REPRESENTATION OF THE ELECTRICAL NETWORK INFORMATION.

WARNING

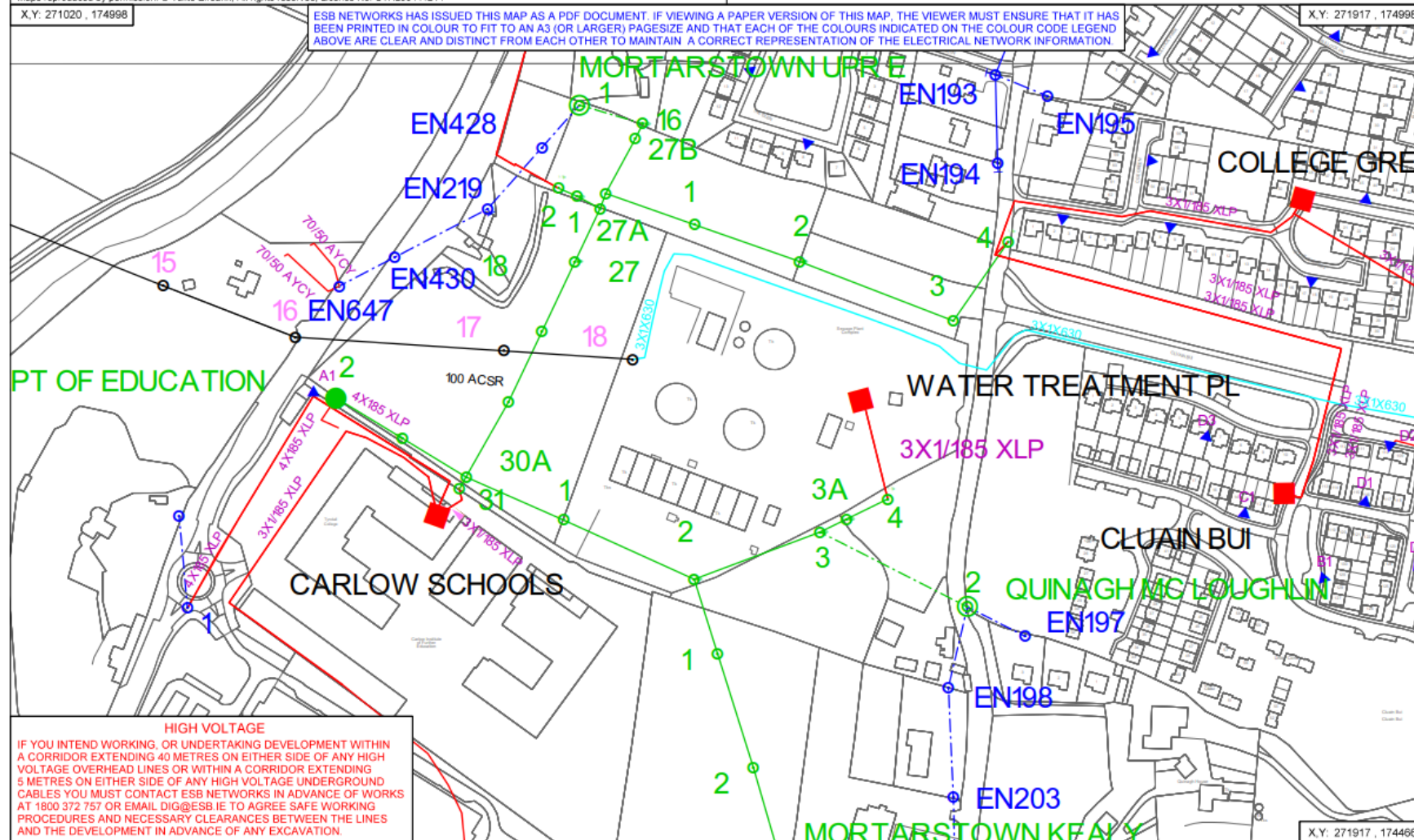
THIS MAP INDICATES THE APPROXIMATE LOCATION OF ESB TRANSMISSION (60KV, 220KV, 110KV, 38KV) AND DISTRIBUTION (20KV, 10KV, 230V/400V) UNDERGROUND CABLES AND OVERHEAD LINES IN THE GENERAL AREA OF THE PROPOSED WORKS. ESB NETWORKS TAKE NO RESPONSIBILITY FOR THE ACCURACY OR COMPLETENESS OF THE MAP. IT IS THE USER'S RESPONSIBILITY TO INDEPENDENTLY VERIFY THE INFORMATION AND THE LOCATION OF UNDERGROUND CABLES AND OVERHEAD LINES. LOW VOLTAGE (230V/400V) SERVICE CABLES (E.G. HOUSE SERVICES, FACTORY/SHOP SERVICES, PUBLIC LIGHTING LAMP SERVICES, ETC.) ARE NOT INCLUDED BUT THEIR PRESENCE SHOULD BE ANTICIPATED. THE DEPTHS OF UNDERGROUND CABLES MUST NEVER BE USED TO DETERMINE THE LOCATION OF UNDERGROUND CABLES. VERIFICATION OF THE LOCATION OF UNDERGROUND CABLES IS UNDERTAKEN. THE ACTUAL LOCATION OF ALL UNDERGROUND ELECTRICITY CABLES MUST BE ESTABLISHED AND VERIFIED ON THE SITE USING

ESTABLISHED AND VERIFIED ON THE SITE USING:

- (A) UP-TO-DATE MAP RECORDS;
- (B) CABLE LOCATOR EQUIPMENT OPERATED IN BOTH POWER AND RADIO MODES;
- (C) CAREFUL HAND DIGGING OF TRIAL HOLES USING 'SAFE DIGGING PRACTICE'.

REFER ALSO TO HSA CODE OF PRACTICE FOR AVOIDING DANGER FROM UNDERGROUND SERVICES' ES8 TAKES NO RESPONSIBILITY FOR AND SHALL BEAR NO LIABILITY, HOWSOEVER ARISING, IN RELATION AS A RESULT OF DAMAGE OR INTERFERENCE WITH ITS NETWORKS.

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5161805DG0442 - Mortarstown
WWTP Renewable Energy
Assessment
1.0 | 22 July 2025



Appendix B. Solar Energy Calculation Summary



B.1 25 Year Solar Production - 10% Energy Production

25-Year Solar Production - 10% of Energy Production on Available Land																											
CAPEX			Energy Price (Day)		Energy Price (Night)		Solar Energy Generated (Annual)		ESB Energy Requirement		Energy Requirement @ Night Rate		Energy Requirement @ Day Rate		Energy Bill Night Rate		Energy Bill Day Rate		Energy Bill		TOTEX		TOTEX (Cumulative)		TOTEX (NPV)		
Year	€		€/kWh		€/kWh		kWh/year		kWh/year		kWh/year		kWh/year		€/year		€/year		€/year		€		€		€		
0	€	720,000.00	€		0.2592	€	0.1362		238,002		2,158,513	€	2,013,441	€	145,072	€	274,231	€	37,603	€	311,833	€	1,031,833	€	1,031,833	€	1,031,833
1			€		0.2670	€	0.1403		235,062		2,161,453	€	2,013,441	€	148,012	€	282,458	€	39,516	€	321,973	€	321,973	€	1,353,806	€	1,317,445
2			€		0.2750	€	0.1445		232,247		2,164,268	€	2,013,441	€	150,827	€	290,931	€	41,475	€	332,407	€	332,407	€	1,686,213	€	1,596,850
3			€		0.2832	€	0.1488		229,556		2,166,959	€	2,013,441	€	153,518	€	299,659	€	43,482	€	343,141	€	343,141	€	2,029,354	€	1,870,189
4			€		0.2917	€	0.1533		226,989		2,169,526	€	2,013,441	€	156,085	€	308,649	€	45,535	€	354,184	€	354,184	€	2,383,538	€	2,137,596
5			€		0.3005	€	0.1579		224,547		2,171,968	€	2,013,441	€	158,527	€	317,908	€	47,635	€	365,543	€	365,543	€	2,749,081	€	2,399,204
6			€		0.3095	€	0.1626		222,229		2,174,286	€	2,013,441	€	160,845	€	327,446	€	49,781	€	377,227	€	377,227	€	3,126,308	€	2,655,139
7			€		0.3188	€	0.1675		220,036		2,176,479	€	2,013,441	€	163,038	€	337,269	€	51,974	€	389,243	€	389,243	€	3,515,551	€	2,905,526
8			€		0.3283	€	0.1725		217,967		2,178,548	€	2,013,441	€	165,107	€	347,387	€	54,213	€	401,600	€	401,600	€	3,917,151	€	3,150,486
9			€		0.3382	€	0.1777		216,022		2,180,493	€	2,013,441	€	167,052	€	357,809	€	56,497	€	414,305	€	414,305	€	4,331,456	€	3,390,136
10			€		0.3483	€	0.1830		214,202		2,182,313	€	2,013,441	€	168,872	€	368,543	€	58,826	€	427,369	€	427,369	€	4,758,825	€	3,624,589
11			€		0.3588	€	0.1885		212,506		2,184,009	€	2,013,441	€	170,568	€	379,599	€	61,199	€	440,798	€	440,798	€	5,199,623	€	3,853,956
12			€		0.3696	€	0.1942		210,935		2,185,580	€	2,013,441	€	172,140	€	390,987	€	63,615	€	454,603	€	454,603	€	5,654,225	€	4,078,345
13			€		0.3806	€	0.2000		209,487		2,187,027	€	2,013,441	€	173,587	€	402,717	€	66,075	€	468,792	€	468,792	€	6,123,017	€	4,297,860
14			€		0.3921	€	0.2060		208,165		2,188,350	€	2,013,441	€	174,909	€	414,798	€	68,576	€	483,374	€	483,374	€	6,606,391	€	4,512,601
15			€		0.4038	€	0.2122		206,967		2,189,548	€	2,013,441	€	176,108	€	427,242	€	71,117	€	498,359	€	498,359	€	7,104,750	€	4,722,668
16			€		0.4159	€	0.2186		205,893		2,190,622	€	2,013,441	€	177,181	€	440,060	€	73,697	€	513,756	€	513,756	€	7,618,507	€	4,928,155
17			€		0.4284	€	0.2251		204,943		2,191,572	€	2,013,441	€	178,131	€	453,261	€	76,315	€	529,576	€	529,576	€	8,148,083	€	5,129,155
18			€		0.4413	€	0.2319		204,118		2,192,397	€	2,013,441	€	178,956	€	466,859	€	78,968	€	545,827	€	545,827	€	8,693,910	€	5,325,758
19			€		0.4545	€	0.2388		203,417		2,193,097	€	2,013,441	€	179,657	€	480,865	€	81,656	€	562,521	€	562,521	€	9,256,430	€	5,518,051
20			€		0.4681	€	0.2460		202,841		2,193,674	€	2,013,441	€	180,233	€	495,291	€	84,375	€	579,666	€	579,666	€	9,836,096	€	5,706,120
21			€		0.4822	€	0.2534		202,389		2,194,125	€	2,013,441	€	180,685	€	510,150	€	87,124	€	597,274	€	597,274	€	10,433,370	€	5,890,045
22			€		0.4967	€	0.2610		202,062		2,194,453	€	2,013,441	€	181,012	€	525,454	€	89,901	€	615,355	€	615,355	€	11,048,725	€	6,069,907
23			€		0.5116	€	0.2688		201,859		2,194,656	€	2,013,441	€	181,215	€	541,218	€	92,701	€	633,919	€	633,919	€	11,682,644	€	6,245,784
24			€		0.5269	€	0.2769		201,780		2,194,735	€	2,013,441	€	181,294	€	557,454	€	95,524	€	652,978	€	652,978	€	12,335,623	€	6,417,750
25			€		0.5427	€	0.2852		201,826		2,194,689	€	2,013,441	€	181,248	€	574,178	€	98,365	€	672,543	€	672,543	€	13,008,165	€	6,585,878



B.2 25 Year Solar Production – Max Installed Energy Production

25-Year Solar Production - Maximum Installed Energy Production on Available Land																								
CAPEX			Energy Price (Day)	Energy Price (Night)	Solar Energy Generated (Annual)	ESB Energy Requirement	Energy Requirement @ Night		Energy Requirement @ Day Rate		Energy Bill Night	Energy Bill Day Rate	Energy Bill	TOTEX	TOTEX (Cumulative)		TOTEX (NPV)							
Year	€		€/kWh	€/kWh	kWh/year	kWh/year	kWh/year	kWh/year	kWh/year	kWh/year	€/year	€/year	€/year	€	€	€	€							
0	€	1,080,000.00	€	0.2592	€	0.1362	357,003	2,039,512	€	2,013,441	€	26,071	€	274,231	€	6,758	€	280,988	€	1,360,988	€	1,360,988	€	1,360,988
1			€	0.2670	€	0.1403	352,593	2,043,921	€	2,013,441	€	30,481	€	282,458	€	8,138	€	290,595	€	290,595	€	1,651,583	€	1,607,224
2			€	0.2750	€	0.1445	348,370	2,048,145	€	2,013,441	€	34,704	€	290,931	€	9,543	€	300,474	€	300,474	€	1,952,058	€	1,848,606
3			€	0.2832	€	0.1488	344,334	2,052,181	€	2,013,441	€	38,740	€	299,659	€	10,973	€	310,632	€	310,632	€	2,262,690	€	2,085,224
4			€	0.2917	€	0.1533	340,484	2,056,031	€	2,013,441	€	42,590	€	308,649	€	12,425	€	321,074	€	321,074	€	2,583,764	€	2,317,162
5			€	0.3005	€	0.1579	336,820	2,059,694	€	2,013,441	€	46,254	€	317,908	€	13,898	€	331,807	€	331,807	€	2,915,570	€	2,544,504
6			€	0.3095	€	0.1626	333,344	2,063,171	€	2,013,441	€	49,730	€	327,446	€	15,391	€	342,837	€	342,837	€	3,258,408	€	2,767,329
7			€	0.3188	€	0.1675	330,054	2,066,461	€	2,013,441	€	53,021	€	337,269	€	16,902	€	354,171	€	354,171	€	3,612,579	€	2,985,717
8			€	0.3283	€	0.1725	326,950	2,069,565	€	2,013,441	€	56,124	€	347,387	€	18,428	€	365,815	€	365,815	€	3,978,394	€	3,199,743
9			€	0.3382	€	0.1777	324,033	2,072,482	€	2,013,441	€	59,041	€	357,809	€	19,968	€	377,776	€	377,776	€	4,356,170	€	3,409,479
10			€	0.3483	€	0.1830	321,303	2,075,212	€	2,013,441	€	61,771	€	368,543	€	21,518	€	390,061	€	390,061	€	4,746,231	€	3,614,997
11			€	0.3588	€	0.1885	318,759	2,077,756	€	2,013,441	€	64,315	€	379,599	€	23,076	€	402,675	€	402,675	€	5,148,906	€	3,816,365
12			€	0.3696	€	0.1942	316,402	2,080,113	€	2,013,441	€	66,672	€	390,987	€	24,639	€	415,627	€	415,627	€	5,564,533	€	4,013,651
13			€	0.3806	€	0.2000	314,231	2,082,284	€	2,013,441	€	68,843	€	402,717	€	26,205	€	428,922	€	428,922	€	5,993,454	€	4,206,917
14			€	0.3921	€	0.2060	312,247	2,084,268	€	2,013,441	€	70,827	€	414,798	€	27,769	€	442,567	€	442,567	€	6,436,021	€	4,396,227
15			€	0.4038	€	0.2122	310,450	2,086,065	€	2,013,441	€	72,624	€	427,242	€	29,328	€	456,570	€	456,570	€	6,892,591	€	4,581,641
16			€	0.4159	€	0.2186	308,839	2,087,676	€	2,013,441	€	74,235	€	440,060	€	30,877	€	470,937	€	470,937	€	7,363,528	€	4,763,218
17			€	0.4284	€	0.2251	307,415	2,089,100	€	2,013,441	€	75,659	€	453,261	€	32,414	€	485,675	€	485,675	€	7,849,203	€	4,941,013
18			€	0.4413	€	0.2319	306,177	2,090,338	€	2,013,441	€	76,897	€	466,859	€	33,932	€	500,792	€	500,792	€	8,349,995	€	5,115,081
19			€	0.4545	€	0.2388	305,126	2,091,389	€	2,013,441	€	77,948	€	480,865	€	35,428	€	516,293	€	516,293	€	8,866,288	€	5,285,475
20			€	0.4681	€	0.2460	304,262	2,092,253	€	2,013,441	€	78,812	€	495,291	€	36,896	€	532,187	€	532,187	€	9,398,475	€	5,452,246
21			€	0.4822	€	0.2534	303,584	2,092,931	€	2,013,441	€	79,490	€	510,150	€	38,329	€	548,479	€	548,479	€	9,946,954	€	5,615,444
22			€	0.4967	€	0.2610	303,093	2,093,422	€	2,013,441	€	79,981	€	525,454	€	39,723	€	565,177	€	565,177	€	10,512,131	€	5,775,115
23			€	0.5116	€	0.2688	302,788	2,093,727	€	2,013,441	€	80,286	€	541,218	€	41,071	€	582,288	€	582,288	€	11,094,419	€	5,931,307
24			€	0.5269	€	0.2769	302,670	2,093,845	€	2,013,441	€	80,404	€	557,454	€	42,365	€	599,819	€	599,819	€	11,694,239	€	6,084,062
25			€	0.5427	€	0.2852	302,739	2,093,776	€	2,013,441	€	80,336	€	574,178	€	43,599	€	617,777	€	617,777	€	12,312,016	€	6,233,425



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Appendix I. Preliminary Health and Safety Management Plan



AtkinsRéalis



Preliminary Safety & Health Plan

Uisce Éireann

01 February 2024
Planning Only

5161805-ATKR-HS

MORTARSTOWN WASTEWATER TREATMENT PLANT UPGRADE

Notice

This document and its contents have been prepared and are intended solely as information for Uisce Éireann and use in relation to Mortarstown Waste Water Treatment Plant upgrade.

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This document has 31 pages including the cover.

Document history

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[illegible]

Client signoff

Client	Uisce Éireann
Project	Mortarstown Wastewater Treatment Plant Upgrade
Job number	5161805
Client signature/date	

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Glossary

Acronym	Definition
PSHP	Preliminary Safety & Health Plan – A document prepared under Regulation 12(1)(a) of the Safety, Health and Welfare at Work (Construction) Regulations 2013 to identify design and construction features affecting safety and health.
PSDP	Project Supervisor Design Process – The duty holder appointed by the Client to coordinate safety and health during the design stage.
PSCS	Project Supervisor Construction Stage – The duty holder appointed by the Client to manage safety and health during the construction stage.
AF1	Approved Form 1 – Notification form submitted to the Health and Safety Authority (HSA) for projects exceeding 30 working days or 500 person-days.
HSA	Health and Safety Authority – The national body responsible for enforcing workplace health and safety legislation in Ireland.
CEMP	Construction Environmental Management Plan – A plan detailing environmental controls and mitigation measures during construction.
RAMS	Risk Assessment and Method Statement – Documentation outlining hazards, risks, and safe systems of work for specific tasks.
Safety File	A statutory record containing health and safety information required for future construction, maintenance, or demolition works.
Temporary Works	Structures or systems required to support construction activities but not forming part of the permanent works (e.g., scaffolding, formwork).
TWC	Temporary Works Coordinator – A competent person appointed to manage and coordinate temporary works on site.



TWD	Temporary Works Designer – A competent person responsible for designing temporary works solutions.
TWS	Temporary Works Supervisor – A site-based role overseeing the implementation and inspection of temporary works.
General Principles of Prevention	A hierarchy of measures under EU and Irish law aimed at eliminating or reducing risks during design and construction.
Safe Pass	A mandatory safety awareness training programme for construction workers in Ireland.
CSCS	Construction Skills Certification Scheme – Certification for specific construction skills required under Irish regulations.
Design Risk Assessment (DRA)	A formal assessment of risks associated with design decisions, used to inform safe construction and maintenance.



1. Introduction

This Preliminary Safety & Health Plan (PSHP) has been prepared in accordance with Regulation 12(1)(a) of the Safety, Health and Welfare at Work (Construction) Regulations 2013. Its purpose is to identify exceptional design and construction features that may affect safety and health on the project, based on information provided by designers, the Client, and contract documentation.

The plan also highlights existing on-site risks and other activities that must be considered by the party appointed as Project Supervisor for the Construction Stage (PSCS). It does not attempt to list normal construction activities that a competent PSCS would anticipate for a project of this nature.

This information has been prepared prior to commencement of work on site and may not reflect conditions discovered later. Excavation or opening works may reveal unforeseen hazards requiring reassessment of design and construction risks.

The absence of mention of any item must not be taken as confirmation by the Client or its consultants that such item is safe. The PSCS remains responsible for undertaking pre-construction risk assessments and developing safe systems of work.

1.1 Safety Objectives for the Project

The safety objectives for the project are designed to ensure that all construction activities are planned, coordinated, and executed in a manner that:

- Complies fully with the Safety, Health and Welfare at Work (Construction) Regulations 2013 and all applicable legislation.
- Eliminates or reduces risks through design, planning, and method selection, applying the General Principles of Prevention.
- Protects all persons on or near the site, including workers, visitors, the public, and third-party stakeholders.
- Maintains operational continuity of any adjacent infrastructure or facilities throughout the works.
- Promotes a proactive safety culture, encouraging reporting, learning, and continuous improvement.
- Ensures effective coordination between all duty holders, including the PSDP, PSCS, Designers, and Contractors.
- Implements robust emergency preparedness, including site-specific response plans and escalation protocols.
- Monitors and manages environmental impacts, including noise, vibration, dust, and waste, to protect public health and sensitive receptors.
- Delivers a complete and compliant Safety File, supporting future maintenance and modification of the asset.



2. Project Details

2.1 Project Description & Scope of Works

Carlow (Mortarstown) Wastewater Treatment Plant (WwTP) has a current total loading of approximately 36,000PE and serves the agglomeration of Carlow Town and environs (a section of which encroaches into Co. Laois). In recent years there has been an increased load demand on the WwTP and there is now a requirement to provide additional treatment capacity to accommodate future growth in the region.

It is estimated that the WwTP requires an upgrade in treatment capacity to 52,500PE and 58,500PE for the 10-year and 25-year design horizons, respectively to meet these requirements. Upgrade works will also be required at the existing Wastewater Pumping Station (WwPS) at Kilkenny Road in Carlow Town, to provide additional pumping capacity. It is proposed to construct a new and larger capacity pumping station at the Mortarstown WwTP site and connect the existing sewer line to it via gravity tunnel from the Kilkenny Road PS. It is also proposed to construct a new outfall pipeline which will convey treated effluent flow as well as the emergency overflow to the outfall location at the River Barrow.

A planning application for the works has been prepared and is being submitted to An Coimisiún Pleanála along with this report and the Environmental Impact Assessment Report (EIAR). On approval of the SID application, the Design Build Contractor will be appointed and required to comply with all design constraints as set out in planning permission conditions granted for the upgrade works.

2.2 Locations & Proposed Works

The construction activities will be mainly performed at two locations.

Site #1: Microtunnel Gravity Sewer,

Location: Along the R448 Kilkenny Road before it traverses a treelined verge and local access road to connect to the WwTP.

Site #2: Mortarstown WwTP.

Location: 2.2km south of Carlow Town on the eastern bank of the River Barrow and serves the Carlow Town.

A breakdown of the multiple elements of the proposed project is as follows.

Microtunnel Gravity Sewer (Site #1)

A 785m long microtunnel gravity sewer (Ø1650mm internal diameter) will be constructed from the south side of Kilkenny Road Pumping Station to the wet well of the new inlet pump station adjacent to the new inlet works of the existing WwTP which is proposed to be upgraded. The microtunnel will be routed under the R448 Kilkenny Road before it traverses under a treelined verge and local access road (to UÉ owned property) to connect to the WwTP.

The existing Kilkenny Road pumping station will be decommissioned. The existing building structure will remain. The existing above ground steel gantry structure, access stairs and pumps will be removed from



site and repurposed. Incoming flows will be diverted via the existing below ground holding tank to a newly constructed manhole positioned south of the existing PS, conveying flows to the new gravity microtunnel. Existing overflows at the Kilkenny Road PS will be retained in accordance with the current Wastewater Discharge Licence (EPA WwDL Ref: D0028-01) and utilised in extreme events where the new gravity microtunnel may be at maximum capacity.

New Inlet Pump Station (replaces Kilkenny Road PS) (Site #2)

The construction of the new inlet pump station at the Mortarstown WwTP site, located west of the WwTP and north of a vacant cottage, will include:

- The provision of 1 no. terminal pump station.
- The provision of 4 no. raw sewerage pumps inclusive of Mechanical, Electrical, Instrumentation, Control, and Automation (MEICA) works.
- The provision of 1 no. odour control unit.
- The provision of 1 no. flow meter chamber.

Mortarstown WWTP (Site #2)

The upgrade of the Mortarstown Wastewater treatment plant will require:

- Provision of a new foul pumping station for local agglomeration adjacent to existing inlet works (supplemented by the WwTP standby generator).
- Provision of new fuel storage tank (5000l) and standby diesel generator to service the WWTP (roofed).
- Provision of new inlet works to include fine screening, mechanically raked by-pass screen, screening compaction and conveyance to skips, grit removal, grit classification and conveyance to skips. The new inlet works will be provided with an odour treatment unit.
- Provision of 2 no. new stormwater storage tanks and 2 no. new stormwater return pumps.
- Existing final settlement tanks and associated Return Activated Sludge (RAS)/ Waste Activated Sludge (WAS) to be retained, cleaned and decommissioned.
- Provision of 4 no. new primary settlement tanks and scraper systems.
- Provision of 4 no. new primary sludge pumps.
- Provision of a new scum pump.
- Provision of 4 no. new air blowers and modifications to existing air delivery pipework
- Provision of a new air blower building (13.6m x 8.6m, roofed) and repurposing of existing blower building for storage purposes.
- Provision of new fine bubble diffused air system in existing aeration tanks.
- Provision of 2 no. new final settlement tanks with half-bridge scrapers.
- Provision of a new RAS/WAS pumping station and station fitted with 2 no. RAS pumps and 2 no. WAS pumps.
- Structural refurbishment of the existing picket fence tanks.
- Mechanical and electrical refurbishment of existing picket fence thickener and conversion of second existing tank to a sludge blending tank.
- Provision of 2 no. additional picket fence thickener tanks.
- Provision of 1 no. belt press, polymer prep unit and polymer dosing pumps in the existing sludge dewatering building.



- Provision of a new pumped sludge transfer system between the sledge blending tank and picket fence thickeners.
- Provision of upgrades to the existing sludge import facility.
- Provision of minimum 6 no. new odour control units
- Provision of upgrade to existing chemical storage tank and dosing facility
- Provision of 1 no. new outfall chamber and outfall pipe.
- Modifications to existing administration building.
- Provision of MEICA and SCADA upgrades.
- New storage shed and associated gantry (24.9m x 12.7m, roofed).
- Demolition of existing inlet works structure.
- Existing utility service relocations.
- General civil site works.
- Future storm tank (not part of this planning consent).
- Future aeration tank (not part of this planning consent).
- Future final settlement tank (not part of this planning consent).
- Provision for PV solar panels,
- Diversion of existing ESB 38kv HV overhead lines and 10kV/20kV MV line on site (carried out by ESB).

2.3 AF1 Notification

HSA Online Notification Reference:

AF1 to be issued by the client.

2.4 Programme / Contract Period

The project schedule should in no way affect the Safety, Health and Welfare of those persons involved in the project to meet its requirements.

Milestones	Timeframe*
Submission of planning application	Q2 2026
ACP planning application decision	Q4 2026
Civil, structural, mechanical, electrical design, site survey works & mobilisation start.	Q1 2027 – Q3 2027
Construction and installation.	Q4 2027 – Q2 2029
Commissioning	Q1-2029 – Q2 2029

**These timelines are estimated at this juncture, and assume that there will be no significant delays to the overall delivery programme through the planning, detailed design, mobilisation, construction and commissioning phases.*



The proposed duration of works is provisional, pending confirmation by the appointed Contractor that they are practicable. This timescale is based on the advice of the design team upon engineering judgment at design stage using knowledge from previous similar projects and on the assumption that the works will be carried out in accordance with the proposed design.

2.5 Project Design Team

Client Details	
Company Name	Uisce Éireann
Address	Colvill House, 24-26 Talbot Street, Dublin 1
Contact Name	Conor Delaney
Project Supervisor Design Process (PSDP)	
Company Name	AtkinsRéalis Ireland Limited
Address	150 Lakeside Drive, Airside Business Park, Swords, Co. Dublin
Contact Name	Richard Joyce
Civils & Structural	
Company Name	AtkinsRéalis Ireland Limited
Address	AtkinsRéalis, 150 Airside Business Park, Swords Co. Dublin, K67 K5W4, Ireland
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Mechanical & Electrical	
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Address	AtkinsRéalis, 150 Airside Business Park, Swords Co. Dublin, K67 K5W4, Ireland
Contact Name	Gavin Kelly
Specialist Design	
Company Name	AtkinsRéalis Ireland Limited
Address	AtkinsRéalis, 150 Airside Business Park, Swords, Co. Dublin, K65 K5W4
Contact Name	Fiona Quigley, Process – Cúán Ó hÓgáin



2.6 Extent & Location of Existing Records & Plans

Name	Comments/ Details
Safety File (existing)	Design team have not made available any existing safety file information relevant to the sites in question
Asbestos Surveys	RDAS Asbestos report completed in July 2018 by OHSS on behalf of the client.
Lead	Risk of lead based pipes during works
Geotechnical	Geotechnical Reports available and used by the design team as part of the design process.
Structural	None
Other Existing Information	Records (incomplete) of as-built infrastructure at existing WwTP provide by UÉ.



3. Existing On-site Restrictions & Risks

3.1 Restrictions on Site

Site Access	The Project Supervisor Construction Stage (PSCS) will manage site access and circulation in compliance with the Safety, Health and Welfare at Work (Construction) Regulations 2013, specifically Regulation 33 (Traffic routes and danger areas) and Regulation 87 (Safe operation of vehicles and plant), as well as relevant industry guidance. Site access will be controlled through designated entry points and secure perimeter arrangements. Only authorised personnel and escorted visitors are permitted on site. All individuals must comply with site rules and remain within their allocated work areas at all times. Traffic management plans will define vehicle routes, pedestrian walkways, and exclusion zones to minimise interaction between plant and pedestrians. Site speed limits apply to all vehicles, and plant movements will be directed by trained banksmen. Smoking and vaping are restricted to designated zones, and the possession or use of alcohol or drugs is strictly prohibited. Edge protection, overhead work zones, and barriers must be respected at all times. Materials and equipment will be stored in assigned areas without obstructing emergency egress or fire routes, in line with welfare and emergency provisions. Any temporary changes to access arrangements or site layout will be clearly signed and communicated through toolbox talks coordinated by the PSCS.
Permits & Authorisation Requirements	The PSCS will establish and oversee a permit-to-work system for high-risk activities (e.g., hot work, confined space entry, electrical isolation, lifting operations, temporary works affecting structural stability, work near live services, and road closures). No such activity will commence without a permit approved by the PSCS or a competent person appointed by the PSCS. Each permit will define scope, controls, duration, area of work, and responsible persons; permits will be displayed at the point of work and retained in the site office. Permits will lapse at the end of the shift unless revalidated. Any change in method, location, or conditions will trigger review and re-issue. The PSCS will brief relevant workers at pre-start and maintain a permit register for audit by the client/PSDP or the HSA if requested. Contractor will be required to provide Permit to Work for access to existing facilities
Restrictions on Working Hours	Working hours will be agreed with the client and contractor in line with any planning requirements.



Security Arrangements	The PSCS will provide and maintain secure perimeter fencing and controlled access gates, supported by a sign-in/sign-out system for all personnel and visitors to specific works area. Visitors will report to the site office, complete induction as required under Regulation 23 (Induction), and remain escorted at all times. Security measures will include perimeter lighting and CCTV coverage of access points and high-value storage areas, with recordings managed in accordance with data protection legislation. Plant, tools, and fuels will be stored in locked containers, and key control will be managed by the PSCS. ID verification may be applied at entry. All personnel must report suspicious activity immediately to the PSCS and must not confront intruders. Security procedures will be reviewed periodically and following any incident, with measures coordinated with the client and PSDP where relevant to site-specific risks.

3.2 Safety Hazards

Site Boundaries & Access	The PSCS will establish secure site boundaries using compliant fencing, hoarding, and controlled access gates to prevent unauthorised entry and protect the public, in accordance with the Safety, Health and Welfare at Work (Construction) Regulations 2013 and HSA guidance. Temporary vehicular and pedestrian access arrangements will be planned and risk assessed, with appropriate signage, lighting, and maintenance. These arrangements will include segregation of plant and pedestrians, clear visibility at junctions, and protection of public footpaths. Any changes to site boundaries or access routes will be approved by the PSCS, coordinated with the client and local authority where applicable, and communicated through updated signage and toolbox briefings. Access arrangements have been coordinated by the design team and included on design drawings for each works location.
Adjacent Land Uses	Click or tap here to enter text. The microtunnel works are adjacent residential housing to the east and woodland located between R448 Kilkenny Road and River Barrow to the west. The south side of the tunnel alignment interfaces directly with Mortarstown WwTP. To the north, the existing Kilkenny Road WwPS is located. The WwTP site is bound by a greenfield corridor and residential housing to the north and Green Road and residential housing to the east. To the west, the site adjoins agricultural land owned by Carlow County Council, as well as a property owned by Uisce Éireann. Tyndall College is located immediately south of the WwTP, directly adjacent to the site boundary.



Existing Storage of Unstable / Flammable / Corrosive Materials	Chemicals present on site include - Ferric sulphate - Polyelectrolyte (Polymer) - Diesel fuel. Current storage of unstable/flammable/corrosive materials to be confirmed during detailed design by the Contractor after commencement of Works.
Ground Conditions	Contractor must refer to design team drawings and associated Technical Reports for all clarifications. Existing Ground Conditions - Soft/Loose Strata Unstable walls in open excavations within soft or loose strata. There is a moderate risk of unsupported excavations collapsing during construction especially where a high, water table is encountered. Therefore, trench box and sheet pile techniques will be used to stabilise the deep excavation or pipeline trench walls. Ground conditions at the Kilkenny Road Pumping Station. Extremely poor ground conditions and a high-water table leading to difficult excavation process and complex temporary works. It is proposed to use a sheet pile cofferdam for the construction process. This will ensure adequate temporary support during construction and enable an easier dewatering methodology. Existing Ground Conditions - Insufficient bearing capacity. It is anticipated that soft deposits encountered will have insufficient bearing capacity to support both dead and live loads associated with chambers and pipe network. Shallow soft material can be excavated and replaced with engineered material using traditional open cut and replace methodologies. Existing Ground Conditions - Groundwater ingress Groundwater ingress is expected to affect construction operations. De-watering by means of submersible pumps installed below formation level are recommended for this site.
Existing Structures – Stability, or Fragile Materials	A number of structures will be subject to demolition. Design team have not advised of any risks associated with stability. Risks associated with Silica dusts, historic uses will impact the demolition strategy.
Activities on or Adjacent to the Site During the Works	Site will remain live for the duration of the works.



Internal Mechanical, Electrical and Data Services	Live services are present to existing pumping stations across the site. A GPR Survey (covering part of the Works) has been completed and an indicative utilities map has been prepared. A detailed survey of existing utilities and each building will be required from the Contractor.
Underground Electrical Services	Electrical services are present across the works area. GPR surveys completed (in part).
Underground Gas Services	Gas services present along the proposed works.
Underground Water Services	Water services present along works route. Foul Sewer present. Surface water drainage system present.
Underground Telecoms Services	Data Cables noted as present in works area.
Overhead Services	Overhead services have been identified across the works area.

3.3 Health Hazards

Asbestos	Asbestos Containing materials have been identified in a July 2018 RDAS report by OHSS. The PSCS will coordinate asbestos management in compliance with the Safety, Health and Welfare at Work (Exposure to Asbestos) Regulations and relevant HSA guidance. No work will proceed in areas where asbestos-containing materials (ACMs) are suspected until a competent asbestos survey has been completed and reviewed. Where ACMs are identified, the PSCS will arrange for licensed asbestos contractors to undertake removal or encapsulation under an approved plan of work, with notifications to the HSA as required. Exclusion zones, air monitoring, and waste consignment procedures will be implemented to ensure safety and legal compliance. All personnel will receive asbestos awareness training where relevant. Any accidental disturbance of ACMs will trigger immediate stop-work, isolation of the affected area, and escalation to the PSCS for emergency response.
Existing Storage of Materials Hazardous to Health	Chemicals and fuel are stored on site for the ongoing operation of the WwTP including: - Ferric sulphate - Polyelectrolyte (Polymer) - Diesel fuel



	A full list of chemicals and SDS will be made available by the Client in advance of Works on site which may result in exposure.
Contaminated Land	Contamination on site, in particular at the proposed outfall pipe with need for offsite disposal. Environmental sampling has been undertaken as part of the Site Investigation and Environmental Surveys have identified invasive species, Japanese Knotweed and Himalayan Balsam at the location of the proposed outfall pipe.
Existing Structures Containing Hazardous Materials	Waste Water sludges Silica Dusts to existing structure Asbestos containing materials.
Health Risks Arising from Client Activities	Live Waste Water Treatment Plants and Pumping stations
Noise / Dust / Vibration	The PSCS will coordinate the Contractor to minimise noise, dust, and vibration in compliance with the Safety, Health and Welfare at Work (General Application) Regulations 2007, Part 5 (Physical Agents - Noise and Vibration), and relevant HSA guidance. Lower-impact construction methods will be prioritised, and all plant and equipment will be maintained in good condition with effective silencers fitted where applicable. Dust will be controlled through local extraction, water suppression, sheeting, and regular housekeeping. Noisy or high-vibration tasks will be time-limited, and worker rotation will be applied to reduce individual exposure. Temporary barriers and clear signage will be installed where noise or vibration levels may affect other site users or the public. Monitoring will be undertaken where required, and control measures will be adjusted if exposure thresholds are approached. Appropriate PPE - including hearing protection, respiratory protective equipment (RPE), and vibration-reducing gloves - will be provided and enforced. The PSCS will notify adjacent occupiers in advance of high-impact works and ensure daily cleaning of affected routes, coordinating with the PSDP where community impact requires additional measures.

3.4 Waste Management

During construction the Contractor will be required to prepare a detailed waste management plan for the works.



3.5 Emergency Procedures

The Contractor will be required to prepare an emergency management plan for all construction works and aligned to the element of works.



4. Significant Design and Construction Hazards

4.1 Design Assumptions and Control Measures

Design Team Assumptions	The final detailed design will be completed by the Contractor post the Commencement Date.
Temporary Works Assumptions (Category 2/3 as defined in BS:5975)	The scope and scale of the Mortarstown WwTP upgrade will require extensive temporary works (TW) design and implementation across both rural and urban settings. The Contractor shall recognise the critical role that safe and structurally robust TW plays in enabling the secure execution of trenching, lifting, working at height, temporary access, water control, and in protecting both the public and workforce. Temporary works will also be essential in concrete construction activities. Key areas requiring temporary works include (non-exhaustive): ☐ Deep Excavations and Trenches: Temporary trench supports (e.g. trench boxes, trench sheets, hydraulic frames) will be required where trench depth or ground instability poses a risk, especially around inlet works, pumping stations, and pipe corridors. ☐ Formwork and Falsework: Temporary formwork will be required for casting new tanks, chambers, and structural walls within the WwTP. ☐ Access Scaffolding and Platforms: Scaffolding will be needed to access elevated pipe racks, blower units, and high-level mechanical equipment in treatment buildings and pumping stations. ☐ Controlling Water Levels: Temporary water management measures (e.g. cofferdams, bypass pumping) will be required during inlet outfall works upgrades. and stormwater tank installations to maintain safe working conditions. ☐ Pipe Crossings and Trenchless Installations: Temporary pipe supports, access platforms, or cofferdams may be required at river or road crossings to enable safe trenchless installation and reinstatement. ☐ Temporary Access Roads and Compounds: In cross-site sections or elevated terrain, surfacing or matting may be required for plant access. Temporary fencing, lighting, and security will be essential for safe and secure operations. ☐ Hoarding and Fencing: Temporary fencing will be required around excavation zones, construction compounds, and access areas to ensure site security and public safety. ☐ Above-Ground Structures: Installation of above-ground tanks and, surge vessels, and heavy-duty pipe spools may require temporary crane platforms and lifting frames, designed and certified by a



	competent engineer. □ Edge Protection and Demarcation: Edge protection must comply with BS EN 13374:2023 and be appropriately tested. Site demarcation must be established to prevent unauthorised or unsafe access, especially near open tanks and deep excavations.
Materials Requiring Particular Precautions	No materials specified for construction which will require particular precautions other than standard construction materials.
Anticipated Lifting Operations	All lifting operations will be planned, risk assessed, and supervised by a competent person appointed by the PSCS, in compliance with the Safety, Health and Welfare at Work (General Application) Regulations 2007, Chapter 2 of Part 2 (Use of Work Equipment for Lifting Loads), and relevant provisions of the Construction Regulations 2013. Only certified lifting equipment with in-date thorough examination reports (GA1) will be used, and weekly inspections will be recorded on GA2 forms. A written lift plan will address load characteristics, lifting route, ground/bearing capacity, exclusion zones, weather limits, communications, and emergency arrangements. The lifting team (operator, slinger/signaller, supervisor) will complete a pre-lift briefing and use agreed hand signals or radios. Exclusion zones will be established to prevent access to the drop area, and loads will never pass over occupied areas or live traffic routes. Operations will be suspended if wind, visibility, or site conditions breach plan limits or if the method changes. Post-lift, equipment will be inspected, cleaned, and stored correctly. Any defects will be reported, quarantined, and records retained for HSA inspection.
Maintenance & Cleaning Requirements	These will be assessed during detailed design and will include ALM reviews.



4.2 Information on Significant Safety and Health Risks Identified During Design

This section of the Preliminary Safety and Health Plan is prepared to highlight work involving particular risks to the health and safety of persons at work. This list has been prepared in accordance with, but not limited to, Schedule 1 of the Safety, Health and Welfare at Work (Construction) Regulations, and represents a non-exhaustive list of particular risks.

It should be noted that many of the risks on the project may arise out of working methods which are at the discretion of the PSCS and as such cannot be determined by the PSDP prior to commencement of the construction phase.

Given the nature of the works to be undertaken, there is a wide variety of risks associated with this project. The designers and PSDP have also assumed that the PSCS and their appointed contracts Safety Statements and Construction Environmental Management Plans (CEMP) deals with the normal hazards arising from their particular type of construction work.

The following is a non-exhaustive list of potential risks to the safety and health of persons during this project that shall be given due consideration in the development of the Construction Stage Safety and Health Plan and all site-specific Method Statements and Risk Assessments to put adequate control measures in place.

Particular Risks	Comments
Falling from height	WwTP works involve elevated access to sludge settling tanks, holding tanks, Bioreactors, digesters and walkways. Temporary structures such as scaffolding, MEWPs, and ladders will be used. Confined access to deep chambers increases fall risk. Excavation edges also pose fall hazards.
Burial under earthfalls	Existing Ground Conditions - Soft/Loose Strata Unstable walls in open excavations within soft or loose strata. There is a moderate risk of unsupported excavations collapsing during construction especially where a high, water table is encountered. Therefore, trench box and sheet pile techniques will be used to stabilise the deep excavation or pipeline trench walls. Ground conditions at the Kilkenny Road Pumping Station - Extremely poor ground conditions and a high-water table leading to difficult excavation process and complex temporary works. It is proposed to use a sheet pile cofferdam for the construction process. This will ensure adequate temporary support during construction and enable an easier dewatering methodology. Deep excavations for pipelines, manholes, and wet wells in soft ground present collapse risks. Ground investigation confirms variable soil stability. Temporary support systems are critical.



Engulfment in swampland	Not anticipated by design team.
Chemical or biological substances	Asbestos Containing Materials presents. Silica Dusts during works Exposure to treatment plant chemicals during construction. Connection into existing sewer network. Weils Disease
Ionising radiation	Not anticipated.
Work near high-voltage power lines. Note: Higher voltage is any voltage greater than: a. 1000 volts (1kV) alternating current (AC), or b. 1500 volts direct current (DC).	Several overhead ESB powerlines transverses the proposed site. Potential to create construction restrictions (no excavators, height restrictors etc.) Proposal for existing ESB overhead powerlines to be diverted in advance of commencing the construction works. Ongoing consultation is being held with the ESB.
Work exposing persons at work to the risk of drowning	Working adjacent river required for construction of new final effluent outfall pipes and associated headwalls to connect into the River Barrow. Contractor to ensure appropriate temporary works measures (i.e., cofferdam, trench boxes, dewatering pumps etc.) are in place in advance of construction works. Groundwater ingress. Groundwater ingress is expected to affect construction operations. De-watering by means of submersible pumps installed below formation level are recommended for this site. Work near open tanks, wet wells, and outfall structures poses drowning risks. Includes pipe installation near water bodies and confined chambers.
Work on wells, underground earthworks, and tunnels	Work includes deep manholes, valve chambers, and underground pipework. Confined space entry and rescue procedures required
Work carried out by divers at work having a system of air supply	Not anticipated at this stage.
Work carried out in a caisson with a compressed-air atmosphere	Not anticipated at this stage.
Work involving the use of explosives	Not anticipated at this stage.



Work involving the assembly or dismantling of heavy prefabricated components	The project may involve installation of large tanks, kiosks, and M&E skids, often lifted by crane into restricted sites. The weight, complexity, and working environment (live sites) present risk of crush injuries or collapse during handling.



5. Safety Management Framework

5.1 Arrangements for Communications

Pre-Start Site Safety Meeting

Before construction commences, a Pre-Start Safety Meeting will be convened by the associated PSCS in collaboration with the PSDP. The purpose of this meeting is to:

1. Identify and discuss significant elements within the project and schedule subsequent pre-start meetings based on a phased approach (where required).
2. Confirm shared understanding of significant residual design risks.
3. Validate the adequacy of the PSHP.
4. Discuss in principle the safe method of construction, particularly for any high-risk or constrained activities.
5. Review key temporary works proposals, coordination zones, and interface points.
6. Clarify the escalation procedures for unresolved safety issues or design changes.

All relevant parties should attend, including the Client and any specialist designers / contractors.

Progress Site Safety Meeting

Once works commence, the PSDP and each PSCS will maintain an active dialogue through monthly progress safety meetings, supplemented by regular ad hoc communication via email or phone. These monthly meetings serve to:

1. Review updates to the CSSHP and confirm compliance with design safety principles.
2. Track implementation of control measures associated with known design risks.
3. Monitor the coordination between temporary and permanent works.
4. Identify any issues arising from ongoing or unplanned design changes.
5. Capture any learnings or safety concerns requiring escalation.

It is the responsibility of the PSCS to promptly notify the PSDP of any of the following:

1. Accidents, incidents, or near-misses on site (& who was affected - if anyone).
2. Inspections or enforcement actions by the Health and Safety Authority (HSA).
3. Health and safety implications of temporary works or design interfaces.
4. Delays to the programme that are caused by safety or risk-related issues.
5. Where new risks emerge or significant change occurs, the PSCS shall liaise with the PSDP and relevant designers to document these changes and ensure that all safety responsibilities remain clear and coordinated.



5.2 Safety File

Purpose of the Safety File

The Safety File is a statutory deliverable required under the Safety, Health and Welfare at Work (Construction) Regulations 2013. It is a living record of all relevant health and safety information needed to enable future construction, maintenance, refurbishment, or demolition works to be carried out safely.

Its primary function is to ensure that those who may interact with the structure at any point in its life cycle, such as maintenance staff, building owners, future contractors, or emergency services, can do so with a clear understanding of any residual risks, key design decisions, or material specifications that could affect health and safety.

The file shall be project-specific, accurate, and up to date at the point of handover.

Preparation and Coordination

Under the Regulations, the PSDP is responsible for compiling and handing over the Safety File to the Client at project completion. However, this is not a standalone task. The PSDP relies heavily on the contributions of the PSCS.

The PSDP will:

1. Issue guidance on the required file structure and naming conventions based upon the Client's requirements.
2. Review all Safety File inputs for adequacy and consistency.
3. Retain editorial oversight to ensure compliance with Regulation 21 and industry good practice.
4. Submit the final Safety File index to the Client upon project handover.

Safety File Content

Typical content in each package-specific submission is expected to include (as appropriate to the assets constructed):

- Project overview and contact directory.
- Record drawings (as built).
- DRA and residual risk summaries.
- Operating manuals and maintenance requirements for installed systems.
- Certificates of compliance for safety critical elements.
- Test reports, commissioning records, and warranties.
- Temporary works records and removal instructions (if applicable).
- Information about unusual construction materials or methods.
- Emergency access and egress provisions.

Only information relevant to ongoing safety and maintenance is included - temporary construction information (e.g., RAMS, lifting plans) should not be submitted unless it has implications for future work.



Handover and Maintenance

At the end of the project, the PSCS shall formally submit the Safety File materials to the PSDP for review. The PSDP will:

1. Confirm completeness and accuracy.
2. Validate coordination across multiple contract packages.
3. Issue formal acceptance or request amendments where necessary.

Only when all components of the Safety File meet the required standard will it be formally handed over to the Client, alongside other project close-out documentation.

The Client is responsible for retaining and maintaining the Safety File for the lifetime of the structure / asset. It shall be made available to any person undertaking future construction / maintenance / demolition work.



6. Roles and Responsibilities

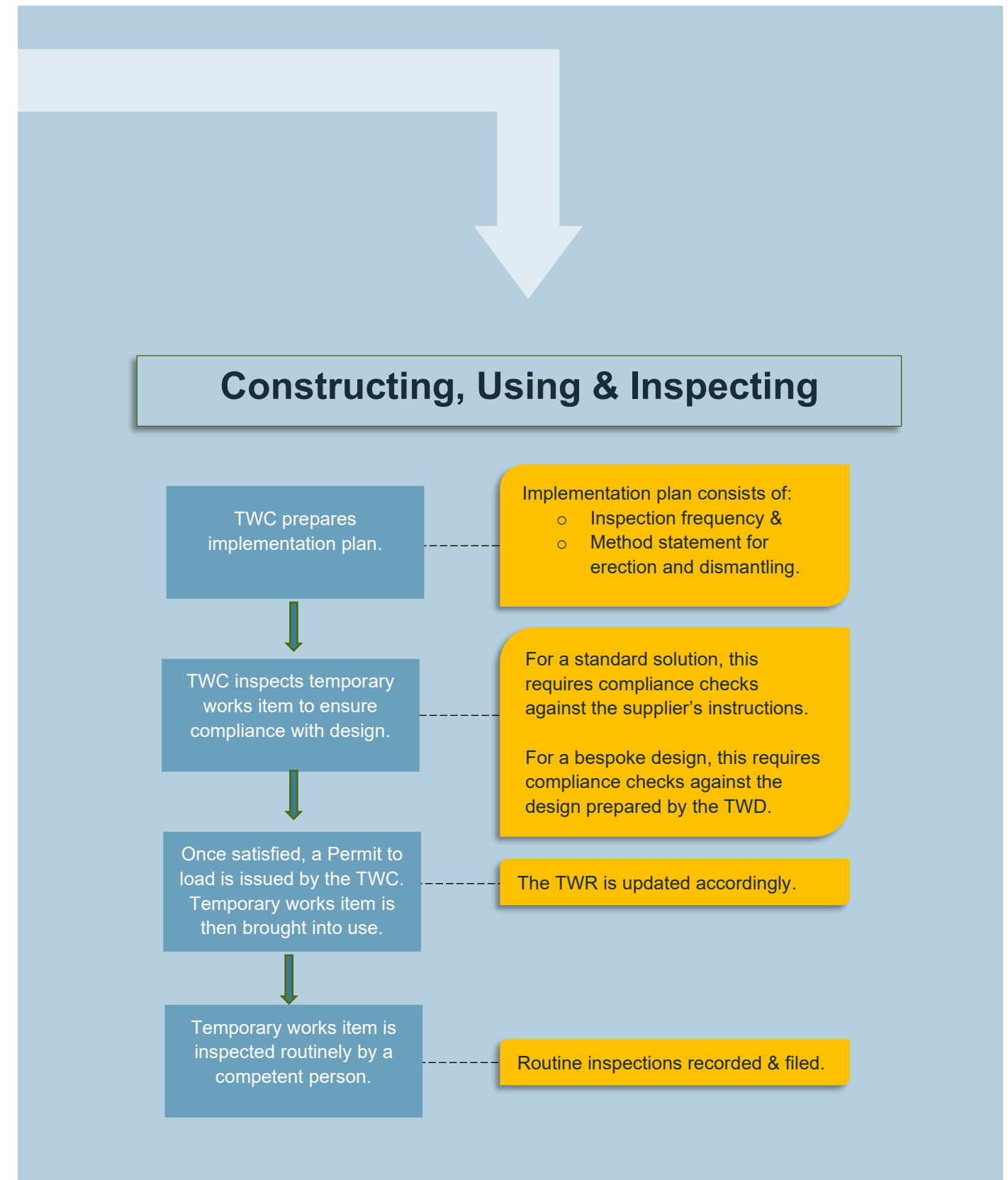
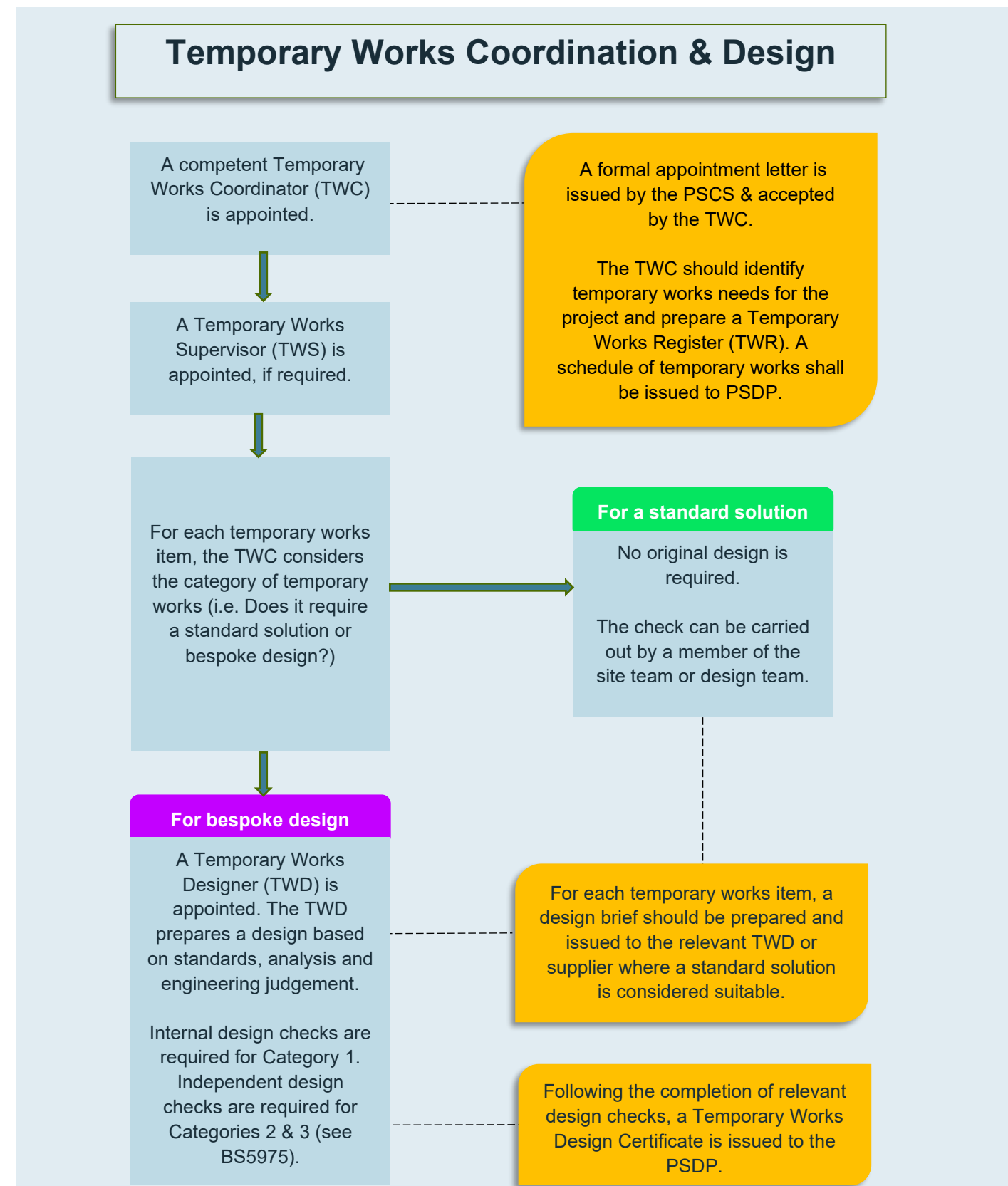
Client	PSDP	PSCS	Contractor / Subcontractors	Designers / Temporary Works Designers
Client Duties under Regulations 6–10 of S.I. No. 291 of 2013. In accordance with the Safety, Health and Welfare at Work (Construction) Regulations 2013, the Client is responsible for: - Appointing competent duty holders, including the Project Supervisor for the Design Process (PSDP) and the Project Supervisor for the Construction Stage (PSCS), in writing before design or construction begins (Regulation 6). - Ensuring the suitability of the PSDP, PSCS, designers, and contractors in terms of training, knowledge, experience, and resources (Regulation 7). - Providing relevant site information to the PSDP, PSCS, designers, and contractors to support safe project planning and execution (Regulation 8). - Ensuring the preparation of a Preliminary Safety and Health Plan by the PSDP before design work commences (Regulation 9). - Notifying the Health and Safety Authority (HSA) of the project using the Approved Form (AF1), where the project is expected to exceed 30 working days or 500 person-days (Regulation 10).	The Client has appointed AtkinsRéalis as the Project Supervisor for the Design Process (PSDP), in accordance with Regulation 6. The PSDP's duties, as outlined in Regulations 11 to 14, include: - Coordinating the design process to ensure that safety and health considerations are integrated into the design (Regulation 11). - Preparing the Preliminary Safety and Health Plan before construction work begins (Regulation 12). - Compiling the Safety File for handover to the Client upon project completion (Regulation 13). - Communicating with designers and the Contractor on design-related safety matters and issuing directions where necessary to ensure compliance (Regulation 14). The Contractor, upon appointment as PSCS, will be required to liaise closely with the PSDP throughout the construction stage to ensure continuity in safety coordination and integration of design risk controls.	The appointed PSCS, in accordance with Regulations 16 to 22 of S.I. No. 291 of 2013, will be responsible for: - Coordinating the implementation of the Safety and Health Plan on site, ensuring it is developed and maintained throughout the construction stage (Regulation 16). - Managing safety arrangements and ensuring that all contractors comply with relevant safety and health requirements (Regulation 17). - Maintaining and updating the Safety File, in collaboration with the PSDP, to reflect construction activities and residual risks (Regulation 21). - Notifying the Health and Safety Authority (HSA) of the project prior to commencement of construction works, using the Approved Form (AF2) (Regulation 22). Formal appointment of the PSCS will occur on the contract award date.	The duties of the Contractor and any Sub-Contractors are set out in Regulations 24 to 28 of S.I. No. 291 of 2013. These include: - Ensuring that construction work is carried out safely and without risk to health, applying the general principles of prevention and complying with relevant statutory provisions (Regulation 24). - Providing appropriate training, supervision, and certification, including ensuring that workers hold valid Safe Pass and Construction Skills Certification Scheme (CSCS) cards (Regulation 25). - Appointing a Safety Officer, where 20 or more persons are engaged on site under the contractor's control (Regulation 26). - Consulting with workers on safety matters, including facilitating the selection of a site safety representative where required (Regulation 28). - Ensuring that plant and equipment are erected, installed, and maintained safely, in accordance with manufacturer instructions and relevant safety standards (Regulation 27). All Sub-Contractors engaged by the Contractor will be required to comply with the PSCS's safety arrangements and site rules, as part of their duty to cooperate and coordinate under Regulation 24.	The duties of Designers, including Temporary Works Designers, are set out in Regulation 15 of S.I. No. 291 of 2013. A Designer is defined as any person who: - Prepares a design relating to a structure intended to be constructed by a competent contractor, or - Directs or controls another person to prepare such a design. - This definition includes specialist designers appointed by the Contractor, such as Temporary Works Designers, façade engineers, and services consultants. Designers must: - Ensure that the structure can be constructed, maintained, and demolished safely, without risk to health. - Avoid foreseeable risks to safety and health during construction and future use, including maintenance and cleaning. - Provide the PSDP with all relevant information necessary to coordinate design safety and compile the Safety File. - Apply the general principles of prevention during design development, including hazard elimination and risk reduction.

7. Arrangement for the Co-ordination of Ongoing Design Work and the Management of Design Change

Co-ordination of Ongoing Design Work	Specialist Design	Design Change Management
In accordance with Regulation 15 of the Safety, Health and Welfare at Work (Construction) Regulations 2013, each Designer involved in the project must identify hazards associated with the works, taking into account the General Principles of Prevention, the existing Safety and Health Plan, and the Safety File. This obligation applies to all members of the Contractor's design team, particularly where design decisions may influence construction safety. Each Designer shall: - Identify any hazards inherent in the proposed design. - Eliminate hazards where reasonably practicable, without introducing greater risks, or reduce them to an acceptable level. - Provide written information to the PSDP regarding any known particular risks to the safety, health, and welfare of persons at work, based on the nature and scope of the project. - Supply all necessary information to enable the PSDP to fulfil their duties under the Regulations and to ensure, as far as reasonably practicable, the safe construction of the design. This document does not aim to identify general construction hazards, as it is assumed that the Contractor, familiar with such hazards, will be appointed. Instead, it focuses on identifying foreseeable significant hazards associated with the design elements of the works up to the point of contractor appointment. The Contractor must exercise due care throughout the works and maintain ongoing liaison with the PSDP, particularly where design amendments may affect safety and health considerations. Importantly, the Contractor will be responsible for the detailed design of the proposed methods of work, including any necessary temporary works. This includes ensuring that all design elements under their remit are assessed for safety and health risks and are coordinated with the PSDP. The Contractor must refer to the tender documentation to identify specific elements of the design for which they are responsible and ensure that all relevant information is communicated and incorporated into the Safety and Health Plan.	All specialist design inputs must be treated with the same level of control and oversight as the original design. Associated hazards must be identified and documented to allow the Contractor to assess the risks and plan appropriate mitigation measures. This ensures that any residual risks are managed effectively during construction. The Contractor must ensure that all specialist design packages are reviewed for safety and health implications and coordinated with the PSDP. This coordination is essential to maintain compliance with the General Principles of Prevention and to support safe execution of the works. Safety Critical Anchors The Health and Safety Authority has produced the Code of Practice for the Design and Installation of Anchors in accordance with section 60 of the Safety, Health and Welfare at Work Act 2005, the design of anchors shall be by "a competent person engaged in work related to the design of a project. The contractor shall ensure that the person installing the anchor is competent and has the following: - Training – Training in the setting of the particular anchor may be provided on site by the contractor or by the anchor supplier. Training from other sites may not be applicable as the installation requirements vary between different anchors. - Knowledge – The anchor installer shall have knowledge of the function of the anchor and the consequences if the installation procedures are not adhered to. - Experience – The anchor installer shall have experience of installing the particular type of anchor. If the installer has limited experience, closer supervision shall be provided by the contractor to ensure that the installation is correct	Where a significant design change is proposed by the Contractor, the change must be fully detailed in writing and accompanied by a Design Risk Assessment. This applies to all changes, including those related to temporary works and any value engineering proposals. The full submission shall be provided to the PSDP for review. The PSDP will assess the proposed change with reference to the General Principles of Prevention. The change may only proceed once it has been formally approved in writing by the PSDP. A design change is considered significant with regard to safety and health where it introduces higher levels of risk to those involved in the construction, use, or maintenance of the structure. Contributory factors may include, but are not limited to: - Relocating work closer to major proximity hazards such as overhead power lines, bodies of water, public roads, or sources of high noise levels. - Amending specification details that result in increased component weights. - Changing material specifications to more hazardous substances. - Altering the design in a way that changes the foreseeable construction or maintenance methods to involve work at height or in confined spaces.



8. Temporary Works Coordination, Design



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Appendix J. Designer's Risk Assessment



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P														
1	Irish Water Form IW-HSQE-FM-037																Revision: 3.0		Design Risk Assessment Form				Approved by: Andrew Cartwright				Approval date: 20/01/15			
2	Project:		Carlow (Mortarstown) Wastewater Treatment Plant Upgrade			Project Type:		Wastewater Treatment Plant Upgrade			Design Stage and Scope of the Design:		Detailed Design Stage			Designer:		Irish Water		PSDP at time of Document Preparation:		AtkinsRéalis								
3	Document Title:		Carlow (Mortarstown) Wastewater Treatment Plant Deisgn Risk Assessment			Date of Assessment:		4/24/2026			Assessment undertaken by:		Kerem Ar			Assessment Reviewed by:		Richard Joyce												
4						Revision No:		0			Role & Organisation of Assessor:		Civil Engineer AtkinRéalis Ireland			Role & Organisation of Reviewer:		PSDP AtkinsRéalis Ireland												
5	Reference No.		Work Phase(s)	Activity	Related Hazard	Who is at Risk?	Initial Risk				Action Taken by the Designer to eliminate, minimise or control the risk			Residual Risk				Residual Risk to be passed to another Party	Residual Risk Owner											
6							Likelihood	Severity	Risk	Ranking				Likelihood	Severity	Risk	Ranking													
7			Enter the work phase(s) to which the risk is applicable. (Construction / Operation / Maintenance / Demolition)	Enter the Activity to which the risk is applicable.	Enter the hazard. Ensure all relevant hazards are addressed.	List persons or groups at risk (see Risk Rating Guidance)	1-5 (select from list)	1-5 (select from list)	Likeliho d x Severity	Low, Medium or High is automaticall y assigned	Give details of control measures taken at this stage to eliminate, reduce or control the risk for the Contractor constructing the works or for those operating and maintaining the works.			1-5 (select from list)	1-5 (select from list)	Likelihood x Severity	Low, Medium or High is automaticall y assigned	Yes or No												
8	Falling from Height																													
9	1		Construction / Maintenance / Operation / Demolition	Deep below-ground structures including stormwater holding tanks, clarifier tanks, preliminary settlement tanks, inlet pump station, microtunnel shafts, outfall pipeline and site-wide pipework and chambers.	Falling from plant and vehicles, falling from ground level into excavation. Operator hazards when working to maitain deep tank.	• Construction Workers • Client / Client's Representative employee • Operator • Maintenance Worker	3	5	15	High	Depth of structures minimised where possible by providing sufficient plan areas to meet volume requirements. Note that it is not possible to reduce the depth of some structures due to their existing configuration and engineering constraints. Depth minimised to that required for interface with existing assets where possible. Designs developed to avoid requirement to access tanks / structures. Equipment requiring maintenance selected to be removable, with lifting equipment provided where possible. Design includes for collective protective measures including integrated railings on structures where there is a risk of falling.			2	4	8	Medium	Yes	PSCS / Contractor											
10	Burial under earthfalls																													
11	2		Construction	Deep Excavation for below-ground structures including stormwater holding tanks, clarifier tanks, preliminary settlement tanks, inlet pump station, microtunnel shafts, outfall pipeline and site-wide pipework and chambers.	Trenches, excavations, confined spaces	• Construction Workers • Client / Client's Representative employee • Operator	3	5	15	High	Ground conditions assessed and full SI report completed to allow for design of suitable temporary works and construction methods. Excavation depths minimised where possible however due to the layout of the existing structures and engineering constraints, it is not possible to reduce the depth.			2	4	8	Medium	Yes	PSCS / Contractor											
12	Engulfment in swampland - Not Applicable																													
13	Work which puts persons at work at risk from chemical or biological substances constituting a particular danger to the safety and health of such persons or involving a statutory requirement for health monitoring																													
14	3		Construction	Breaking up, removal, storage and disposal of road base and sub-base materials that may contain Polycyclic Aromatic Hydrocarbons (PAH).	Risk of long-term illness due to exposure to carcinogenic materials.	• Construction Workers • Client / Client's Representative employee • Operator	3	4	12	High	Review of testing of samples from site to be conducted during the construction stage.			1	4	4	Low	Yes	PSCS / Contractor											
15	4		Construction	Cutting existing concrete or road surfaces	Silica dust from cutting operations through concrete, road construction, etc	• Construction Workers • Client / Client's Representative employee • Operator	3	4	12	High	Existing roads and structures retained where possible with modifications necessitating cutting works minimised where possible.			1	4	4	Low	Yes	PSCS / Contractor											
16	5		Construction / Maintenance / Operation / Demolition	Working with Asbestos Containing Materials (ACMs)	Risk of exposure to asbestos fibres. It is noted that there are ACMs present in the roof materials of the existing admin/control and final effluent buildings.	• Construction Workers • Client / Client's Representative employee • Operator • Maintenance Worker	3	5	15	High	Survey carried out to identify asbestos-containing materials (ACMs) present on site, included within the SID Engineering Report. Where works are required at locations to disturb ACMs, contractor to adopt safe systems of work.			2	5	10	Medium	Yes	PSCS / Contractor											

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P																	
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4						Revision No:		0			Role & Organisation of Assessor:		Civil Engineer AtkinRéalis Ireland			Role & Organisation of Reviewer:		PSDP AtkinsRéalis Ireland															
5	Reference No.		Work Phase(s)		Activity		Related Hazard		Who is at Risk?		Initial Risk				Action Taken by the Designer to eliminate, minimise or control the risk			Residual Risk				Residual Risk to be passed to another Party		Residual Risk Owner									
6											Likelihood		Severity					Risk		Ranking						Likelihood		Severity		Risk		Ranking	
17	6		Construction / Maintenance / Operation / Demolition		Use and Storage of Chemicals required for the treatment process.		Risk of exposure to chemicals, resulting in skin or eye damage. Risk to the environment / public health.		• Construction Workers • Client / Client's Representative employee • Operator • Maintenance Worker		3		4		12		High		Chemical storage to be in accordance with Uisce Éireann standards. The design includes for bunded storage and provision of an emergency shower in proximity to the storage area. The delivery area is to include for an apron with drainage which will be isolated during delivery, allowing for containment and management of any spills, in emergency scenario.			2		4		8		Medium		Yes		PSCS / Contractor	
18	Work with ionising radiation requiring the designation of controlled or supervised areas as defined in Directive 96/29/Euratom - Not Applicable																																
19	Work near high voltage power lines																																
20	7		Construction / Maintenance / Operation / Demolition		Installation and commissioning, operation or repair of assets in vicinity of existing overhead services.		Overhead MH Electricity Cables – risk of arcing or plant coming into direct contact with cables.		• Construction Workers • Client / Client's Representative employee • Operator • Maintenance Worker		4		5		20		High		Position of overhead HV/MV cables within the site have been reviewed in consultation with ESB Networks. Cable diversions will be undertaken by the ESB to mitigate the interface with the works. Positions of overhead cables to be recorded on drawings where in proximity to works.			1		5		5		Low		Yes		PSCS / Contractor	
21	Work exposing persons at work to the risk of drowning																																
22	8		Construction / Maintenance / Operation / Demolition		Installation of new assets in proximity to existing live works (sewers, tanks etc) or maintenance of new assets during operation of the works.		Danger from breach of existing sewers, watermainns or tanks flooding excavations or works areas.		• Construction Workers • Client / Client's Representative employee • Operator • Maintenance Worker		3		5		15		High		Service crossings and proximity to pipeline installation works have been considered as part of the design. Connection to live wastewater pump station wet well will be established. Suitable temporary works, overpumpng and isolation measures to be adopted where necessary, to minimise risk during construction stage. Isolation measures including penstock controls included in design to facilitate maintenance works in future, while works are live.			2		5		10		Medium		Yes		PSCS / Contractor	
23	9		Construction		Deep excavations near watercourses or areas at risk of flooding.		Danger of excavation flooding. Drawning of workers.		• Construction Workers • Client / Client's Representative employee • Operator		4		5		20		High		Outfall construction works to be carried out at/adjacent to River Barrow. A temporary cofferdam will be constructed to protect the workers and construction activities from the regular flow regime or flood events of River Barrow. Height of the cofferdam has been determined in accordance with the detailed flood risk assessment prepared for the project.			2		5		10		Medium		Yes		PSCS / Contractor	
24	10		Maintenance / Operation		Operation and maintenace of equipment within the flood zone.		Danger of works areas flooding / risk of drowning when maintaining equipment.		• Operator • Maintenance Worker		4		5		20		High		Assets positioned above flood level + freeboard where susceptible to water damage, reducing risk of failure in a flood event.			2		5		10		Medium		Yes		PSCS / Contractor	

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P																	
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5	Reference No.		Work Phase(s)		Activity		Related Hazard		Who is at Risk?		Initial Risk				Action Taken by the Designer to eliminate, minimise or control the risk			Residual Risk				Residual Risk to be passed to another Party		Residual Risk Owner									
6											Likelihood		Severity					Risk		Ranking						Likelihood		Severity		Risk		Ranking	
25	11		Construction / Maintenance / Operation / Demolition		Construction, operation and maintenace of deep tanks as part of the treatment process.		Danger of falling into deep, water filled tanks.		• Construction Workers • Client / Client's Representative employee • Operator • Maintenance Worker		3		5		15		High		Designs developed to minimise requirement to access into the tanks / structures. Equipment requiring maintenance selected to be removable, with lifting equipment provided where possible. Design includes for collective protective measures including integrated railings on structures where there is a risk of falling. Fall protection to be provided as part of all chamber lids. Secure, lockable lids with fall arrests to be provided. Site to be fenced and secured to prevent unauthorised entry. Isolation features provided in tanks to facilitate maintenance. It is not possible to reduce the Operational phase risks for the WWTP due to the existing configuration and the nature/requirements of the operations (e.g. working next to deep tanks filled with sludge). Suitable control measures to be put in place for the operational of the WWTP for the duration of the project.			2		5		10		Medium		Yes		PSCS / Contractor	
26	Work carried out by divers at work having a system of air supply - Not Applicable																																
27	Work carried out in a caisson with a compressed-air atmosphere - Not Applicable																																
28	Work involving the use of Explosives - Not Applicable																																
29	Work involving the assembly or dismantling of heavy prefabricated components																																
30	12		Construction		Assembly of pipework before placing in trench		Risk of large, heavy materials causing injury.		• Construction Workers • Client / Client's Representative employee • Operator		2		5		10		Medium		Components designed to be installed in manageable lengths/configurations which minimise handling risks. Items designed to be bolted during installation. Further prefabrication should not be carried out if it will result in increased handling difficulties. Lighter materials specified in the design to minimise handling risks			1		5		5		Low		Yes		PSCS / Contractor	
31	13		Construction		Lifting and placing of precast concrete chambers and manholes or other precast tanks / components.		Risk of large, heavy materials causing injury.		• Construction Workers • Client / Client's Representative employee • Operator		4		5		20		High		Standard sections specified in accordance with UÉ requirements. Design is developed in accordance with industry standard configurations. Precast elements where utilised, to be manageable size for maneuvering on site. Detailed method statements and risk assessments to be in place in advance of commencing works and communicated to all operatives.			2		5		10		Medium		Yes		PSCS / Contractor	

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P																																																																
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32	14		Construction / Maintenance / Operation / Demolition		Mechanical and Electrical equipment including pumps, generator etc.		Risk of large, heavy materials causing injury.		• Construction Workers • Client / Client's Representative employee • Operator • Maintenance Worker		2		5		10		Medium		Industry standard equipment selected. Manufacturer handling guidelines to be adopted. Lifting equipment to be provided to allow removal of heaviest item of plant. Equipment designed to ensure continued operation whilst repairs are taking place (duty-standby)					1		5		5		Low		Yes		PSCS / Contractor																																														
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34	15		Construction / Maintenance / Operation / Demolition		Traffic management – working in live site		There is a risk of operators entering the works area or machinery colliding with works / assets.		• Construction Workers • Client / Client's Representative employee • Operator • Maintenance Worker		3		4		12		High		Site layout selected to allow necessary vehicle movements. Autotrack analysis completed for vehicles for operation/maintenance/delivery.					2		4		8		Medium		Yes		PSCS / Contractor																																														
35	16		Construction		Traffic management – working in live highway for tunnel works.		Risk of collisions at the temporary working areas of the microtunnelling works at R448 Kilkenny Road..		• Construction Workers • Client / Client's Representative employee • Operator • Members of the public		4		5		20		High		Detailed traffic management plan will be prepared for the Works. Traffic management, lane closures, stop-go system and other measures will be applied to minimise the risk of collisions.					2		5		10		Medium		Yes		PSCS / Contractor																																														
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37	17		Construction		Excavating or carrying out works in proximity to existing structures including walls, barriers, lampposts, signage, tanks, buildings etc.		Risk of undermining foundations, striking structures with plant, causing collapse of structure		• Construction Workers • Client / Client's Representative employee • Operator		3		3		9		Medium		Adequate separation provided in the design between structures and works areas where possible. Equipment to be removed and restored after works if necessary.					2		3		6		Medium		Yes		PSCS / Contractor																																														
38	Working in proximity to or crossing other services																																																																															
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43	20		Construction / Maintenance / Operation / Demolition		Operation and maintenace of electrical equipment.			Risk of electrocution			• Construction Workers • Client / Client's Representative employee • Operator • Maintenance Worker			3		5		15		High		Use of a lockout system to ensure that the equipment that is being upgraded is shut off from the electrical supply; SOP to be in place for construction works.					1		5		5		Low		Yes		PSCS / Contractor																																											
44	Confined Spaces																																																																															
45	21		Construction / Maintenance / Operation / Demolition		Construction, operation and maintenace of tanks and chambers at the WWTP.			Confined Spaces			• Construction Workers • Client / Client's Representative employee • Operator • Maintenance Worker			3		5		15		High		Confined spaces minimised in the design where possible, however due to the configuration of existing structures and pipework it is not possible to eliminate all confined spaces. Access equipment and permits to work to be implemented. Only authorised personnel to be allowed to work in confined spaces.					2		5		10		Medium		Yes		PSCS / Contractor																																											
46	Other																																																																															
47	22		Construction		Excavation works at the River Barrow.			Contamination of River Barrow by excavated material			• Environment			4		3		12		High		Silt barriers to be implemented for the works near river barrow. Sheet piles at the outfall location will be driven from a barge on the River Barrow to minimise the impacts during implementation.					2		3		6		Medium		Yes		PSCS / Contractor																																											
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7			Enter the work phase(s) to which the risk is applicable. (Construction / Operation / Maintenance / Demolition)		Enter the Activity to which the risk is applicable.		Enter the hazard. Ensure all relevant hazards are addressed.		List persons or groups at risk (see Risk Rating Guidance)		1-5 (select from list)		1-5 (select from list)		Likeliho d x Severity		Low, Medium or High is automaticall y assigned		Give details of control measures taken at this stage to eliminate, reduce or control the risk for the Contractor constructing the works or for those operating and maintaining the works.			1-5 (select from list)		1-5 (select from list)		Likelihood x Severity		Low, Medium or High is automaticall y assigned		Yes or No			
8	Falling from Height																																
9	1		Construction / Maintenance / Operation / Demolition		Deep below-ground structures including stormwater holding tanks, clarifier tanks, preliminary settlement tanks, inlet pump station, microtunnel shafts, outfall pipeline and site-wide pipework and chambers.		Falling from plant and vehicles, falling from ground level into excavation. Operator hazards when working to maitain deep tank.		• Construction Workers • Client / Client's Representative employee • Operator • Maintenance Worker		3		5		15		High		Depth of structures minimised where possible by providing sufficient plan areas to meet volume requirements. Note that it is not possible to reduce the depth of some structures due to their existing configuration and engineering constraints. Depth minimised to that required for interface with existing assets where possible. Designs developed to avoid requirement to access tanks / structures. Equipment requiring maintenance selected to be removable, with lifting equipment provided where possible. Design includes for collective protective measures including integrated railings on structures where there is a risk of falling.			2		4		8		Medium		Yes		PSCS / Contractor	
10	Burial under earthfalls																																
11	2		Construction		Deep Excavation for below-ground structures including stormwater holding tanks, clarifier tanks, preliminary settlement tanks, inlet pump station, microtunnel shafts, outfall pipeline and site-wide pipework and chambers.		Trenches, excavations, confined spaces		• Construction Workers • Client / Client's Representative employee • Operator		3		5		15		High		Ground conditions assessed and full SI report completed to allow for design of suitable temporary works and construction methods. Excavation depths minimised where possible however due to the layout of the existing structures and engineering constraints, it is not possible to reduce the depth.			2		4		8		Medium		Yes		PSCS / Contractor	
12	Engulfment in swampland - Not Applicable																																
13	Work which puts persons at work at risk from chemical or biological substances constituting a particular danger to the safety and health of such persons or involving a statutory requirement for health monitoring																																
14	3		Construction		Breaking up, removal, storage and disposal of road base and sub-base materials that may contain Polycyclic Aromatic Hydrocarbons (PAH).		Risk of long-term illness due to exposure to carcinogenic materials.		• Construction Workers • Client / Client's Representative employee • Operator		3		4		12		High		Review of testing of samples from site to be conducted during the construction stage.			1		4		4		Low		Yes		PSCS / Contractor	
15	4		Construction		Cutting existing concrete or road surfaces		Silica dust from cutting operations through concrete, road construction, etc		• Construction Workers • Client / Client's Representative employee • Operator		3		4		12		High		Existing roads and structures retained where possible with modifications necessitating cutting works minimised where possible.			1		4		4		Low		Yes		PSCS / Contractor	
16	5		Construction / Maintenance / Operation / Demolition		Working with Asbestos Containing Materials (ACMs)		Risk of exposure to asbestos fibres. It is noted that there are ACMs present in the roof materials of the existing admin/control and final effluent buildings.		• Construction Workers • Client / Client's Representative employee • Operator • Maintenance Worker		3		5		15		High		Survey carried out to identify asbestos-containing materials (ACMs) present on site, included within the SID Engineering Report. Where works are required at locations to disturb ACMs, contractor to adopt safe systems of work.			2		5		10		Medium		Yes		PSCS / Contractor	

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17	6		Construction / Maintenance / Operation / Demolition		Use and Storage of Chemicals required for the treatment process.		Risk of exposure to chemicals, resulting in skin or eye damage. Risk to the environment / public health.		• Construction Workers • Client / Client's Representative employee • Operator • Maintenance Worker		3		4		12		High		Chemical storage to be in accordance with Uisce Éireann standards. The design includes for bunded storage and provision of an emergency shower in proximity to the storage area. The delivery area is to include for an apron with drainage which will be isolated during delivery, allowing for containment and management of any spills, in emergency scenario.			2		4		8		Medium		Yes		PSCS / Contractor	
18	Work with ionising radiation requiring the designation of controlled or supervised areas as defined in Directive 96/29/Euratom - Not Applicable																																
19	Work near high voltage power lines																																
20	7		Construction / Maintenance / Operation / Demolition		Installation and commissioning, operation or repair of assets in vicinity of existing overhead services.		Overhead MH Electricity Cables – risk of arcing or plant coming into direct contact with cables.		• Construction Workers • Client / Client's Representative employee • Operator • Maintenance Worker		4		5		20		High		Position of overhead HV/MV cables within the site have been reviewed in consultation with ESB Networks. Cable diversions will be undertaken by the ESB to mitigate the interface with the works. Positions of overhead cables to be recorded on drawings where in proximity to works.			1		5		5		Low		Yes		PSCS / Contractor	
21	Work exposing persons at work to the risk of drowning																																
22	8		Construction / Maintenance / Operation / Demolition		Installation of new assets in proximity to existing live works (sewers, tanks etc) or maintenance of new assets during operation of the works.		Danger from breach of existing sewers, watermainns or tanks flooding excavations or works areas.		• Construction Workers • Client / Client's Representative employee • Operator • Maintenance Worker		3		5		15		High		Service crossings and proximity to pipeline installation works have been considered as part of the design. Connection to live wastewater pump station wet well will be established. Suitable temporary works, overpumpng and isolation measures to be adopted where necessary, to minimise risk during construction stage. Isolation measures including penstock controls included in design to facilitate maintenance works in future, while works are live.			2		5		10		Medium		Yes		PSCS / Contractor	
23	9		Construction		Deep excavations near watercourses or areas at risk of flooding.		Danger of excavation flooding. Drawning of workers.		• Construction Workers • Client / Client's Representative employee • Operator		4		5		20		High		Outfall construction works to be carried out at/adjacent to River Barrow. A temporary cofferdam will be constructed to protect the workers and construction activities from the regular flow regime or flood events of River Barrow. Height of the cofferdam has been determined in accordance with the detailed flood risk assessment prepared for the project.			2		5		10		Medium		Yes		PSCS / Contractor	
24	10		Maintenance / Operation		Operation and maintenace of equipment within the flood zone.		Danger of works areas flooding / risk of drowning when maintaining equipment.		• Operator • Maintenance Worker		4		5		20		High		Assets positioned above flood level + freeboard where susceptible to water damage, reducing risk of failure in a flood event.			2		5		10		Medium		Yes		PSCS / Contractor	

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25	11		Construction / Maintenance / Operation / Demolition		Construction, operation and maintenace of deep tanks as part of the treatment process.		Danger of falling into deep, water filled tanks.		• Construction Workers • Client / Client's Representative employee • Operator • Maintenance Worker		3		5		15		High		Designs developed to minimise requirement to access into the tanks / structures. Equipment requiring maintenance selected to be removable, with lifting equipment provided where possible. Design includes for collective protective measures including integrated railings on structures where there is a risk of falling. Fall protection to be provided as part of all chamber lids. Secure, lockable lids with fall arrests to be provided. Site to be fenced and secured to prevent unauthorised entry. Isolation features provided in tanks to facilitate maintenance. It is not possible to reduce the Operational phase risks for the WWTP due to the existing configuration and the nature/requirements of the operations (e.g. working next to deep tanks filled with sludge). Suitable control measures to be put in place for the operational of the WWTP for the duration of the project.					2		5		10		Medium		Yes		PSCS / Contractor																																														
26	Work carried out by divers at work having a system of air supply - Not Applicable																																																																															
27	Work carried out in a caisson with a compressed-air atmosphere - Not Applicable																																																																															
28	Work involving the use of Explosives - Not Applicable																																																																															
29	Work involving the assembly or dismantling of heavy prefabricated components																																																																															
30	12		Construction		Assembly of pipework before placing in trench		Risk of large, heavy materials causing injury.		• Construction Workers • Client / Client's Representative employee • Operator		2		5		10		Medium		Components designed to be installed in manageable lengths/configurations which minimise handling risks. Items designed to be bolted during installation. Further prefabrication should not be carried out if it will result in increased handling difficulties. Lighter materials specified in the design to minimise handling risks					1		5		5		Low		Yes		PSCS / Contractor																																														
31	13		Construction		Lifting and placing of precast concrete chambers and manholes or other precast tanks / components.		Risk of large, heavy materials causing injury.		• Construction Workers • Client / Client's Representative employee • Operator		4		5		20		High		Standard sections specified in accordance with UÉ requirements. Design is developed in accordance with industry standard configurations. Precast elements where utilised, to be manageable size for maneuvering on site. Detailed method statements and risk assessments to be in place in advance of commencing works and communicated to all operatives.					2		5		10		Medium		Yes		PSCS / Contractor																																														

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35	16		Construction		Traffic management – working in live highway for tunnel works.		Risk of collisions at the temporary working areas of the microtunnelling works at R448 Kilkenny Road..		• Construction Workers • Client / Client's Representative employee • Operator • Members of the public		4		5		20		High		Detailed traffic management plan will be prepared for the Works. Traffic management, lane closures, stop-go system and other measures will be applied to minimise the risk of collisions.					2		5		10		Medium		Yes		PSCS / Contractor																																														
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43	20		Construction / Maintenance / Operation / Demolition		Operation and maintenace of electrical equipment.		Risk of electrocution		• Construction Workers • Client / Client's Representative employee • Operator • Maintenance Worker		3		5		15		High		Use of a lockout system to ensure that the equipment that is being upgraded is shut off from the electrical supply; SOP to be in place for construction works.			1		5		5		Low		Yes		PSCS / Contractor	
44	Confined Spaces																																
45	21		Construction / Maintenance / Operation / Demolition		Construction, operation and maintenace of tanks and chambers at the WWTP.		Confined Spaces		• Construction Workers • Client / Client's Representative employee • Operator • Maintenance Worker		3		5		15		High		Confined spaces minimised in the design where possible, however due to the configuration of existing structures and pipework it is not possible to eliminate all confined spaces. Access equipment and permits to work to be implemented. Only authorised personnel to be allowed to work in confined spaces.			2		5		10		Medium		Yes		PSCS / Contractor	
46	Other																																
47	22		Construction		Excavation works at the River Barrow.		Contamination of River Barrow by excavated material		• Environment		4		3		12		High		Silt barriers to be implemented for the works near river barrow. Sheet piles at the outfall location will be driven from a barge on the River Barrow to minimise the impacts during implementation.			2		3		6		Medium		Yes		PSCS / Contractor	
48															0									0									
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